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International Transport Forum

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17th International Symposium on Transport Economics and Policy




Benefiting from globalisation

Transport sector contribution and policy challenges

17TH INTERNATIONAL ITF/OECD SYMPOSIUM
ON TRANSPORT ECONOMICS AND POLICY

BENEFITING FROM GLOBALISATION

TRANSPORT SECTOR CONTRIBUTION AND POLICY CHALLENGES

Introductory Reports
and Summary of Discussions

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The International Transport Forum is an inter-governmental body within the OECD family. The Forum is a global platform for transport policy makers and stakeholders. Its objective is to serve political leaders and a larger public in developing a better understanding of the role of transport in economic growth and the role of transport policy in addressing the social and environmental dimensions of sustainable development. The Forum organises a Conference for Ministers and leading figures from civil society each May in Leipzig, Germany.

The International Transport Forum was created under a Declaration issued by the Council of Ministers of the ECMT (European Conference of Ministers of Transport) at its Ministerial Session in May 2006 under the legal authority of the Protocol of the ECMT, signed in Brussels on 17 October 1953, and legal instruments of the OECD. The Forum's Secretariat is located in Paris.

The members of the Forum are: Albania, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Canada, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, FYROM, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Mexico, Moldova, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom and the United States.

The OECD and the International Transport Forum established a Joint Transport Research Centre in 2004. The Centre conducts co-operative research programmes addressing all modes of transport to support policy making in Member countries and contribute to the Ministerial sessions of the International Transport Forum.

Further information about the International Transport Forum is available on Internet at the following address:
www.internationaltransportforum.org

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OPENING SESSION

Before proceeding with the actual research work of the Symposium, an official opening ceremony was held with Mr. Houko Luikens, Chairman of the OECD/ITF Joint Transport Research Centre, presiding. Speakers at the opening ceremony were, in turn:

- Mr. Wolfgang Tiefensee, German Federal Minister of Transport, Construction and Urban Affairs;

- Mr. Kristos Pavlov, Director for International Relations of the Bulgarian Ministry of Transport, representing Mr. Petar Moutafchiev, the Bulgarian Minister of Transport and acting Chairman of the International Transport Forum;

- Mr. Jack Short, Secretary-General of the International Transport Forum;

- Professor Anthony Venables, Chief Economist, London School of Economics and Political Science.

The themes of mobility, transport and logistics were of concern to the public, Mr. Tiefensee said in his opening address, but they were yet the priority they should be. The Symposium could help change that. Mr Tiefensee believed that it could point out that there were ways of shaping globalisation — the theme of the Symposium — so as to influence what were perceived as the negative aspects of a process that seemed virtually inevitable. While globalisation was indeed happening in the mobility, logistics, traffic and transport sector, the challenges that had to be faced called for a hard-nosed, open and transparent discussion of the facts. Some of these challenges related to the fact that the increasing internationalisation of our economies meant that product and production cycles were becoming ever shorter. Logistics had to adapt to keep up with this faster pace. Furthermore, value creation in transport chains — where interfaces should not be a barrier — played a key role in the dynamism of an economy. At the same time, firms were falling back on their core business and outsourcing ancillary activities, giving rise to totally new structures. These trends required that each mode be given its due place, according to its utility. Public resources should therefore be directed to where they would be most useful. Barriers to the smooth operation of transport chains and hence to value creation along the chain had to be eliminated. Lastly, environmental issues were becoming increasingly important. What good was it if mobility made people's living conditions lastingly worse, causing a backlash against mobility? The need to strike a balance between profitability and concern for the environment, between financial, personal and economic resources on the one hand and quality of life on the other were issues that were becoming increasingly important to our fellow citizens, said Mr. Tiefensee.

In closing, he said that he thought the Berlin Symposium would provide a unique opportunity to discuss the issues of globalisation and to help contribute to the creation of an International Transport Forum.

Mr. Pavlov, in turn, stressed that it was in Sofia, Bulgaria, in May 2007 that the first stage in this major transformation would be inaugurated. The Council of Ministers had asked the ECMT to become an International Transport Forum where Ministers could exchange views on a single topic of strategic importance in the presence of eminent personalities from civil society. The aim was also to enhance the newsworthiness of the event in order to raise perceptions of transport issues and make them easier to understand.

The theme chosen for the 17th Symposium was very revealing in that respect: "Benefiting from Globalisation – Transport Sector Contribution and Policy Challenges". The creation of the new International Transport Forum was in some ways in response to current challenges in the transport sector, which are increasingly rooted in globalisation. The 17th Symposium added another brick to the edifice by providing an insight into overall trends in the economy and their impacts on the transport sector. Mr. Pavlov expressed his deepest gratitude to the German authorities and the City of Berlin for hosting the Symposium, saying that it would undoubtedly deliver a host of invaluable insights.

Mr. Jack Short, Secretary General of the International Transport Forum, also expressed his sincere thanks to the German Government and in particular to the Federal Ministry of Transport, Construction and Urban Affairs for hosting this Symposium of the OECD/ITF Joint Transport Research Centre in Berlin. It was the first Symposium held under the joint ECMT-OECD banner. This was because, in 2004, the research capacity of the ECMT, now the International Transport Forum, increased by joining forces with OECD transport activities. What this meant was that, now, all transport activities in the OECD family were concentrated in one place, reporting to Transport Ministers. It also meant that there was now a strong presence and participation, not just from Europe but also from the OECD countries outside Europe. This gave the Centre's research the global perspective that was so needed today and so relevant for the creation of the Forum.

Mr. Short went on to stress that, on the theme of globalisation, there were key analytical and research questions to be discussed. They were very closely linked to sensitive political issues. This could be seen, for example, in the collapse of the World Trade Organization's Doha Round discussions. The worrying growth in protectionist attitudes was sometimes driven by genuine concerns, but was often driven by narrow producer interests. This raised some fundamental questions:

- If transport was so important to our economies why did we worry so much about who owned assets rather than whether they were used efficiently?

- Why were we so bothered by the share of traffic our own operators or carriers had rather than by whether they were efficient and obeyed the rules?

- What was it about international activities that often saw the suspension of economic principles that we seemed to have accepted nationally?

With good speakers, good papers and a large expert audience, Mr. Short went on to say that he wished the discussions at the Symposium to be provocative and provide fresh thinking and ideas. He closed his address by saying how gratifying it was to see so many highly respected academics and researchers taking part in this 17th Symposium.

Professor Anthony Venables of the *London School of Economics and Political Science* gave the keynote speech before the opening session of the Symposium. His presentation was structured around the idea that transport played a key role in economic development. In his view, transport shaped the spatial structure of our economies, which was a key factor in their productivity and in the level of wealth achieved. Transport was a vector of economic transformation: it enabled trade, which in turn led economies to specialise. In developing countries, for example, rural roads opened up villages to trade. Of course, at the other end of the spectrum, transport led to congestion and urban sprawl and so not all changes that transport brought were necessarily positive.

One of the challenges facing policy makers and economists was to find a way of evaluating the benefits of infrastructure projects that was both thorough and comprehensive.

That said, one could not put down all of the impacts of globalisation to transport alone, given that such a large part had been played by market liberalisation and the political processes accompanying it or by information technologies, for example. Globalisation was a factor in reducing poverty and one of the challenges was to extend the benefits of globalisation to regions experiencing a development lag. This made improving infrastructure, whether intercity links or access to ports, crucial. But that infrastructure also had to be used efficiently and maintenance and operating costs had to be covered. At the same time, it was not possible to speak about transport and globalisation without mentioning the most important challenge of the 21st century: climate change. In order to cut emissions by 25 per cent by 2050 – which amounted to a reduction of 75 per cent per unit of dollar output, allowing for a probable increase in wealth by then – transport would have to be made more efficient, chiefly through pricing, through encouraging innovations in technology and through shaping the use of space so that it is more economical on transport activities.

Every aspect of the keynote speech by Anthony Venables centred on the idea that it was possible to use transport to spread the advantages of economic development and globalisation by increasing trade and substantially reducing CO_2 emissions. The price we paid to take firm action now on reducing emissions would be far less than the price of taking no action.

The speech by Anthony Venables brought the opening session of the 17th Symposium to a close.

INTRODUCTORY REPORTS

Topic I:

Data and Trends

Global Trends in Trade and Transportation

by

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SUMMARY

West Lafayette, July 2006

1. INTRODUCTION

This paper provides an overview of recent trends in international trade and transportation. The goal is two-fold. First, changes in international trade and integration are documented, that have particularly interesting consequences for transportation demand. Second, we see how international transportation demand itself has changed, and provide a forward look to likely future changes.

The basic insights of the paper are these. International trade has grown rapidly, driven primarily by growth in manufactures, and growth in the “extensive” and “quality” margins of trade. The composition of trade has changed in important ways that affect transportation demand. Goods are lighter, and manufacturing exports embody a growing share of foreign inputs. But for all the talk about a new era of globalisation, trade frictions remain significant: most firms serve only domestic markets; borders still matter; distance maintains a surprisingly strong grip on trade; and trade spells are very short, especially for “new” and small-valued flows.

While ocean cargo continues to dominate tonnages shipped, airborne cargo is growing rapidly and, despite its much greater cost, represents a remarkably large and growing share of trade by value. Why has air transport grown so rapidly? Four factors seem especially important. Timely delivery has become more valuable, the absolute and relative cost of air shipping has declined precipitously, goods are getting lighter, and consumer incomes are rising, especially at the upper end of the income distribution. Looking forward, airplanes will become only more useful because of their particular value in accomplishing four goals: coordinating far-flung production processes; reaching distant markets and the interior regions of geographically large countries; hedging uncertain demand and testing “new markets”.

2. INTERNATIONAL TRADE

In the post-war era, international trade has grown rapidly. Table 1 reports data from the WTO on global trade and output. Between 1950 and 2004, trade grew from $US 375 billion to $US8 164 billion, a 22-fold increase overall and an annual growth rate of 5.87% per year. Of course, much of this increase is due to the increasing size of the world economy, but trade relative to output has also grown substantially, more than tripling in the post-war era.

…driven primarily by growth in manufactures…

While the precise causes of trade growth remain a hotly debated subject, it is a simple matter to examine, in an accounting sense, which portions of trade have grown the most. One way to decompose trade is to look at very broad categories such as manufacturing, mining and agriculture.

As Table 1 shows, since 1950 the share of manufacturing in world trade doubled, from 36.7 to 73.7%. Much of this growth is accounted for by a shift in the composition of world output toward manufacturing and away from mining and agriculture. However, trade relative to output in manufacturing has grown even faster than trade overall, quadrupling since 1950.

…and growth in the "extensive" and "quality" margins of trade

Consider a thought experiment. Give a country more productive resources: land, labour, capital, skilled workers. These resources can be used in one of three ways. The economy can produce the same set of goods as before, but in larger quantities (the intensive margin), it can produce a larger set of goods (the extensive margin), or it can produce better goods (the quality margin). This distinction is important because each margin has different implications for the economic impacts of trade. For example, growth in the extensive or quality margins can prevent terms of trade deterioration associated with continuing to pump ever larger quantities of the same goods onto world markets[1]; and, as discussed below, each margin has potentially different implications for transportation demand.

Recent academic work employs highly detailed trade flow data to provide insights into how trade growth occurs along these various margins. Hummels and Klenow (2005) compare the exports of large to small countries, decomposing those exports into intensive, extensive and quality margins. Large economies export more in absolute terms than do small economies, at a rate roughly proportional to size: that is, double a country's GDP and, on average, its exports will also double. The extensive margin accounts for around 62% of the greater exports of larger economies, meaning that doubling an economy's size increases the number of products it exports by almost two-thirds. Further, a significant portion of the remaining 38% (the intensive margin) corresponds to quality upgrading.

Schott (2003) looks at changes in product prices over time. For a given product (e.g. apparel), price increases are thought to correspond to higher product quality. Countries that have increased their capital/labor or skilled/unskilled labour ratios see pronounced increases in export product quality. Finally, Evenett and Venables (2002) look at changes in the extensive margin over time, emphasizing both the number of goods and destinations to which exporters ship goods. They find that one-third of developing country trade growth consists of shipping to new markets that the exporter had not previously explored.

The composition of trade has changed…

Apart from growth in manufacturing and growth in the extensive margin, there have been additional changes in the composition of trade that significantly impact on transportation demand.

…goods are lighter…

Transportation specialists are accustomed to thinking of transportation costs in per unit terms, the cost of transportation services necessary to move grain a ton-km or to move one TEU container from Rotterdam to Hong Kong. International trade specialists who pay attention to shipping costs as an impediment to trade are accustomed to thinking of these costs in *ad valorem* terms, the cost of transportation services necessary to move a dollar of grain or microchips between two points. The distinction is important because even if the cost of moving one TEU remains constant, the *ad valorem* cost and the implied impediment to trade can change if the contents of the container change.

To see this, suppose we sell q TEU containers of a good at a price p, and pay shipping costs f per container shipped. The ratio of destination (p*) to origin (p) prices is given by $p^* / p = (p + f)q \; pq = 1 + f / p$. If the container holds scrap metal, p is low, and the ratio p*/p is high. If the container holds micro chips, p is very high and the ratio p*/p is close to 1.

This observation is important because the commodity composition of world trade has shifted toward manufactures and away from bulk commodities, and the weight/value ratio for world trade has dropped. Using the data from Table 1, we can make a rough calculation of this change. From 1960-2004, the real value of trade in all goods grew about 1.8% faster per year than the weight of all trade, that is, the weight/value ratio fell by 1.8% per year. Even within manufacturing, the same pattern can be seen: the real value of trade in manufactures grew about 1.5% per year faster than the weight of non-bulk cargoes.

…manufacturing exports embody a growing share of foreign inputs

Manufactured goods, and their production processes are becoming increasingly complex. They require research and development, component manufacture, final assembly, marketing and distribution, and each of these stages is further subdivided into hundreds if not thousands of individual production steps. Maintaining co-ordination across these steps is critical. New product ideas that seem groundbreaking on paper must survive prototyping processes, and the whims of fickle consumers. Minor component pieces that do not meet appropriate tolerances can ruin the quality of finished products. Inputs arriving late can idle an entire factory.

Difficulties in co-ordination would seem to argue in favour of geographic concentration, that is, doing all steps of a production process in one place. This is an important force for agglomeration, as Harrigan and Venables (2004) argue. However, to an increasing degree, countries specialise in stages of production rather than produce entire products.

Three factors help explain the fragmentation of international production processes:

1) Successive production steps may require very different factor inputs – research and development requires a ready supply of scientists and engineers, component manufacture requires inexpensive supplies of capital and capital machinery, assembly requires low-cost labour. No country has low-cost and innovative scientists, low-cost capital supplies and low-cost labour. Accordingly, countries specialise in those stages in which they have a comparative advantage.

2) Co-ordinating production requires that proprietary information about products and production processes be shared over stages. This is most easily done within a multinational organisation. As more firms become global in scope, it becomes easier to co-ordinate production *across* national borders by retaining production co-ordination *within* corporate borders.

3) As described below, there has been a dramatic drop in the cost of moving goods and information between countries at high speeds.

The precise extent to which global production is "fragmented" is difficult to measure. One technique involves calculating the extent of vertical specialisation, that is, the value of imported inputs that are embodied in a country's exports. Simply, goods are manufactured using foreign inputs, domestic inputs and domestic value added (labour and capital services). Some of the value of output is then exported. By using input-output tables it is possible to calculate vertical specialisation across countries and over time.

Hummels, Ishii and Yi (2001) provide such a calculation, using OECD input-output tables; a summary of their results is reported in Table 2. The first two columns report the value of foreign inputs as a percentage of exports for each country in 1970 and 1990. In Canada, for example, foreign inputs rose from 20 to 27% of the value of exports, in the US the percentage rose from 6 to 10.8 and in Denmark from 29 to 29.5%. Smaller and more open economies tend to have more vertical specialisation. For example, calculations from the Asian International Input-Output database indicate that imported inputs represented about one-third of the value of exports for Singapore, Malaysia, Thailand and the Philippines in 2000.

Vertical specialisation can lead to trade growth through two channels:

1) It allows countries to more efficiently specialise;

2) It leads to double counting of traded inputs, once when they are imported and again when they are exported and embodied in the final good[2].

The next two columns of Table 2 report the percentage growth in exports, measured as a fraction of gross output, and the contribution of vertical specialisation to that growth. For Canada, the Netherlands and Taiwan, vertical specialisation accounted for nearly half of overall trade growth.

But for all the talk about a new era of globalisation, trade frictions remain significant…

A casual reader of popular press articles on globalisation could be forgiven for thinking that nations have become seamlessly integrated into a unitary global economy. Certainly, the message of Thomas Friedman's recent bestseller, "The World is Flat", or its more compelling antecedent, "The Death of Distance", by Frances Cairncross, is that we live in a new world in which goods, people, capital and ideas flow easily from place to place. But the data, so far, disagree.

…most firms serve only domestic markets…

Data on exporting behaviour at the firm level have recently become available and these data paint a common picture across many countries. The large majority of firms serve only domestic markets, and for those firms that do export, only a small portion of their overall sales go to foreign customers. For example, Bernard *et al.* (2003) show that only one-fifth of US manufacturing firms export, and of these exporting firms, two-thirds export less than 10% of their output. Eaton, Kortum and Kramarz (2004) show similar results for French firms, and further show that most exporters ship to a small number of (typically nearby) export destinations.

There are two leading, and possibly complementary, explanations for these facts. The first is that firms serving foreign markets face large fixed costs. These costs might include learning about and adapting to foreign customer needs, establishing foreign sales and distribution channels and coping with differences in the regulatory environment. As a result, only the very best firms are able to sell enough to make foreign entry profitable. The second explanation is that consumer demands are not universal, and that local firms are best situated to accommodate subtle differences in tastes. This can be seen clearly in the national character of foodstuffs, but the same idea applies to industrial inputs as well. (Car-makers do not want generic fuel injectors for their engines, or seats for their interiors, they want specific inputs customised for their particular products.) As a consequence, firms become highly specialised and adapted to service their local clientele. However, the more specialised they become, the less universal is the demand for their services.

…borders matter…

How open are nations to trade? One way to address this is to construct a thought experiment, asking: if there were no barriers to trade, how much trade would we see? McCallum (1995) pioneered this approach in a seminal article that showed that the quantity of trade between Canadian provinces was some 22 times greater than trade between a Canadian province and a US state of similar size and distance. This finding has triggered an enormous literature, which has done much to qualify and fine-tune the initial estimates, but the basic insight remains. Trade flows look much smaller than we might expect if frictions were absent.

Part of the surprise factor in this finding is that explicit tariff barriers have been, for most manufactured products and within the OECD, negotiated close to zero. Data on non-tariff barriers are much harder to come by, but studies examining customs data consistently find that transportation costs pose a barrier to trade at least as large as, and frequently larger than tariffs[3]. For the typical good in US trade, exporters pay $9 in shipping costs for every $1 they pay in tariffs. The US is actually a notable outlier in that it pays *much less* for transportation than other countries. In 2000, aggregate transportation expenditures for major Latin America countries were two to four times higher than for the US[4].

…distance maintains a surprisingly strong grip on trade…

Unlike tariffs, transportation costs vary considerably over partners. This implies an especially large role for these costs in altering relative prices across exporters and determining bilateral variations in trade. For US imports in 2004, exporters at the high end of the cost range faced shipping charges that were eleven times greater than those faced by exporters at the low end[5]. This variance provides a plausible explanation for one of the most robust facts about trade: countries trade primarily with neighbours. Roughly a quarter of world trade takes place between countries sharing a common border and half of world trade occurs between partners less than 3 000 kilometres apart. Even after controlling for other plausible correlates, such as country size, income and tariff barriers, the distance between partners explains much of bilateral trade volumes.

…and trade spells are very short, especially for "new" and small-valued flows

Economists are accustomed to thinking of comparative advantage as something that evolves slowly over time; and to the extent that comparative advantage is based on such things as factor supplies (the relative abundance of capital or skilled labour), this is undoubtedly true. However, recent looks at trade data suggest instead that comparative advantage is extremely dynamic.

Besedes and Prusa (2003, 2004) have established a set of intriguing facts about the duration of trading relationships. They pose the following question. Suppose Brazil were to export a new product to the US market in 2006, how long would we expect Brazil to continue successfully exporting that new product? The answer is: not very long. Besedes and Prusa find that, for the median product, the average duration of trade is only two to four years. Those exporters and products that survive exporting infancy go on to take large shares of the market.

Their data, plus the data on firm level exports, provide the following picture. Comparative advantage is highly dynamic, a process of trial and (mostly) error. Exporting is difficult. Few firms try it, and those that do frequently fail, whatever their successes in their home markets.

3. INTERNATIONAL TRADE AND TRANSPORTATION

This chapter focuses primarily on ocean and air cargo because of the difficulty of obtaining internationally comparable data on land transit. For context, roughly 23% of world trade by value occurs between countries that share a land border. This number varies considerably across continents. For Africa, the Middle East and Asia, between 1 and 5% of trade is with land neighbouring countries; for Latin America trade with land neighbours is 10 to 20% of the whole and for Europe and North America it is 25-35% of trade. Detailed modal data are sparse, but US and Latin American data indicate that trade with land neighbours is dominated by surface modes (truck, rail, pipeline), with perhaps 10% of trade going via air or ocean. Interestingly, the share of trade with neighbours has been nearly constant over time.

Ocean cargo dominates tonnages…

Table 1 reports worldwide data on ocean and air shipping of non-bulk traded goods[6]. More than 99% of trade by weight (excluding bulks!) moves via ocean cargo, with tonnages increasing nine-fold since 1960.

…but airborne cargo is growing rapidly…

Air shipments represent less than 1% of total tons and ton-miles shipped, but are growing rapidly. Between 1975 and 2004, air tonnages grew at 7.4% per annum, much faster than both ocean tonnage and the value of world trade in manufactures. The relative growth of air shipping is even more apparent in looking at ton-miles shipped, with 11.7 per annum growth rates going back to 1951.

Table 3 reports tonnages moved by region from 1980-2004. In this period, world air cargo (both foreign and domestic) increased at a rate of 10.5% per year. The highest volumes were between high-income regions and those involving Asia. Growth rates substantially higher than the rest of the world were seen within Europe (international), Europe-Asia and North America-Asia trade and cargo internal to domestic North American markets. Air cargo in domestic European markets remains fairly unimportant.

…and air cargo represents a remarkably large and growing share of trade value

Because heavy goods are rarely air shipped, weight-based quantity data understate the importance of air shipping. Table 1 also reports the value share of air shipments for US trade. In the past forty years, air shipments have grown to represent a third of US imports and more than half of US exports with countries outside North America. Time series data on modal shares are not available for other countries, but the US reliance on air shipping does not appear to be an anomaly. Excluding land neighbours, the air share of import value in 2000 exceeded 30% for Argentina, Brazil, Colombia, Mexico, Paraguay and Uruguay[7].

Why has air transport grown so rapidly?

The use of air shipping is about a trade-off between speed and flexibility *versus* unit costs. For some goods, speed and flexibility are unimportant and the lower unit costs offered by ocean transport dominate the shipping decision. But for an increasing number of goods and production arrangements, speed and flexibility are paramount.

…timely delivery is valuable…

How valuable is speed? Hummels (2001) estimates the demand for timeliness by examining the premium that shippers are willing to pay for speedy air shipping relative to slow ocean shipping. He shows two effects. First, for every day in ocean travel time that a country is distant from the importer reduces the probability of sourcing manufactured goods from that country by 1%. Second, conditional on exporting manufactures, firms are willing to pay just under 1% of the value of the good per day to avoid travel delays associated with ocean shipping.

Why is time in transit so important? Some products (fresh foods, flowers) are subject to literal spoilage. Other products such as electronics, whose product cycle times are measured in months rather than years, obsolesce too rapidly for long ocean voyages.

More generally, if there is uncertainty in demand plus lags between production ordering and final sales, firms may face a mismatch between what consumers want and what the firm has available to sell. Consumers will pay a premium to purchase goods containing “ideal” characteristics, but firms may not be able to predict long in advance what constitutes the ideal. Firms that can wait longer to produce are better able to match the ideal characteristics and capture that premium. Evans and Harrigan (2003) provide an excellent example of this phenomenon in the apparel industry. They show that product lines requiring frequent restocking tend to be purchased from local and quickly re-supplied sources. An alternative solution to sourcing locally is to source from abroad but use air transport to bridge lengthy travel gaps.

….the price of air cargo is falling dramatically…

The International Air Transportation Association surveys international air carriers and reports worldwide data on revenues and quantities shipped in their annual *World Air Transport Statistics (WATS)*. Figure 1a shows average revenue per ton-km shipped for all air traffic worldwide, indexed to 100 in 2000. Over this 50-year period, prices fell from \$3.87 per ton-km to under \$0.30 in constant 2000 dollars, a more than tenfold decline.

Hummels (2006) reports a number of additional series on air transportation costs with greater regional detail but covering shorter time periods, as well as data on ocean transport costs. These other air data series confirm the basic message from the WATS data. For example, Figure 1b reports the cost of air cargo relative to goods shipped worldwide from 1973-93 and shows steep cost declines. The ocean transport price data show either no change or increases in costs, indicating that both the absolute cost of air shipping, and its cost relative to ocean shipping have declined precipitously.

…goods are getting lighter…

Above, we noted that the value of trade is growing much faster than its weight. This compositional shift is happening both across products (the shift away from bulks and toward manufacturing), and within manufacturing products. This shift raises the demand for air shipping.

Consider this example. I want to import a $25 wristwatch from Japan. Air shipping costs of $10 are twice ocean shipping costs of $5. Going from ocean to air increases the delivered cost by $5, or 20% of the original price. Now suppose I want to import a $250 wristwatch. The shipping costs are the same, but now the $5 cost to upgrade to air shipping represents just a 2% increase in the delivered price. The consumer is much more likely to use the more expensive shipping option when the effect on delivered price is smaller.

Consumers are sensitive to changes in the delivered product price, not to changes in the transportation price. If the cost of transportation substantially affects the delivered price, as in the first example, modal choice will be driven by cost considerations. But if the transportation price is but a small fraction of the delivered price, or if consumer demand is not highly price-elastic, the difference in transport prices may seem insignificant compared to other factors such as timeliness or reliability.

…consumer incomes are rising, especially at the high end of the income distribution

Above I discussed how nations, given additional productive resources, can use those resources to produce a large quantity of the same set of goods, a larger set of goods, or higher quality goods. Households face similar choices in consumption. Bils and Klenow (2001) provide strong evidence showing that higher income households use much of their greater purchasing power to buy higher quality goods. Several authors have shown that this household behaviour aggregates up to national purchasing behaviour: higher income countries import higher quality goods.

This affects demand for air transport in three ways:

1) Higher quality goods have higher prices and therefore a lower *ad-valorem* transportation cost, for reasons just discussed;

2) As consumers grow richer, so does their willingness to pay for precise product characteristics[8]. That, in turn, puts pressure on manufacturers to produce to those specifications, and be rapidly adaptable;

3) Delivery speed is itself an important characteristic of product quality, and will be in greater demand as income grows[9].

Airplanes are especially useful for

…co-ordinating far-flung production processes…

As noted above, a hallmark of recent trade growth is the importance of vertical specialisation/fragmentation[10]. Multi-stage production may be especially sensitive to lags and variability in timely delivery. The absence of key components can idle an entire assembly plant, and inventory on-hand will be larger if managers must accommodate variation in arrival times. This in turn magnifies the costs of defects in component quality, as sizable inventories (at the plant, in transit) may be built up before defects are detected. The defect problem motivates "just-in-time" inventory techniques, which aim to minimise both the inventory on-hand and in the pipeline. Clearly, the ability to implement a "just-in-time" strategy is limited when parts suppliers are a month of ocean transit time removed from the assembly plant[11].

Of course, airplanes move people in addition to cargo. Firms producing abroad rely heavily on the ability to fly executives and engineers for consultations with their foreign counterparts. For all the wonder of information technology, there is not yet a good substitute for face to face communication, especially when new products and production processes are being introduced.

…reaching interior regions…

Geographically large countries face a challenge in getting products into and out of interior regions. Cargo unitisation and multimodal transport systems go a long way to solving these problems, at least for those countries with more advanced transportation infrastructure. But many developed countries lack these facilities, effectively isolating their interior regions.

Both developed and developing countries face significant issues with port congestion in cities that act as entrepots for interior regions of their own countries. This becomes more pronounced in cases where ports vie for land and coastal access that retain significant value for housing and public amenities. Trucks arriving at and leaving these facilities also compete with other users of roadways, leading to major highway congestion and significant pollution effects. This has caused several East Asian nations to ban truck traffic into port cities, except in the early morning hours. In the US, severe congestion around the major west coast port of Los Angeles/Long Beach spurred the creation of the Alameda Corridor. This $2.4 billion project was completed in 2002 and designed to ease the flow of goods through California to interior regions of the US.

Air cargo that overflies congested ports and slow multimodal facilities can be an effective way to reach interior regions. This can be seen clearly in US data, where air cargo represents one-third of US imports and half of US exports by value. Until recently, most air cargo landed at coastal facilities, but the share of coastal facilities is shrinking in favour of direct transport into the US interior[12].

…reaching distant markets…

Suppose I am trying to decide between air and ocean shipping in reaching two foreign markets, the first proximate to and the second distant from my exporter. How does the distance affect my calculation of the appropriate mode to use? Exporters consider two costs, both rising in distance. The first is the direct cost of transport and the second is the time cost.

Time costs are unimportant for some goods, and in these cases exporters can focus more narrowly on direct transport cost considerations. In most instances, direct cost considerations will favor ocean transport, whether the foreign destination is distant or proximate.

For some goods, time costs are important, and more subtle calculation is required. For the nearby export destination, direct costs favor ocean shipment, and the time difference between ocean and air is small enough that time costs can be ignored in the calculation. For the distant export destination, however, the time difference between ocean and air can loom large indeed. In short, the further away the market, the greater the time advantages provided by air shipping.

This effect has become more pronounced as: (a) the time sensitivity of goods rises; (b) the absolute cost of air shipping declines (see Figure 1); and (c) the marginal cost of air shipping cargo an additional mile falls.

Hummels (2006) estimates the elasticity of air shipping costs with respect to distance for each year from 1974-2004, and finds a dramatic decline in the elasticity, from 0.43 in 1974 to 0.045 in 2004. Put another way, doubling distance shipped caused a 43% increase in air shipping costs in 1974, but only a 4.5% increase in air shipping costs in 2004.

The effect of these three factors in combination can be seen in the Table 1 data. The average air shipment is getting longer and the average ocean shipment is getting shorter. Combining the tons and ton-miles data, we see that ocean shipped cargo travelled an average of 2 919 miles in 2004, down from 3 543 miles in 1975. In contrast, air shipped cargo travelled an average of 3 383 miles in 2004, up from 2 600 in 1975.

…hedging uncertain demand…

Many firms face volatile demand for their products, which makes it difficult to decide in advance on the optimal combination of inventory on hand and prices charged. Firms in volatile markets would like to respond to demand shocks after they are known. That is, when demand rises firms should offer larger quantities for sale and raise prices, and do the reverse when demand falls. However, these adjustments can be difficult for any firm, especially those serving foreign markets. In an international context, firms face an important constraint in the form of the time lag between when a good is produced and shipped and when the product arrives in the foreign market. Ocean shipping times between Asia and the US can take as long as three weeks, and shipments from Asia to Europe twice that.

Recent papers by Aizenman (2004) and Schaur (2006) have argued that air shipping may be an effective way to handle international demand volatility. Because air shipments take hours rather than weeks, firms wishing to adjust to demand shocks can wait until the realisation of those shocks before deciding on quantities to be sold. That is, air shipping provides these firms with a real option to smooth demand shocks.

The idea in these models is that an exporter serves a foreign market with a mix of inexpensive but slow ocean shipping and fast but expensive air shipment. Because ocean transport is time-consuming, quantities must be shipped early, before having full information about the demand that will materialise. Using only ocean shipping would minimise the total shipping bill, but at some risk. If demand is low, the exporter will have too much quantity on the market and incur losses.

Alternatively, the exporter can wait until close to the sale date in order to obtain better information about foreign demand and then serve that demand using air shipping. If the demand is higher than expected, the exporter fills in demand with an air shipment.

The model in Schaur (2006) provides several predictions which he then confirms by looking at data on the use of air shipping for many goods and exporters. First, when exporting goods with historically high demand volatility, the exporter will rely more heavily on air shipment. Second, conditional on high volatility, high goods prices indicate that demand is unusually high in that period and exporters will air ship additional quantities. These predictions are borne out in the data.

…testing new markets

The use of air shipping is about a trade off: speed and flexibility versus unit costs. Speed and flexibility are more important when markets are a long distance away, and when there is uncertainty in quantity demanded, product quality or desired product characteristics. Unit cost advantages for ocean shipping are greatest when the goods have low value/weight ratios and when the scale of trade is large.

We saw in Chapter 2 that much of the growth in trade is along the extensive margin, meaning that nations are growing their exports by shipping new goods to new markets, not by increasing the quantities sold of existing exports. What are the characteristics of these new markets? Most firms begin producing only for a local market, slowly expand sales within their own country, and some small fraction of these gradually expand sales abroad. Those who do go abroad initially look to neighbouring countries. Because of this process, new and unexploited markets tend to be further away. When serving these distant markets, firms face tremendous uncertainty about demand, quantities sold are likely to be very low initially, and most trading relationships fail in a few years.

All of these characteristics - initially small quantities, uncertain demand and distant markets - are precisely what makes air shipping particularly attractive. This suggests that airplanes may be an especially effective tool for firms wishing to test new markets.

NOTES

1. See Hummels and Klenow (2005). Also several authors have emphasized that import expansions along the extensive margin yield larger gains from trade.

2. This also implies that small reductions in trade costs can call forth large increases in trade since the costs are borne twice. See Yi (2003).

3. This finding is robust to time periods and importers examined. Waters (1970) and Finger and Yeats (1976) employ US import data from the mid-1960s. Sampson and Yeats (1977), and Conlon (1982) employ Australian import and export data from the early 1970s. Hummels (1999) reports data from seven countries in 1994.

4. Author's calculation based on ECLAC BTI database.

5. Products were sorted on the basis of cross-exporter variance in costs. For the median product, 90^{th} percentile exporters faced costs of 15.8% *ad valorem, vs*. 1.4% *ad valorem* for the 10^{th} pctile exporter.

6. I focus on modal shifts for non-bulk cargoes, as major bulks (oil and petroleum products, iron ore, coal and grains) are never air shipped. The bulk commodity share of total ocean cargo tonnes fell from 72% in 1960 to 58% in 2004. The bulk value share of trade is much smaller, and shrinking.

7. Author's calculation from ECLAC BTI database, 2000.

8. Hummels and Lugovskyy (2005).

9. Consider purchases at online stores such as Amazon.com, where customers can pay large sums to have items delivered overnight. While this author is not aware of any direct evidence on this point, it would not be surprising to learn that higher income consumers are more willing to pay for this service.

10. Hummels, Ishii and Yi (2001).

11. Harrigan and Venables (2004) provide a model of this process.

12. Haveman and Hummels (2004).

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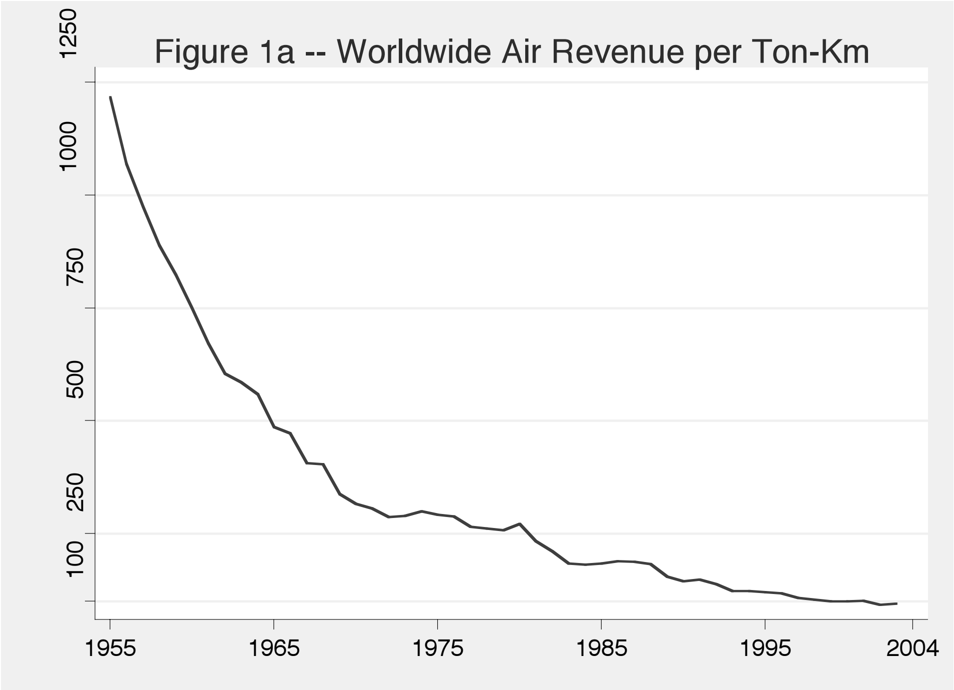
FIGURES AND TABLES



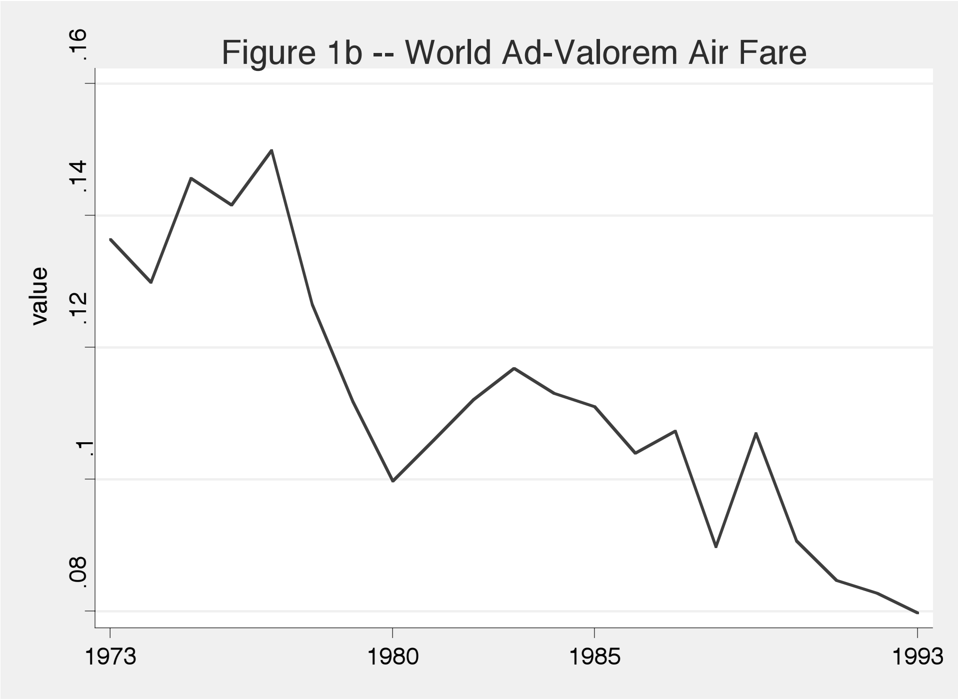


Table 1. **World Trade and Transport**

Year	World Trade		World trade relative to output		World quantities of non-bulk cargos				US : Air share of trade	
	2 000 $US billion		Indice 1950 = 100		Million tons		Billion ton/miles		Excl. N. America	
	All goods	Manufactures	All goods	Manufactures	Ocean	Air	Ocean	Air	Imports	Exports
1950	375	138	100.0	100.0				0.2		
1955	505	222	111.5	106.9				0.3		
1960	623	301	127.2	122.7	307			0.7		
1965	844	453	138.5	130.9	434		1537	1.8	8.1	11.9
1970	1152	684	161.9	162.5	717		2118	4.3	12.1	19.5
1975	2341	1307	171.3	190.5	793	3.0	2810	7.7	12.0	19.3
1980	3718	2009	186.6	211.7	1037	4.8	3720	13.9	13.9	27.6
1985	2759	1683	189.6	232.9	1066	6.5	3750	19.8	19.8	36.3
1990	4189	2947	213.4	271.7	1285	9.6	4440	31.7	24.6	42.3
1995	5442	4041	265.7	349.3	1520	14.0	5395	47.8	33.1	44.3
2000	6270	4688	308.3	412.6	2533	20.7	6790	69.2	36.0	57.6
2004	8164	6022	332.3	447.4	2855	23.4	8335	79.2	31.5	52.8
Annualised growth rates										
All years	5.87	7.24	2.25	2.81	5.20		4.43	11.72	3.55	3.89
1975-2004	4.40	5.41	2.31	2.99	4.52	7.37	3.82	8.35	3.40	3.53

Notes :

1. World trade data from WTO, *International Trade Statistics, 2005* and author's calculations.
2. World air shipments from IATA, *World Air Transport Statistics*, various years.
3. World ocean shipments from UNCTAD, *Review of Maritime Transport*.
4. US modal data from *US Statistical Abstract*, US Imports of Merchandise; US Exports of Merchandise.

Table 2. **Vertical Specialisation and Trade Growth**

	Foreign inputs as a % of exports		Growth in trade/output (%)	Contribution of VS to trade growth (%) 1970-90
	1970	**1990**	**1970-90**	
Australia	9.0	11.2	6	16.2
Canada	20.0	27.0	8	50.9
Denmark	29.0	29.5	17	30.8
France	18.0	23.9	11	32.4
Germany	18.0	19.6	9	22.2
Ireland	28.7	27.8	27	33.5
Japan	13.0	11.0	3	6.1
Korea	25.9	30.1	17	30.7
Mexico			19	40.0
Netherlands	34.0	36.9	10	48.2
Taiwan		40.5	27	51.8
UK	20.0	25.9	15	31.7
US	6.0	10.8	7	14.1

Source : Hummels, Ishii and Yi (2001).

Table 3. **Air Cargo by Region**
(thousand tons carried)

	1980	**1985**	**1995**	**2000**	**2002**	**2004**	**Annualised growth rates**
North America							
Within North America	57	64	52	317	276	258	6.5
with Europe	725	1027	1595	2764	2594		6.0
with Asia	190	346	1030	2259	3345		13.9
with Central America	108	113	98	337	361	156	1.6
with South America		194	146	406	600	1086	9.5
with the Middle East	24	34		85	59		4.2
with Africa	9	11	10	18	17		2.7
Europe							
Within Europe	586	654	1011	1414	1264	2036	5.3
with Asia	216	305	1290	2530	3029	3343	12.1
with Central America	27	40	100	141	145		8.0
with South America	101	110	114	320	234		3.9
with the Middle East	256	372	337	583	716	908	5.4
with Africa	389	434	382	602	588	591	1.8
Others							
Within Asia	114	232	1545	2104	3886	5386	17.4
N. America Domestic			1749	7847	8767	9649	20.9
Europe Domestic			318	340	280	263	-2.1
Asia Domestic			1404	2402	2535	2490	6.6
World	3258	4674	12575	26896	31793	36111	10.5

Source: IATA World Air Transport Statistics, various years.
Annualised growth rates are calculated from first to last year available in each row.

Transport Time as a Trade Barrier

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SUMMARY

Paris, April 2006

ABSTRACT

This paper analyses the relationship between time for exports and imports, logistics services and international trade. Time is found not only to reduce trade volumes but, more importantly, lengthy procedures for exports and imports reduce the probability that firms will enter export markets for time-sensitive products at all. Furthermore, a broader range of products are becoming time-sensitive following the proliferation of modern supply chain management in manufacturing as well as retailing. Labour-intensive products such as clothing and consumer electronics are increasingly time-sensitive and many developing countries urgently need to shorten lead time in order to stay competitive in these sectors. The report argues that reforms to this effect can be implemented at relatively low cost, and in low-income countries.

INTRODUCTION

It is no coincidence that cities and industrial clusters are located around good harbours or other nodes in transport networks. Easy access to food, industrial inputs and markets goes a long way in explaining the location of economic activities. One would, however, expect that with improved transport and communications technology, economic activity would become more evenly spread across the globe. This has not happened. On the contrary, better communications has led to increased geographical clustering of economic activities, while the world's most peripheral countries have become increasingly economically remote over time[1]. This paradox is first due to the fact that as transport, communications and other trade costs come down, more is traded and trade costs remain as important as ever for location of production[2]. Second, remote areas become relatively more economically remote when infrastructure and logistics are improved in central areas. Better roads will encourage investment in bigger trucks that cannot economically service remote areas, better ports encourage investment in larger and faster vessels that bypass smaller ports, and so on. For many developing countries this means that integration into world markets requires a long leap forward as far as the availability and quality of transport and other logistics services are concerned.

Trade costs have both a financial and a time dimension, and the latter has become increasingly important. This is best understood at the level of the firm, where non-core activities are increasingly outsourced to outside suppliers, who are expected to deliver their inputs just-in-time. An example can illustrate this: Ford, a car manufacturer, has contracted a logistics firm to organise the supply of components and parts for its factory in Toronto. The logistics firm organises 800 deliveries a day, from 300 different parts makers, to 12 different points along Ford's assembly line without being more than ten minutes late on any delivery[3]. It goes without saying that supplies must be kept close to the assembly line in this case. However, it does not necessarily mean that suppliers must be close to the assembly. Intermediary logistics firms can play an important role in matching suppliers and assemblers. In the case of standard components, the logistics firms can hold buffer stocks and ensure timely delivery, even when suppliers have longer lead times than the final customer demands.

Just-in-time is no longer only a feature of advanced manufacturing, it is also increasingly important in the retail sector, where the practice has been coined “lean retailing”. One example is fast fashion, where new models designed on the basis of observed consumer behaviour are introduced at frequent intervals. This usually requires that suppliers are located close to the market where production costs can be relatively high[4]. Nevertheless, it is claimed that the higher production costs are compensated for by not having to resort to seasonal sales to clear the stock. One example of this is American Apparel, which is a vertically integrated clothing firm with production facilities in Los Angeles, employing 3 000 people. It is the largest sewn products facility in the USA, and the average wage paid to sewers is $12.50 per hour. The company also has a distribution centre in Canada and offers two days’ air-freight to Europe. It markets itself as a sweatshop-free, socially responsible company, which appears to be a successful competitive factor in addition to the product itself, which is mainly T-shirts for young people[5]. In Europe, Zara, a Spanish vertically integrated fashion clothing firm, has rapidly gained market share based on the fast fashion concept. It takes two weeks for a skirt to get from Zara’s design team in Spain to a Zara store almost anywhere in the world. Clothing is largely manufactured in Spain and Portugal, at higher production costs than rivals producing in China, India or other low-wage countries. Nevertheless, the company claims that higher labour costs are more than compensated by higher productivity, lower distribution costs and greater flexibility[6].

The purpose of this paper is to shed more light on the extent to which time constitutes a barrier to trade. It will not only focus on how time affects the size of observed trade flows but, more importantly, it will look at the probability of whether trade between two locations will take place at all. In order to do so, it is necessary to include countries that do not trade with each other in the analysis. Delivery time depends on distance between the trading partners, geographical and institutional characteristics and transport and logistics services. The study will attempt to disentangle the causality chain from logistics to delivery time and from delivery time to trade flows. It is recognised that the direction of causality can also run from trade to logistics services. Clearly, the higher the volume of trade, the more viable are frequent calls of ships and planes. The relation between trade and logistics services is thus a dynamic one, where a virtuous as well as a vicious circle can prevail. This raises an important and intriguing question: Are the major barriers to trade in time-sensitive manufactures, that face exporters from e.g. low-income countries, found at home rather than in the major export markets? If so, how can trade barriers be reduced through unilateral reforms, trade facilitation and liberalisation of the markets for services, and how can aid for trade help?

The study is organised as follows. Chapter 2 reviews existing research on time as a trade barrier. Chapter 3 presents econometric analysis of exports to Australia, Japan and the United Kingdom including total merchandise exports, exports of intermediate goods, fashion clothing and electronics. The three chosen export destinations are developed economies to which imports must arrive either by sea or air. This means that exporters face the same or at least very similar conditions at the receiving end, which allows us to focus on time for exports while abstracting from logistics at the export destination. Chapter 4 discusses policy implications and concludes.

1. TIME, LOGISTICS AND TRADE – HOW ARE THEY RELATED?

1.1. The relationship between time and trade

Time to market has two distinct effects on trade: first, it determines whether or not a manufacturer will enter a particular foreign market. This is a variable with two possible outcomes - enter or not enter. Second, time affects the volume of trade once a market entry is made. Hummels (2001) made the distinction between these two effects in a detailed study of US imports. He found that an increase in shipping time of one day reduces the probability that a country will export manufactures to the USA by 1.5%. Presumably, delays due to other causes, such as administrative procedures related to exporting or importing, delays on the domestic leg of the transport route – including waiting time for shipment – and delays related to testing and certification of goods, will have the same effect on the probability of exporting to a particular market as has shipping time. There are three aspects of time that need to be considered when discussing time as a trade barrier:

- Lead time;
- Just-in-time;
- Time variability.

Lead time is the amount of time between the placement of an order and the receipts of the goods ordered. It depends on the nature of the product, e.g. whether it is made to order or if it is an "off the shelf" product. Lead time also depends on planning and supply chain management, logistics services and, of course, distance to customers and suppliers. A long lead time does not need to be a problem if delivery is predictable and demand is stable[7]. However, if there is uncertainty about future demand, a long lead time is costly even when the customer knows exactly when the merchandise will arrive. If future demand has been underestimated, running out of stock has costs in terms of foregone sales and the possibility of losing customers. If future demand has been over-estimated, excess supply must be sold at a discount. Furthermore, the longer the lead time and the more varieties of the product in question on the market, the larger are the stocks needed. It is also important to notice that competitiveness on lead time is not a static concept. When some firms are able to shorten lead times, others must follow in order to avoid punishment in terms of discounted prices or, at worst, exclusion from the bidding process. The latter can happen when a critical mass of suppliers are able to deliver just-in-time and the customer finds it safe to reduce inbound inventories to a couple of days', or in some cases even a couple of hours', supply.

Just-in-time refers to a way of organising production where inbound as well as outbound inventories are kept to a bare minimum and inputs arrive at the factory at the point where they enter the production process. Finally, time variability is measured by the (statistical) variation in delivery time. The more variable the delivery time, the larger buffer stocks are needed. Thus, even if the average lead time is low, a high rate of variability can render a supplier uncompetitive and can be more damaging than having long, but predictable lead times.

While lead time mainly affects trade volumes, time variability in an environment of just-in-time production systems and lean retailing mainly affects whether or not a supplier will be eligible for bidding on a contract. Nevertheless, lead time can be prohibitively long, reducing trade volumes to zero. Thus, the distinction between the three aspects of time does not perfectly correspond to costs that affect market entry and costs that affect trade volumes, but in general costs that are independent of trade volume (time for administrative procedures, waiting time for testing, etc.) mainly affect market entry, while time costs that are proportional to trade volume or value (insurance, storage) mainly affect trade value or volume.

1.1.1 Time as an entry barrier

There is not much empirical work on estimating time as an entry barrier, apart from the study by Hummels mentioned above. There are, however, theory developments that can shed light on the issue. A seminal paper by Kremer (1993) models production as a sequence of tasks and operations that all are essential. This means that if one task, operation or input is missing, the product cannot be finalised and it generates no revenue. The missing task or input will consequently nullify the value of all the tasks and inputs that have been performed in previous production stages. A less extreme version of the theory assigns a quality to the final product and assumes that, in order for the final product to have the desired quality, all inputs must have the minimum required quality. Examples of this abound. A producer of upmarket clothing with high-quality fabric and elaborate designs would not choose low-quality thread, zippers or buttons. Likewise, upmarket car producers would not dream of fitting a hundred thousand dollar car with a 50-dollar radio or a plastic dashboard, etc. By the same token, there is no point in using high-quality fabric in a bright orange T-shirt made to last for the few months that bright orange is in fashion. Consequently an optimal strategy for an assembler will be to choose the same quality of all inputs. As demand for quality increases with more affluent consumers, demand for low-quality, low-price inputs may decline in OECD markets.

Adapted to just-in-time production processes, the theory implies that if just-in-time is introduced at one stage of the production process, it is optimal to synchronise the entire supply chain in order for it to operate smoothly. The chain is as strong as its weakest link and therefore all links should have the same strength. When just-in-time technology is introduced, delayed delivery of a component can hold up the entire production and cause costs that are much higher than the market price of the delayed component. Therefore, no discount can compensate the customer for unreliable delivery time, and firms with highly variable lead times will not be short-listed for contracts that require just-in-time delivery.

1.1.2 Time as a trade cost

Studies of the impact of time costs in cases where time can be seen as equivalent to a tariff are more numerous, but the body of research is still relatively small. Direct estimates of the tariff equivalent of time include the study by Hummels (2001). It estimates the tariff equivalent per day in transit to 0.8%, which amounts to a tariff rate of 16% on a 20-day sea transport route, which is the average for imports to the USA. It is far and away above the actual average tariff rate.

Recent studies, that introduce time for exports from the new Doing Business Survey into gravity model estimates, find that a 10% increase in time reduces bilateral trade volumes by between 5 and 8% (Hausman *et al.*, 2005; Djankov *et al.*, 2005). These estimates are low compared to estimates of the impact of transport costs on trade flows. Limao and Venables (2001), for instance, find that a 10% increase in transport costs reduces trade volume by 20%. The two studies of the impact on time for exports do, however, suffer from a downward bias, since they ignore zero trade flows. In Chapter 3, estimates taking the zero flows into account are presented and our estimates are generally higher than the two studies mentioned, ranging between 5 and 25% reduction in trade value for every 10% increase in time for exports, depending on sector and export destination.

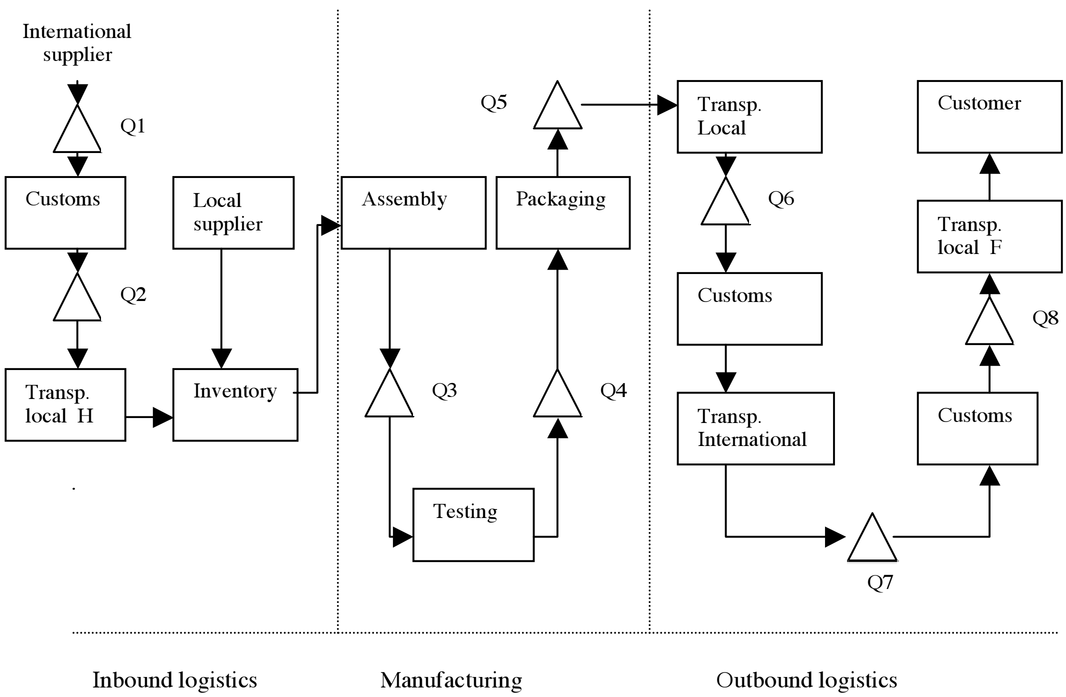
Time costs have been reduced through a sharp fall in the cost of air transport, faster ships and more effective multi-modal transport. The relative cost of air transport has, for instance, declined by 40% between 1990 and 2004 (Harrigan, 2005), while average shipping time to the United States has declined from 40 to 10 days during the period 1950-98 (Hummels, 2001)[8]. A decline in transaction costs leads to more transaction-intensive ways of doing business. Duranton and Storper (2005), for example, find that as transport and communication costs decline, exporters in the machinery industry find it profitable to produce higher-quality machines that require more interactions between producer and customer. Just-in-time management techniques have been extended to international production-sharing networks, and lean retailers contract directly with suppliers, local as well as foreign. International production networks involve the location of various production stages in different countries and imply that the components embodied in a product have crossed international borders several times before the product reaches the consumer. A commonly used measure of vertical specialisation is the import content of exports, which has increased steadily over the past 35 years[9]. However, the rate of increase appears to have slowed down in recent years and for Denmark and Japan the import share of exports has actually declined slightly since 1990. One possible explanation for this is that more time-intensive production technologies and ever leaner and more sophisticated supply chain management lead to the agglomeration of firms into concentrated areas, and that a larger number of activities are located within a country, particularly in large countries[10].

Finally, not only does time affect trade volumes, it also has an impact on f.o.b. prices received by exporters. Several studies have found that suppliers with an above average lead time fetch lower prices for their produce[11]. Exporters far from major markets can compensate for this in two, not mutually exclusive, ways. First, they can reduce lead time by shipping their exports by air. Second, since air freight is more expensive than sea freight, they can specialise in products with a high value-to-weight ratio. Such products exist in most sectors, e.g. cut flowers, peas and herbs in agriculture; brassieres and swimwear in clothing, etc. Harrigan (2005) documents that imports to the United States from its more distant trading partners have much higher unit values and are much more likely to arrive by plane. Thus, he finds that unit values are between 19 and 37% higher when imports come from countries located more than 4 000 km from the United States, and the probability for air shipment is about five times higher. The unit value does not increase monotonically with distance, however, and the effect tends to peak at around 7 800 km, a distance that includes most of western Europe and Latin America. Developing countries in Asia and sub-Saharan Africa are located between 7 800 and 14 000 km from the United States, and many of these have structural problems, including inadequate air transport infrastructure and related services preventing them from specialising in high value-to-weight products. Harrigan finally finds that the relation between distance and unit price has increased over time during the period 1990-2003. He argues that relative distance may become more important still if the relative cost of air transport comes down further. The implication could be that relatively heavy goods would be increasingly traded within regions while trade between regions would be more concentrated in high-quality light products. This prediction is worrying for low-income countries, located far from major markets and with limited capacity to specialise in high value-to-weight products.

1.2. The role of logistics services

Logistics play an important role for whether or not firms will enter international markets and for the price they receive for their product. The role of logistics is illustrated in Figure 1. The material flow chart starts at the point when imported inputs have been loaded off the ship in the country of destination. Within international production-sharing systems, the inbound material flow and related logistics are repeated for a large number of supplies. These are often synchronised by means of sophisticated supply chain management tools, but the less they are synchronised, the larger the inbound inventory needs to be. For example, an Egyptian exporter of cotton clothing imports yarn from India and Pakistan, and the time for terminal handling, customs clearance and transport from Alexandria to the company's storage facilities is thirty days. Customs clearance, including waiting time (Q1), takes at best two weeks. However, time variability when including the lead time of Indian and Pakistani suppliers is substantial, and the company keeps storage of yarn corresponding to four months' supply in order to avoid stoppages. When the clothing is ready for exports, export documents are prepared (the time unknown). Time for packaging into a container is four hours, and it takes two days from the time the container leaves the factory gate until it is loaded on a ship in Alexandria, 220 km away. The sailing time to the export destination (New York) is twenty-one days, which is about average for shipments to the USA. It could, however be shorter if export volumes allowed direct shipping, as there are many stops along the route that also goes via Canada (Devlin and Yee, 2005).

Figure 1. **Material flow**



Q1-Q8: Queue for inventory processing; H and F represent home and foreign country respectively.

Source: Adapted from Li *et al*. (2004).

Another critical service in the manufacturing section in Figure 1 is testing. Accredited test laboratories can be scarce in developing countries and Q3 can consequently be quite long. In some cases, testing facilities that satisfy the customer may simply not exist in small and shallow markets. An example of this was reported in a study of the car industry in India. A local manufacturer of switches for passenger cars could not sell to a foreign affiliate in India because thermal shock tests that satisfied the multinational company's requirements were not available locally, and the equipment to perform the tests was too expensive for in-house testing (Humphrey and Memedovic, 2003). Finally, the price a low-technology consumer good fetches in the market critically depends on to what extent it is differentiated from competitors' products. In mass consumer markets differentiation is often added late in the process, sometimes as late as at the packaging and marketing stage. Lack of expertise and speed in these areas adversely affects the price the exporter receives in the market.

Exports of cut flowers from poor countries are an example of how trade in transport services – in this case air transport – allows, for instance, Kenya to exploit its comparative advantage in floriculture. At first, flowers were transported by passenger flights, creating linkages between the tourism and floriculture sectors. As export volume grew, dedicated cargo flights have become commercially viable. However, south-bound flights run almost empty due to lack of demand in Kenya for time-sensitive imports in Kenya. This could become a constraint on future expansion in floriculture as competition increases and margins decline. Recent developments towards direct imports by retailers are also a challenge to Kenyan exporters because this would shift more of the logistical activities, including packaging and testing to exporters[12].

The logistics services included in the manufacturing section of Figure 1 are often undertaken in-house in developing countries, where the market for such services is shallow. This limits the quality of the services since most firms cannot afford to employ specialists in each of the services mentioned. It is usually the case that purchasing services from outside has a much lower fixed cost but somewhat higher variable costs than in-house production. Therefore, small firms in particular would benefit from a broad and rich logistics services market which would allow them to purchase only the amount of expert services they need, saving the fixed costs of in-house logistics provision. In fact, a well-developed logistics services market reduces the entry barriers for small and medium sized firms, both in local and international markets.

The dynamics between market size, the cost of services and depth of the services market constitute a virtuous cycle. As export volume increases, there is space for more service suppliers operating at lower costs, allowing for more timely delivery and further export expansion. Special economic zones can, in some cases, create sufficient demand both for logistics services and time-sensitive inputs in otherwise shallow markets. Finally, it should be stressed that improvements in one link in the supply chain will not shorten lead time or reduce time variability unless improvements are made in complementary links as well. More efficient customs clearance services, for instance, will not reduce lead time if local transport and logistics services remain inefficient and uncompetitive.

1.3. How long does it take to export?

The World Bank has recently conducted a survey of freight forwarders in 140 countries on freight time and costs from the factory gate until the cargo is loaded on a ship, including administrative procedures such as acquiring an export or import license, customs clearance, inspection of goods and several other indicators. In some developing countries these time costs alone account for a lead time beyond the requirement of customers in developed countries. Table 1 presents regional averages and the top and bottom five countries from the 2005 survey.

It is important to note that manufactured exports contain a considerable amount of imports. This is particularly the case in manufacturing industries characterised by international production sharing. Electronics and clothing, for instance, have typically elaborate international production networks where timely delivery is of the utmost importance. In 2001 in the electronics sector, the import content was 32% of export value in China, 55% in Ireland, 65% in Thailand and 72% in the Philippines. In the clothing sector, the import content of exports was 43% in Sri Lanka, 40% in Vietnam, 54% in Ireland, 80% in Botswana and 38% in the Philippines, to mention but a few[13]. This means that time for imports

Table 1. **Time for exports and imports**

	Time for export (days)	Time for import (days)
East Asia & Pacific	25.8	28.6
Europe & Central Asia	31.6	43
Latin America & Caribbean	30.3	37
Middle East & North Africa	33.6	41.9
OECD: High income	12.6	14
South Asia	33.7	46.5
Sub-Saharan Africa	48.6	60.5
Denmark	5	5
Germany	6	6
Lithuania	6	17
Singapore	6	8
Sweden	6	6
Central African Republic	116	122
Iraq	105	135
Kazakhstan	93	87
Chad	87	111
Sudan	82	111

Source: World Bank.

is equally important for lead time as is time for exports, and we notice that for the bottom five countries, except for Kazakhstan, time for imports is longer than time for exports.

Depending on at what point in the production cycle the administrative procedures related to exports can start, and whether or not the necessary permits and documents are specific to each shipment or are given to an exporting or importing company for a defined time period, the time for exports and time for imports could overlap to various degrees. In the worst scenario, the administrative procedures are repeated for each shipment, the procedures for imports start when an order is received and procedures for exports start when the goods are finished. In such a scenario, lead time for exporters in the Central African Republic would be more than eight months, and exports on a contractual basis to retailers or downstream manufacturers would be as good as ruled out for this reason only. This prediction is largely borne out in the data. In 2003, the Central African Republic's exports of manufactured goods were about $24.5 million, almost all of it going to the OECD countries. This underscores both how time to market restricts total exports and how logistical difficulties on the African continent curb trade within the region[14].

While transport time once the cargo is seaborne largely depends on the distance to the export destination, there is considerable time variation among countries with similar distance to export destination due to differences in port efficiency. Clark *et al.* (2004), for instance, find that improving port efficiency from the 25th to the 75th percentile (in a ranking of countries according to port efficiency) is equivalent to reducing the distance by 60%. It is also the case that routes with lower trade volumes are serviced by smaller and often slower vessels, and hence have a longer time to market.

To sum up this chapter, market entry barriers are associated with threshold levels of time to market, and a maximum tolerated variance in lead time. The lead time in, for instance, fashion clothing can be as little as two weeks, while variability in delivery can be as little as ten minutes in the car industry. Timely delivery requires high frequency and high reliability of transport links, which in turn requires a critical trade volume and reasonably good infrastructure. Finally, shorter lead times require higher speed in all links in the supply chain, which probably implies higher capital intensity, given the physical limits of the human body.

2. ECONOMETRIC ANALYSIS

This chapter presents econometric analyses of exports to Australia, Japan and the United Kingdom, focusing on the role of time. Since intermediate inputs enter into the production process of downstream customers, one would expect that time plays a more important role for intermediate inputs than for final goods, although with the proliferation of lean retailing, time is also increasingly important for consumer goods. Among consumer goods, fashion clothing has been shown to be particularly sensitive to time, and the most time-sensitive clothing items are women's and girls' wear (HS categories 6104, 6106, 6204, 6206)[15]. Vertical fragmentation and international supply chains are most developed in the electronics sector, and this sector is included in the analysis (SITC rev 2 categories 75, 76, 77). Although electronics is classified as a high-technology sector, a number of developing countries, including China and the Philippines, have entered international supply chains in this sector, mainly in labour-intensive activities.

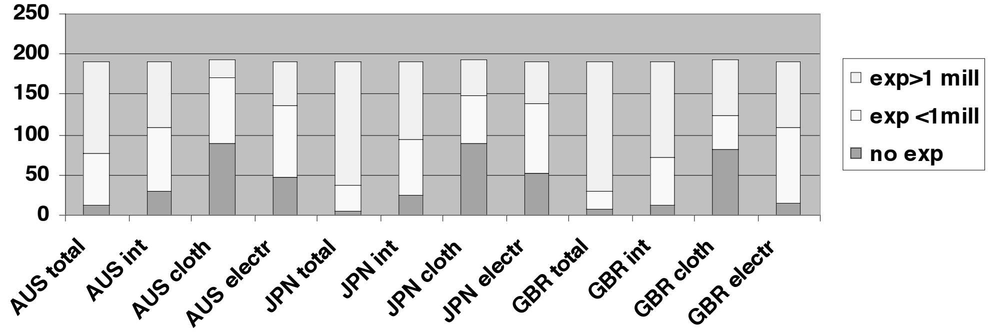
2.1. Descriptive statistics

The data includes a panel of 192 countries, covering the period 1996 to 2004. It is assumed that for the countries for which the reporters (Australia, Japan and the UK, respectively) have no registered import in the Comtrade database, imports are zero[16]. Data on control of corruption and GDP are from the World Bank[17]. The regressions including time for exports and imports are based on cross-sectional data for 140 countries in 2004.

The three reporters are different in country size, geography and industrial structure. One indicator of particular relevance to this study is the remoteness index, which is measured as the weighted average distance to all other countries, weighted by GDP in 2000. This index is about 13 000 km for Australia, 7 900 km for Japan and 6 000 km for the United Kingdom. Australia therefore probably has higher natural barriers to trade than, for instance, the United Kingdom. This is also reflected in the trade data as illustrated by Figure 2, which shows the number of countries not exporting or exporting less than $1 million of total merchandise exports, intermediate inputs, fashion clothing and electronics, respectively, for the three importers. Only ten countries in the sample, all small economies, do not export more than $1 million to any of the three export destinations.

For all three countries, imports are more concentrated for intermediate inputs and electronics than for total merchandise trade, and more concentrated still for fashion clothing. Japan is the largest economy among the three and it has the largest number of suppliers of total imports. In fact, only three among the 191 countries included in the database (excluding Japan) did not export at all to

Figure 2. **Number of countries exporting to Australia, Japan and the United Kingdom in 2004**



Source: Comtrade.

Japan in 2004. However, more countries export intermediate goods, electronics and fashion clothing to the UK than to Japan.

2.2. Gravity model estimates

The analyses start with estimates including the core variables in the gravity model, which are Gross Domestic Product (GDP) of the exporter and the distance between the exporter and the market, adjusted for the distance to all other markets[18]. In addition, as is standard in this type of analysis, we control for common language, having been part of the same colonial empire and whether or not the exporter is an island or landlocked[19]. The standard gravity model is extended by including measures of time for exports. Control of corruption is a first proxy for lead time and time variability. As discussed in Chapter 2, time for administrative procedures related to exports and imports is a very significant part of total lead time and it is furthermore strongly correlated with control of corruption[20]. Control of corruption can therefore be seen as an instrument for time for administrative procedures related to exports and imports, and it is available biannually for the period 1996-2004, while time for exports and imports is available for 2004 only. Finally, time for exports and time for imports are included in the regressions for 2004. As for the distance variable, it is the time to market *relative to other exporters* that matters, and the time is therefore normalised by dividing the absolute time by the mean for all countries (denoted *reltime* in the equations below).

2.2.1 Time and distance and the likelihood of entering the market

This subsection analyses the determinants of entering an export market. For many countries the export value is just a few thousand dollars in some years while no exports are registered in other years. As mentioned in Section 2.1, trade barriers that determine market entry are related to fixed costs. It is, however, conceivable that occasional, small export volumes can take place without traders having incurred the fixed cost of establishing a supplier relation; e.g. the occasional bargain, tax-free sales at airports and other forms of cross-border shopping. In order to capture the determinants of market entry on a more sustainable and regular basis, regressions are run where the entry/non-entry cut-off rate is set to \$1 million[21]. The regression is the following:

$$\rho_{ij} = \Phi\left(\alpha_0 + \alpha_1 \ln gdp_i + \alpha_2 \ln reldist_i + \alpha_3 reltime + \sum{}_n \alpha_{in} x_{in}\right) \qquad (1)$$

This is a Probit equation where ρ_{ij} is a measure of the probability that a firm in country i will export to country j. The parameters, α_i represent a measure of how the probability of entering the market changes with variable i. A positive coefficient means that the probability improves as the variable increases. The results are presented in Tables 2 and 3, which report the probability of exporting more than $1 million to each of the three markets. Robust standard errors are reported in parentheses and ** and * indicate significance at a 1 and 5% level, respectively[22]. Fashion clothing is a relatively small sector in most countries, and here we have estimated the probability that exports are positive rather than a cut-off rate of $1 million[23].

In all regressions the probability of exporting to each of the three reporters increases with the size of the exporting economy. The parameter is smaller for clothing than the average for total exports. Better control of corruption significantly improves the probability of entering all three markets for the time-sensitive products, and the impact is particularly strong for intermediate inputs to Australia and Japan and for electronics to all three markets. The coefficients are somewhat lower for the United Kingdom, to which most countries in the world export.

From Table 3 it appears that time for exports is particularly important for exporting electronics and intermediate inputs, the latter especially to Australia and Japan, while time also has a significant effect on the probability of exporting fashion clothing to the United Kingdom. It is finally noted that geography (distance, island, landlocked) matters less when time for exports is controlled for, suggesting that geography matters partly because it is related to time. Countries can therefore, to some extent, overcome geographical disadvantages by reducing the behind-the-border time for exports.

There is one possible problem with using time for exports as an explanatory variable for the probability to export. Transport capacity and frequency of call clearly depend on trade volumes, and causality could therefore run in the opposite direction. The results' robustness to this possible problem was tested and the results were in fact strengthened by this robustness check[24].

The parameters in Tables 2 and 3 do not provide much information about the magnitude of the effects reported, except for giving the direction of change (see Annex for an explanation of the estimated coefficients). Figure 3 illustrates the relationship between time for exports and probability to export for intermediate inputs to Australia and Japan, and for fashion clothing and electronics to the United Kingdom, respectively. The probability of exports falls off the most steeply with time for exports in the electronics sector (this applies to exports to Australia and Japan as well). It is also noticeable that the predicted probabilities for exports tend to be either high or low, with relatively few countries in between. Yet, the countries in between are the most interesting from a policy point of view.

One important insight from probit analysis is that it gives some guidance as to which countries would benefit the most from reforms. The impact of an improvement in timeliness is likely to be largest for the countries with predicted probability to export below, but not too far below 0.5. These countries are close to fulfilling the conditions for market entry, but are not quite there yet, and reforms could have a significant impact. For those countries where the probability is close to zero, more thorough reforms are probably needed in order to enter export markets for time-sensitive products. For those with a probability well above 0.5, the relevant policies are more related to enhancing export volumes, diversifying exports beyond the region and entering export markets in even more time-sensitive products within each sector. The ovals included in the figures encircle the countries with

Table 2. **The impact of control of corruption on the probability to export**

	Australia				Japan				United Kingdom			
	Total	Interm	Clothing	Electr	Total	Interm	Clothing	Electr	Total	Interm	Clothing	Electr
Ln GDP	0.80**	0.93**	0.49**	0.62**	0.50**	0.55**	0.49**	0.80**	0.86**	0.80**	0.50**	0.62**
	(0.06)	(0.06)	(0.04)	(0.06)	(0.06)	(0.05)	(0.04)	(0.10)	(0.08)	(0.06)	(0.04)	(0.04)
Ln reldist	-1.04**	-1.32**	-0.60**	-0.57**	-0.89**	-1.40**	-0.73**	-1.05**	-0.32	-0.92**	-0.30*	-0.62**
	(0.29)	(0.19)	(0.13)	(0.20)	(0.23)	(0.18)	(0.14)	(0.20)	(0.26)	(0.19)	(0.14)	(0.14)
Island	0.33	0.66*	0.14	0.45*	0.42*	-0.66**	0.41*	1.00**	0.28	0.55*	0.37*	0.55*
	(0.23)	(0.28)	(0.19)	(0.23)	(0.20)	(0.20)	(0.18)	(0.34)	(0.23)	(0.23)	(0.19)	(0.22)
Landlocked	-0.11	-0.30	0.03	0.19	-0.40**	-0.19	-0.05	0.67**	-0.49**	-0.40**	-0.17	-0.48**
	(0.15)	(0.21)	(0.13)	(0.20)	(0.16)	(0.14)	(0.13)	(0.25)	(0.19)	(0.15)	(0.14)	(0.19)
Language	0.24	0.38	-0.19	0.38					1.87**	0.85**	0.29	-0.08
	(0.17)	(0.23)	(0.15)	(0.23)					(0.35)	(0.26)	(0.21)	(0.21)
Colony			0.12			-1.87**	-1.49**	-0.42	-0.86**	-0.23	-0.08	0.57**
			(0.64)			(0.32)	(0.28)	(0.31)	(0.30)	(0.23)	(0.16)	(0.17)
Ln corr	1.45**	2.05**	0.73**	2.15**	-0.00	1.27**	1.05**	1.57**	0.43	0.47*	0.76**	1.42**
	(0.25)	(0.28)	(0.18)	(0.24)	(0.22)	(0.24)	(0.22)	(0.21)	(0.29)	(0.24)	(0.20)	(0.26)
N	827	827	832	827	816	830	830	830	835	835	835	837
Pseudo R^2	0.53	0.65	0.38	0.61	0.30	0.47	0.40	0.66	0.46	0.52	0.39	0.57

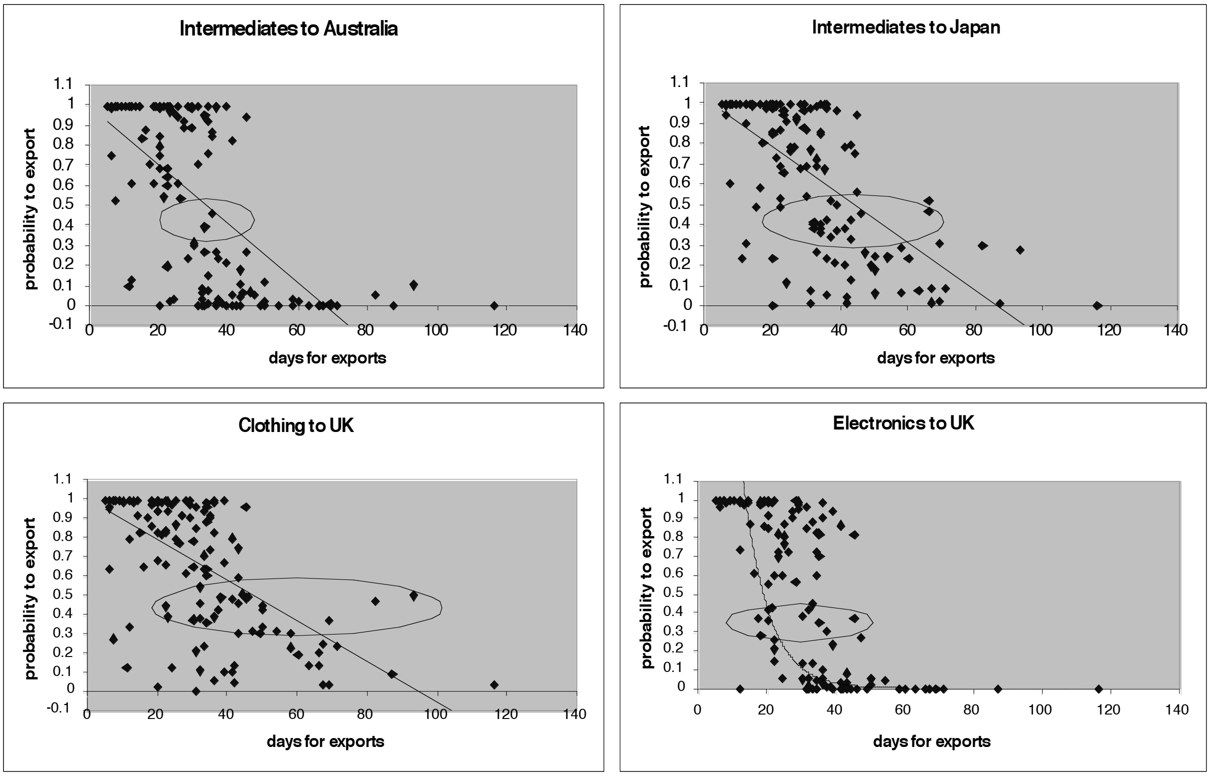
Ln = the natural logarithm;
Reldist = relative distance (which in turn is the distance in km between the capitals of two countries divided by the GDP-weighted average distance to all countries):
N = number of observations.

Table 3. **The impact of time for exports on the probability to export**

Variable	Australia				Japan				United Kingdom			
	Total	Interm	Clothing	Electr	Total	Interm	Clothing	Elelctr	Total	Interm	Clothing	Electr
Ln GDP	0.69**	1.11**	0.45**	0.86**	0.71**	0.56**	0.55**	0.89**	1.78**	0.89**	0.59**	0.73**
	(0.14)	(0.20)	(0.09)	(0.12)	(0.24)	(0.13)	(0.11)	(0.16)	(0.49)	(0.21)	(0.13)	(0.14)
Ln reldist	-0.76*	-0.93**	-0.15	-0.14	-1.88*	-1.37**	-0.80*	-0.68	0.27	-1.06*	0.40	-1.00**
	(0.35)	(0.42)	(0.34)	(0.39)	(0.65)	(0.46)	(0.39)	(0.46)	(0.99)	(0.50)	(0.33)	(0.37)
Island	0.18	0.69	0.20	0.58		-0.97	0.53	0.67	-0.25	-0.09	0.18	0.61
	(0.51)	(0.63)	(0.60)	(0.57)		(0.57)	(0.57)	(0.77)	(1.22)	(0.66)	(0.57)	(0.71)
Landlocked	-0.07	0.06	-0.13	0.13	-0.41	0.12	0.17	0.91	-0.69	-0.95*	-0.02	-1.43
	(0.38)	(0.54)	(0.33)	(0.38)	(0.49)	(0.38)	(0.35)	(0.60)	(0.65)	(0.42)	(0.36)	(0.76)
Language	0.08	0.24	0.05	0.38					5.51**	1.88*	-0.32	0.03
	(0.48)	0.67	(0.41)	(0.40)					(1.93)	(0.79)	(0.64)	(0.69)
Colony						-1.84	-1.73	0.22	-2.85*	-1.10	-0.15	0.63
						(3.64)	(2.61)	(18.09)	(1.22)	(0.60)	(0.55)	(0.50)
Ln reltime	-0.74*	-1.48**	-0.49*	-0.95**	-0.62	-1.21**	-0.46	-0.88*	0.35	-0.24	-0.71*	-0.82*
	(0.31)	(0.41)	(0.26)	(0.34)	(0.53)	(0.39)	(0.28)	(0.38)	(0.62)	(0.40)	(0.30)	(0.42)
N	135	135	134	135	119	135	135	135	135	135	135	135
Pseudo R^2	0.47	0.69	0.35	0.65	0.44	0.49	0.39	0.66	0.72	0.58	0.45	0.66

1. In the regression for Japan the regression fully explained the probability to export for the islands, so these observations were dropped in the regression for total exports. The same goes for the colony variable in the regressions for Australia.

Figure 3. **Predicted probabilities to export**



the estimated probability to export between 0.3 and 0.5. Among the countries with probabilities in this range in more than one sector and to more than one market are Albania, Belarus, Bosnia and Herzegovina, Kenya, Romania, Tanzania, Ukraine and Vietnam. Some of the countries encircled actually do export, in spite of the odds. An example of this is Cambodia's exports of fashion clothing, which can be explained by industrial policies promoting this sector and proximity to other large-scale exporters who have integrated Cambodia in regional supply chains. Small island economies such as Samoa, and other small and remote countries such as Tajikistan, have relatively high natural barriers to trade and a low probability to export even if time for exports is relatively short. A final note of warning is, however, called for. Although these results help to identify which countries would benefit the most from reform, results must be used with caution and combined with other indicators and considerations.

2.2.2 Distance and time, and trade volume

In this subsection, the determinants of export volume, given that the country in question has entered the export market, are estimated using the gravity model. We focus on the role of distance and time. The following equation is estimated:

$$\ln m_{ij} = \beta_0 + \beta_1 \ln gdp_j + \beta_2 \ln reldist_{ij} + \beta_3 reltime + \sum \beta_n x_n + \beta_{u\eta}\overline{\eta}_{ij} + \varepsilon \quad (2)$$

Lower case m represents imports, i = (Australia, Japan, UK) and the summation represents the control variables[25]. The results are presented in Tables 4 and 5 where the first includes control of corruption and the second time for exports. The parameters in these regressions are elasticities, and thus give an estimate of the percentage change in exports as a result of a one per cent change in the variable in question (all else being equal).

Exports of intermediate inputs and electronics increase more than proportionally with the exporters' GDP, while exports of clothing increase less than proportionally with the exporters' GDP, suggesting that large and/or rich countries export more intermediate products and electronics while small and/or poor countries export more fashion clothing. Cultural and institutional similarities, as represented by common language and/or having belonged to the same colonial empire, also appear to facilitate trade, although the results for the latter are somewhat mixed. Control of corruption, which as argued above is closely related to both timeliness and supply reliability, also has a large and statistically significant effect on trade volumes, particularly to Australia. The impact is strongest in electronics, which is perhaps the most time-sensitive of all major industrial sectors. For exports of fashion clothing, control of corruption appears not to matter for export volumes, but as shown in Table 3, control of corruption is important for whether or not fashion clothing is exported at all. This effect is captured when doing the two-step analysis presented in this study, but it is missed when doing gravity regressions only, as in most previous work on the determinants of bilateral trade flows.

A similar pattern is found when introducing the direct measure of time for exports, as reported in Table 5. For exports of clothing to the United Kingdom there are no statistically significant variables, except for exporter's GDP[26]. All countries in the dataset had positive exports to Japan in 2004, so the standard gravity methodology is used for that regression[27]. The other regressions are run according to equation 2 above. The geographical variables (island and landlocked) are omitted since they were not significant and did not add explanatory power to the regressions. In other words, they appear to be irrelevant for export value when time for exports is controlled for. It is again observed that time for exports is important for market entry (see Table 3) in the fashion clothing sector, but not for subsequent trade flows. For intermediate exports, exports of electronics and total exports, time for exports has an impact on both export values and market entry, and the impact is largest for electronics.

To summarise this chapter, the econometric estimates indicate that scale, relative distance and time for exports are important determinants of whether or not an exporter will enter a particular export market, and time is also important for trade volumes, particularly in the electronics sector. The results underscore the importance of reliable deliveries within international production networks. Finally, the analysis can help identify countries that would benefit the most from reforms aiming at reducing time for exports.

Table 4. **Gravity regressions with control of corruption**

	Australia				Japan				United Kingdom			
	Total	**Interm**	**Clothing**	**Electr**	**Total**	**Interm**	**Clothing**	**Electr**	**Total**	**Interm**	**Clothing**	**Electr**
Ln GDP	1.35**	1.37**	0.69**	1.77**	0.99**	1.24**	1.23**	2.07**	1.10**	1.24**	0.86**	1.34**
	(0.04)	(0.04)	(0.13)	(0.08)	(0.05)	(0.06)	(0.08)	(0.26)	(0.03)	(0.03)	(0.11)	(0.04)
Ln reldist	-2.15**	-2.03**	-1.58**	-1.78**	-1.54**	-1.99**	-2.05**	-3.16**	-0.47**	-0.74**	-1.14**	-0.93**
	(0.15)	(0.15)	(0.22)	(0.26)	(0.19)	(0.19)	(0.23)	(0.66)	(0.09)	(0.10)	(0.19)	(0.13)
Island	-0.09	0.42	0.19	0.09	0.31	-0.38	0.86*	0.45	0.14	0.28	1.04**	0.87**
	(0.25)	(0.26)	(0.41)	(0.37)	(0.28)	(0.28)	(0.36)	(0.93)	(0.17)	(0.19)	(0.41)	(0.25)
Land-locked	-0.26	-0.18	-0.08	1.45**	-0.48*	0.19	0.14	-0.08	-0.48**	-0.47**	0.37	-0.68**
	(0.19)	(0.20)	(0.32)	(0.44)	(0.21)	(0.22)	(0.31)	(0.73)	(0.13)	(0.15)	(0.38)	(0.20)
Language	0.42*	0.12	0.51	0.42					1.23**	0.65**	-0.96*	0.63**
	0.19	(0.20)	(0.32)	(0.35)					(0.13)	(0.20)	(0.41)	(0.26)
Colony	3.66**	4.84**	-5.49**		-0.19	-1.71*	-1.51	-1.47	0.27	0.24	1.42**	0.24
	(0.91)	(0.90)	(1.33)		(0.69)	(0.79)	(0.86)	(2.54)	(0.16)	(0.18)	(0.37)	(0.23)
Ln corruption	2.63**	3.21**	-0.29	4.37**	0.61*	1.73**	0.19	4.79**	1.28**	1.37**	-0.83	2.09**
	(0.23)	(0.24)	(0.74)	(0.42)	(0.26)	(0.26)	(0.36)	(1.00)	(0.17)	(0.19)	(0.45)	(0.25)
N	832	832	832	832	830	830	830	828	837	837	837	837
Ow censored	70	163	427	304	13	127	359	235	22	42	325	66

Table 5. **Gravity regressions with time for exports**

	Australia				Japan				United Kingdom			
	Total	Interm	Clothing	Electr	Total	Interm	Clothing	Electr	Total	Interm	Clothing	Electr
Ln GDP	1.35**	1.50**	0.79**	1.69**	1.13**	1.34**	0.74**	1.68**	1.15**	1.33**	0.90**	1.55**
	(0.09)	(0.10)	(0.21)	(0.21)	(0.07)	(0.11)	(0.23)	(0.28)	(0.07)	(0.08)	(0.23)	(0.10)
Ln reldist	-2.10**	-2.06**	-1.55**	-1.40*	-1.75**	-1.56**	-1.32**	-2.16**	-0.19	-0.67**	-0.77	-0.74**
	(0.30)	(0.33)	(0.39)	(0.62)	(0.29)	(0.38)	(0.50)	(0.46)	(0.20)	(0.22)	(0.44)	(0.29)
Ln reltime	-1.48**	-1.62**	0.07	-2.34**	-0.52*	-1.01**	0.78	-1.57**	-0.78**	-0.95**	0.27	-1.19**
	(0.29)	(0.32)	(0.44)	(0.82)	(0.25)	(0.34)	(0.47)	(0.43)	(0.23)	(0.25)	(0.61)	(0.33)
N	136	136	136	136	135	135	135	135	136	135	135	135
Ow censored	3	13	47	25		14	48	30	3	6	46	8
Adjusted R^2					0.74							

3. POLICY IMPLICATIONS AND CONCLUSIONS

It has been shown in this study that what is a sufficiently short lead time to stay competitive from the perspective of one country depends on the lead time of other countries. Both a sufficiently short lead time and low time variability depend on the smooth operation of a number of complementary services within a broadly defined logistics services sector, as well as a well-functioning customs service and other public services related to trade. In the absence of reforms, the developing countries with relatively long times for exports and imports run the risk of a widening competitiveness gap in time-sensitive products; and because of complementary activities along the supply chain, a reform package is needed in order to reduce lead time and time variability. A reform package should include measures that stimulate the development of a diversified logistics services market, including technical testing, packaging and marketing.

Our measure of time for exports included time from factory gate to the ship or plane and thus did not incorporate time for international transport. The large impact of the domestic leg of the transport route, both on market entry and export volume, suggests that reforms that reduce entry barriers and enhance competition in transport services are of particular relevance. Such reforms would include domestic regulatory reforms as well as liberalisation of international trade and investment. Transport services are subject to scale economies, and the frequency of call of trucks, rail and ships depends on the volume transported. For small, developing countries regional agreements, aiming at creating efficient integrated transport systems (e.g. regional hubs), could potentially reduce time for both exports and imports, facilitating the region's integration into international production networks/supply chains.

The scale issue is also critical for the creation of a diversified, broadly-defined logistics services sector. In small or poor countries this can be a problem. Special industrial zones could provide a possible first step towards a solution. These are often associated with export processing enclaves where investors enjoy tax holidays and few regulatory restrictions. This is not what is advocated here. The argument is rather that poor countries with weak infrastructure and shallow services markets cannot easily mobilise the resources necessary for investment in adequate infrastructure for the country as a whole. Furthermore, a critical mass of customers for key service providers will often be lacking. Fully serviced industrial zones could bridge this gap and serve as a first step towards integration of local firms into international markets. When well designed and managed, such zones could attract a diversified supplier base of essential logistic and infrastructure services. The special economic zones in South East Asia and China have, for instance, contributed to creating a critical mass of skills and services inputs for the electronics sector (Kimura and Ando, 2005). Lessons can also be learnt from the role that trading houses in Hong Kong have played for the emergence of China as one of the world's largest traders. During the period 1988-98, as much as 53% of China's exports were re-exported through Hong Kong, where the Hong Kong trading houses added value through sorting, packaging, testing and marketing. The Hong Kong trading houses also played an important role in providing information on Chinese producers to potential customers abroad and thus had a crucial role in matching suppliers and customers. The mark-ups on Hong Kong re-exports averaged 24%, which also illustrates how valuable these services are (Feenstra *et al.*, 2002). Finally, special economic zones are more likely to be successful when located close to a node in transport networks (e.g. port or airport).

Turning to the administrative procedures that may impede trade, reforms in customs and other government services are called for. WTO negotiations on trade facilitation aim at providing a framework for simplification and harmonisation of international trade procedures. The Doha Round negotiations are, however, limited to GATT 1994 Article V (freedom of transit), Article VIII (fees and formalities connected with importation and exportation) and Article X (publication and administration of trade regulations). In countries where time costs related to Article V and/or VIII constitute the weakest links in the supply chain, gains from trade facilitation can be substantial. In such cases trade facilitation can remove barriers to entry and induce a leap forward in terms of exports of time-sensitive goods. Furthermore, trade facilitation can in that case trigger a demand-driven expansion of logistics services in the private sector. Conversely, if logistics services represent the weakest link in the chain, trade facilitation alone is not sufficient to reduce lead time or time variability. In that case trade facilitation will reveal bottlenecks in the logistics chain and these will limit the effect of trade facilitation[28].

Earlier OECD work has documented benefits and costs of trade facilitation in developing countries as well as discussed policy options and implementation issues. This work has emphasized that more efficient and modern customs services tend to stimulate trade as well as enhancing customs revenue. Therefore, the expenses related to trade facilitation, including investment in information technology, are quickly paid back when reforms are successfully implemented. Work has emphasized the costs of not undertaking trade facilitation in a situation where trade becomes more complex and demands on customs' timely and efficient response increase[29]. The current study strengthens this argument by showing that exports of time-sensitive products decline as the time to market relative to competitors increases. In other words, doing nothing while others reform would leave firms in the non-reforming country at a competitive disadvantage.

To summarise the study, it has shown that time is an important competitive factor and hence also a trade barrier in its own right. It not only affects the volume of trade, it more importantly also affects the ability of enterprises to enter export markets at all. Many developing countries have time for exports and imports that exceeds the level that enables local entrepreneurs to enter international production networks or to become regular suppliers to lean retailers. For entrepreneurs in these countries, time for imports and exports constitutes a substantial disincentive to invest in quality and upgrade their products, since they cannot be sure that their product will arrive on the market in time to reap the price premium that new and differentiated products command. Trade facilitation has been pointed out as the "lowest-hanging fruit" in reducing lead time and time variability. In addition, as the traditional wholesalers are increasingly being bypassed in modern supply chains, developing countries need to ensure that their entrepreneurs have access to modern intermediaries who can help in matching local suppliers with foreign buyers and with ensuring that products meet quality as well as time reliability requirements. Trade liberalisation in key logistics services, as well as domestic reforms in transport and port services, would help entrepreneurs in developing countries to reduce lead time and time variability and give them incentives to invest in quality.

NOTES

1. See Redding and Schott (2003), Harrigan and Venables (2004) and Duranton and Storper (2005).

2. World trade increased from 23 to 47% of world GDP from 1960 to 2004.

3. *The Economist* (2002), Special Report Logistics, 7 December.

4. See Evans and Harrigan (2005) for a recent study on US trade in textiles and clothing.

5. See http://www.americanapparel.net/mission/workers.html, accessed 01.03.2006.

6. See http://www.inditex.com/en, accessed 01.03.2006.

7. If demand was known months in advance, orders on the quantity demanded could be placed months in advance as well, and lead time would not matter much.

8. The shipping time is the weighted average of ocean shipping and air freight.

9. Hummels *et al.* (2001) found that vertical specialisation measured this way accounted for 21% of world trade in 1990, up from 17% in 1970. Chen *et al.* (2005) found that this share had increased further in a number of OECD countries between 1990 and 1998.

10. See, for instance, Harrigan and Venables (2004) for a theory predicting such an outcome.

11. See Hummels and Skiba, (2004) and Hummels and Klenow (2005).

12. See Nordås, Pinali and Geloso-Grosso (2006) for a discussion.

13. These ratios are calculated from the GTAP database for 2001, which is the only available database that distinguishes between imported and locally sourced intermediate inputs for developing as well as developed countries. See Nordås (2003) for a discussion.

14. Limao and Venables (2001) estimate that intra-sub-Saharan African transport costs are 136% higher than what is predicted on the basis of distance and the economic and geographical features of the countries.

15. Evans and Harrigan (2005) could not reveal which categories are replenishment goods, due to confidentiality. However, a (somewhat dated) study by Courault and Parat (2000) found that women's and girls' ready-to-wear clothing had the fastest turnover in France in 1995.

16. This may not be strictly accurate since there is a category for "unspecified". Nevertheless, the trade included in "unspecified" represents a tiny share of the total, and such trade would probably not represent flows of trade based on regular supplier relationships.

17. http://www.worldbank.org/wbi/governance/govdata/ and World Development Indicators (CD-Rom). GDP for Chinese Taipei is not included in the World Development Indicators and is taken from the Republic of China National Statistics http://eng.stat.gov.tw/ct.asp?xItem=12700&CtNode=1561 and converted to US dollars at the nominal exchange rate.

18. An exporter takes a decision on which countries to export to based on, among other things, the distance to the market in question *relative to all alternative markets*. The absolute distance between the country pairs is therefore adjusted by the exporters' weighted average distance to all other countries (denoted *relrem* in the equations). The distance is weighted by GDP in 2000. See Anderson and Wincoop (2004) for a recent discussion.

19. It is common practice to introduce a dummy for whether or not the country pair in question shares a common border. This dummy relates to land borders and none of these countries has a land border, except the border between Northern Ireland and the Irish Republic. The border dummy is therefore omitted.

20. The correlation coefficients are -0.64 for control of corruption and time for imports, and -0.62 for control of corruption and time for exports. The better the control of corruption, the shorter is the time for imports and exports.

21. This cut-off rate is somewhat arbitrary. Robustness checks were run for higher and lower values. It is found that a cut-off value around $1 million gives the best fit, but even when the cut-off rate is zero the results are qualitatively the same, except in those cases where all or almost all countries export to the country in question, where the variation in the data is too small to get significant results.

22. Robust standard errors are robust to possible problems of heteroskedasticity.

23. The colony=1 dummy variable for Australia and Japan predicts success perfectly for total and intermediate goods exports and total exports, respectively, and the observations for which colony=1 are dropped.

24. The test was done by using an instrument variable for time; the number of signatures needed for exporters from the World Bank Doing Business Survey. This is a variable that is highly correlated with time for exports (correlation coefficient 0.77), but there is no reason to believe that it is correlated with the error term. The parameter estimates were similar and their statistical significance was even stronger than when using the direct measure of time.

25. The estimation technique is a full maximum likelihood Heckman regression where the selection function is whether or not exports take place and the cut-off rate here is zero. The number of zero observations (censored observations) in each regression is reported in the tables. The second to last term in the equation represents the inverse Mills ratio which in turn adjusts for sample selection bias from including only positive trade flows. Th regressions for total exports to Japan presented in Table 5 is, however, done by means of ordinary least squares since all countries in the sample exported to Japan in 2004.

26. Since the clothing sector was subject to a number of trade measures such as MFA quotas or preferential access to the EU, trade in fashion clothing is probably highly influenced by trade policy measures.

27. Data on time for exports was not available for the three countries that did not export to Japan (see Figure 2).

28. Recent modelling exercices analysing the agains from trade facilitation do not capture such complementarities and in some cases they underestimate the gains from trade facilitation and in other cases they overestimate the gains, depending on which are the weakest in the supply chain. See Engman (200) for a discussion of these studies.

29. See OECD (2003a; 2003b; 2004; 2005) and Engman (2005) for further discussion.

ANNEX

How should the probit coefficients be interpreted?

The probit equation is given as follows:

$$\rho_{ij} = \Phi\left(\alpha_0 + \alpha_1 \ln gdp_i + \alpha_2 \ln reldist_i + \alpha_3 reltime + \sum{}_n \alpha_{in} x_{in}\right) = \Phi(x\alpha)$$

The estimated values of the α_i are presented in Tables 2 and 3. The impact of a change in, for instance, time for exports on the probability to export is given by $\Phi'(x\alpha)\alpha_3$ where $\Phi'(x\alpha)$ is the standard normal probability density function evaluated at the point . The important thing to note is that the impact of a change in time varies with the value of x,α which in turn represents the underlying function in the bracket in the formula. It should also be noted that the impact is largest when the estimated probability is around 0.5.

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International Transport Infrastructure Trends and Plans

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SUMMARY

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1. INTRODUCTION

World trade is developing at a much faster pace than GDP. This has led to an unprecedented increase in international transport and has created bottlenecks at the big hubs and transhipment points. Transport capacity planning is still a national domain and this can lead to serious shortcomings in capacity development. Prestige projects can take a substantial share of available public budgets, while unspectacular upgrades and maintenance work is neglected. In the vicinity of borders there may be underinvestment, because the synergy effects of cross-border links do not enter into national cost-benefit calculations; there may also be overinvestment, because national self-interests dominate project procurement and strict tests of economic viability are not applied to funding.

The European Union has tried to overcome national barriers to cross-border investments by defining guidelines for Trans-European Networks (TENs[1]), first issued in 1996 and revised in 2004. In order to encourage investment in TENs in the past, the Commission has co-sponsored planning costs (by up to 50%) and construction costs (by up to 10%). However, it was felt that the success of the first phase of TENs was limited, since only about one-third of the priority projects have been completed and most of them had already been decided beforehand at national level, and were only later baptised as "Trans-European" in order to receive EU funding.

The second phase of TENs started in 2004 with the revised networks and a list of 75 projects for 30 corridors. It was announced in the White Paper of 2001 that the Commission would consider innovative means of financing; in particular, through the involvement of private investors and that the contribution of the EU to the investment costs would be increased to 20%, or even to 30% in the case of cross-border projects. Against the background of the budget agreements, there are serious doubts that such prospects of European sponsorship are realistic. While the Commission had expected to allocate about EUR 21 billion to TEN investments, the budget actually allocated is only about one-third of this sum. Facing extended needs after the accession of ten new members, with a further two members to come, there is little probability that the Commission will be able to push investment in the TENs.

Now that budget resources for investment are scarce, the challenge of making more efficient use of existing facilities has again arisen. Modernisation, replacement and maintenance have been widely neglected in the past and will be the dominant issues for the medium-term future. Prestige projects will have to be reconsidered, in particular if they concern market segments which are not fast-growing and where good and less expensive alternatives are available.

Coming back to international aspects, one can see that the most serious bottlenecks are to be expected along the busiest supply chains involving seaports and hinterland corridors. The main seaports will have to adapt to the requirements of mega container vessels, to faster container handling and transhipment to inland waterways or railways. The railways have a great opportunity to profit from this development, provided that they make a radical switch to commercial organisation with reliable services and uncomplicated transactions.

While the first four chapters of this paper are dedicated to major trends, transport capacity requirements, quality of service and the European approach to meeting these challenges, chapter 5 discusses the weaknesses of the European freight transport system. The potential of road traffic management has been largely unexploited and the railway sector is still too oriented towards protection by national flags rather than to the market. There is too little interest in interoperable systems or the formation of Europe-wide operating companies or alliances, which would bring more market success than huge infrastructure investments.

When the Commission's railway-friendly policy, based on its 2001 White Paper, did not yield the desired results, a change of paradigm was announced by DG TREN to prepare the ground for a new White Paper which would query a predominantly rail-oriented policy. If so, the old questions of the past few decades would again arise. Will an extension of road capacity be able to accommodate the expected growth in freight transport? What portion can be carried by inland waterways, considering their mostly variable water conditions? Will this alternative policy be consistent with the environmental goals set by the Commission? While fully understanding the annoyance of the Commission at the lack of willingness or ability of railway companies to revitalise the rail transport market, one has to consider that structures which have developed over more than a century can hardly be changed within five years. Therefore a patient, continuous and reliable EU transport policy is needed. Infrastructure improvement is necessary for the railways, but it is not the key. Railway undertakings need commercialisation and privatisation on an international scale to be able to meet the market needs of international transport. Only if that reorganisation is successful will investment in more capacity and better quality of railway services pay.

2. GLOBAL TRENDS IN INTERNATIONAL TRANSPORT DEVELOPMENT

2.1. Passenger transport

Tourism will be the main driver of passenger transport, while travel motives such as business or visits to friends and relatives are less dynamic. The highly industrialised countries show a fairly small rate of growth while the new member countries are catching up rapidly and exhibit growth rates higher than GDP.

The TEN-STAC project, which provided the basic input for the Commission's review of the Trans-European Networks, forecast modest growth in passenger transport for the old EU-15 countries, with more dynamic growth for the new EU-10 members. Air transport came out as the mode with the highest growth rates in international transport. A report by the Boston Consulting Group (BCG, 2004) gives the main reasons for this. Air carriers are able to adjust flexibly to customers' needs and already provide connections at origin-destination (OD) demand volumes, which are highly unprofitable to competitors such as high-speed trains. This means that for distances beyond 700 kilometres the market will be dominated by air, except for extremely efficient high-speed rail lines such as the Paris-Marseilles-Nice TGV. A second reason is tariff strategy, which is dominated by low-cost carriers. The latter will force competitors to apply similar business strategies. In the end, there will be many more OD links in international passenger transport, providing convenient conditions at lower prices for customers. High-speed rail will be competitive on some corridors and for medium hauls. However, it will not be able to serve spatially dispersed demand, as the latter is not high enough to fill the train capacity at financially viable frequencies of service.

When it comes to airport capacity requirements, one can observe the following trend. First of all, there is increasing demand for hub-and-spoke services, but only at very large hubs. It appears that not all major airports will satisfy the hubbing requirements to accommodate terminals to mega-airplanes (A 380), nor provide enough spokes, including high-speed rail. Secondly, the market for direct international flight services will develop even more rapidly, and the development of the Boeing 787 and Airbus (A 350) indicates that manufacturers will equip carriers with fuel-efficient and flexible aircraft.

The remainder of this paper will not go into further details on passenger and air transport.

2.2. Freight transport

2.2.1 The driving forces of freight transport

For industrialised countries, transport dynamics are the result, primarily, of the rapid development of trade and goods transport. Traditionally, a strong correlation, or "coupling" as it is known, has been assumed between GDP and goods transport. Various papers discuss ways of "decoupling" transport from GDP growth. However, such a policy would be based on a faulty paradigm as it is not GDP that drives transport. First of all, contributions from the service sectors account for two-thirds or more of GDP, and even a portion of the value added of production sectors is generated by production-related services. Secondly, as the level of industrialisation rises, production output becomes "lighter" because the share of raw and other bulk materials necessary for production declines over time. Thirdly, as the level of industrialisation rises, the "heavy" components of production processes are out-sourced and production structures become flatter.

2.2.2 Globalisation patterns

The globalisation of production, distribution and sourcing is not a new phenomenon; it was described long ago by Karl Marx (1867). However, since the political changes in Central and Eastern Europe and the rapid economic development of the South-East Asian "tiger" countries, China and India, globalisation has been developing at an unprecedented speed.

The first reason for this is technological. Since Schumpeter (1952), we know that following radical innovations, particular technologies have governed economic trends for cycles lasting several decades ("Kondratieff cycles"). The last Kondratieff cycle was characterised by microelectronics and the information industry (Nefiodow, 2001). Since, physically, products had not fundamentally changed, production could easily be broken down into components. This prepared the way for dispersing production worldwide at locations where the education of workers was sufficient for the particular components and wages were low. Spatially dispersed production operations could be co-ordinated by using advanced communications technologies and efficient logistics supply chains for transport.

The second reason is economic. The CEECs have gone through a transition phase and introduced market economies with a high level of division of labour and trade. China has developed into a socialist market economy which, in many respects, looks like a high-speed replay of the Industrial Revolution. Accordingly, international trade has been growing dynamically. Export/import activities with Germany increased by 25% in one year (2005). While trade between old trading partners grew more modestly, the rates for 2005 were nevertheless between 5 and 7% (see Table 1 and Map 7 in annex).

The third reason is social integration. People increasingly learn about foreign countries, spend their holidays there and learn to appreciate foreign products. Thus consumers accept more readily that a software product has been made in India, a spare part for their Mercedes in Korea or that their jogging shoes come from China.

Despite globalisation, intra-European trade is still significant and represents a share of about 60% of total European trade.

2.2.3 Freight transport development in industrialised countries

We can safely draw the conclusion that the driving forces behind the increase in goods traffic are trade and industrial exchange. The growth rate of world trade is substantially higher than that of world GDP. In Germany, a country with a high share of international trade, the growth rates of exports and imports are about triple that of GDP. The reason is that sourcing and distribution of goods are dispersed throughout the world and production processes are organised such as to combine the best resource options (resource cost, labour cost and taxation). Worldwide production chains and networks are controlled by efficient communication, organised by logistics providers and carried out by cost-efficient transport carriers. Transport costs are comparatively low for high-value products, so transport distances have increased dramatically in recent decades.

This is reflected in the following characteristics of freight transport development in industrialised countries.

(1) Volumes in tonnes per year are stagnating or even decreasing for domestic freight movements;

(2) International origin-destination transport volumes are increasing slightly, while transit is growing most dynamically;

(3) Transport performance in terms of tonne-kilometres shows a slight increase for domestic freight, a fairly small increase for international origin-destination transport and a sharp increase for international transit;

(4) Weight/value ratios (transport intensities = tonnes of transport volume per Euro of production) are declining in the accession countries, starting from a high level. In highly industrialised countries, such as Germany, the figures decreased until 2002 and then showed an upward trend. This holds in particular for international trade (exports, imports);

(5) The development of modal split is not uniform. In many countries the railways continuously lose market share to road freight traffic. In other countries in which the railways have been privatised and the major players are behaving commercially, the share of the railways has increased since 2003.

Points (4) and (5) warrant further analysis. One would expect transport intensities to decrease continuously, because transport is costly and efficient logistics would reduce transport to the minimum per unit of production. However, transport is only one part of the logistics business and its costs are traded off against other process costs. In recent years, other factors, such as direct labour costs, indirect labour costs and proximity to market have become more and more important. As transport costs are only a small part of total logistics costs, there is a tendency to lower overall logistics costs by replacing high-cost elements such as inventory holding with low-cost elements such as transport. This development can be observed in particular for NST/R group 9: transport equipment, machinery, manufactured and miscellaneous products.

Summing up, the trends in freight intensity, measured in tonne-km per unit of GDP, show an increase in highly industrialised countries like Germany.

3. QUANTITATIVE AND QUALITATIVE RESTRICTIONS ON GROWTH

3.1. Major bottlenecks

In recent decades, the development of road traffic was the dominant dynamic in transport development and a lot of bottlenecks appeared on the road network. A large number of bottlenecks will persist in the future, as Map 6 shows for Germany. However, the extension of the road network is problematic for the following reasons:

(1) Road development leads to induced road transport such that the forecast needs for capacity extensions are in general insufficient;

(2) Road extensions encounter environmental and social barriers to growth;

(3) Sufficient road capacity encourages ad hoc planning of transport supply instead of medium-term planning of quality logistics.

As a result, alternative and environmentally more efficient modes, such as rail and inland waterways, are being considered for their potential to attract higher transport shares. These modes appear to be the most efficient for parts of supply chains, however, they also suffer from serious bottlenecks which prevent them from diverting a substantial share of transport volume from road to rail. Physical bottlenecks in railway systems often occur because service categories are mixed. If interregional and regional passenger transport share the same network, capacity in the vicinity of railway stations declines because of mixed service operation. In Germany, the states (*Länder*) and community co-operatives have established integrated regular services for local and regional transport and reserved the capacity needed from the railway company. As there are penalties for non-punctual service, the railway company might give priority to local and regional services rather than to interurban passenger transport. In many cases freight trains are only allocated paths in time slots when passenger train frequency is low, i.e. at night. During the day, capacity for freight trains is in general very limited. Again, the dedicated allocation of capacity to regional/local passenger trains is the main reason for this.

In contrast to France, the problem of service mix in Germany exists even with high-speed trains, which in the vicinity of stations often have to share tracks with slow train categories (this also holds for Cologne, the terminal of the fastest high-speed line in Germany). Consequently, the separation of tracks for different types of train is a major challenge for increasing capacity. In Germany, the "Network 21 investment programme" is aimed at creating a freight train network on which freight operations are not disrupted by passenger train movements.

For inland waterways, capacity restrictions can usually be put down to insufficient lock size and variable water conditions. For instance, many canals are not prepared to accommodate three-tier container ships, and rivers like the Elbe allow for unrestricted shipping for only some 200 days per year on average.

Over the past few years, maritime container shipping has increased dramatically. Many ports are not prepared for this development and have serious capacity bottlenecks. They may not have sufficient loading/unloading capacity, deep-sea access or sea-port hinterland connections. The latter is a typical weakness of Italian Mediterranean ports, such as Goia Tauro, south of Naples. Although container transport through the Mediterranean is increasing dynamically, this relatively new port does not share in this growth because of its very poor connections to rail and motorway networks.

Analysis of bottlenecks in railway and waterway systems can lead to differing conclusions. It might be possible to remove bottlenecks through relatively small investments and a change of operating schedules, for instance, on the international Strasbourg-Kehl rail link between France and Germany. The removal of other bottlenecks would require huge investments, e.g. upgrading locks along the Rhine-Main-Danube canal to allow for three-tier container shipping.

3.2. Backlogs in levels of service

The weak market position of rail and waterways in the EU is not so much a consequence of physical bottlenecks as of a level of service that has lagged seriously behind. While transport companies in the road and air sectors increased service quality and decreased tariffs dramatically after the deregulation phase in the nineties, the railways are lagging behind because the deregulation and privatisation process only got off to a start with the implementation of Directives 2001/12-14, which injected some dynamism into the hitherto stagnant railway environment.

In the freight sector, where logistics requirements have changed rapidly in the past 15 years, railway companies have been unable to follow the lead set by their main competitor, road freight transport. Even in market segments that are suited to rail transport, with high volumes transported over long distances, they have lost market shares. Just recently the success of some railway companies, such as Railion, has shown that service quality can be improved substantially - here, along the north-south corridor - if shippers' contacts and negotiations can be reduced to just one provider (a one-stop shop) and operations can be optimised across borders. In other words, high-quality logistics and co-ordinated train operations must go hand in hand if rail is to attract new customers. Looking at the East–West corridors, there is continuing stagnation and only a few trial connections between Germany and France which offer a co-ordinated cross-border service. However, one important element of high-quality logistics is still missing and that is the guarantee to the shipper that the goods will arrive on time and undamaged. Until now, the railway companies involved have been unable to allocate this risk appropriately.

As long as railway companies are unable to meet the basic requirements of the market they will lose market shares to road transport, despite its increasing problems with meeting just-in-time or just-in-sequence requirements on highly congested roads. Yet, as soon as the quality of service becomes good enough industry changes readily to rail, as is clear from the recent example of Porsche, which is to switch to rail-based logistics on well-served corridors.

4. THE EUROPEAN RESPONSE: TRANS-EUROPEAN NETWORKS

4.1. Physical infrastructure

The Trans-European Transport Networks (TEN-T) were first defined in the 1996 guidelines and revised in 2004 in accordance with the suggestions of the high-level Van Miert Group.

Twenty-nine corridors in all plus the satellite navigation system, Galileo, are defined as being of particular European interest (Map 1). Alongside these corridors, 75 projects are regarded as necessary and of high priority to bring the TEN-T to the desired quality standard. The costs of the investment programme, which would take about two decades to complete, are estimated at EUR 220 billion.

The Commission, assisted by the TEN-STAC consultation project, considered the four most important criteria to be the following, which were taken as the basis for a rough assessment of the corridors (see Map 5).

(1) Transport volume and share of international transport.

(2) Improved accessibility for the regions of the Union.

(3) Savings in generalised costs (time and operation costs in transport).

(4) Environmental protection.

In the TEN-STAC project these criteria were quantified and, furthermore, a rough financial calculation was prepared to give an indication of financing possibilities. However, it was not possible, in the process of TEN development, to prepare a project-based cost-benefit analysis, to perform a systems assessment for the complete investment plan, or to check the financial viability of single projects. This highlights a dilemma that continues to dog TEN-T planning and one that has been addressed by several authors, in particular by Turro (1999): the EU has no planning competence for transport networks because this is a national domain.

The Commission can only promote the implementation of TEN projects by giving grants and subsidies. While formerly the EU contribution to TEN projects was limited to a maximum of 10% the Commission has tried to increase this level for the forthcoming budget period from 2007 to 2013.

The plans were cut back by the general budget decision which finally reduced TEN funding from EUR 21 billion to EUR 7 billion. Funding selected border crossing projects such as the Brenner base tunnel by more than 10% (the agreement provides for EU support of 20% of investment costs and 50% of planning costs) will restrict the potential funding for other projects, for instance, in the new member countries.

4.2. Dominance of mega-projects compared with upgrading and maintenance

Looking at the corridor maps, one cannot fail to notice that the priority list for the TEN-T contains a number of projects reflecting the past dreams of European transport policy, which could not be developed because the countries concerned were unable to finance these undertakings. In general these projects are extremely costly and would eat up most of the EU funding available. Some of the most prominent projects are:

- Fehmarn-Belt Bridge (Corridor P20)
- Strait of Messina Bridge (Corridor P01)
- Brenner Base Tunnel (Corridor P01)
- Mont Cenis Tunnel (Lyon-Turin, Corridor P06)
- Turin-Venice-Trieste (Corridor P06)
- The Pyrenees Crossing (P18)
- High-speed links in Portugal and Spain (P08)
- Upgrade of the Spanish rail network to standard gauge (P8, 16, 19).

It is widely known that the procurement of transport mega-projects follows particular rules, which are not overly influenced by economic calculations (see Flyvbjerg, Bruzelius and Rothengatter, 2003). This being the case, against the background of reduced funds, the Commission has not tried to hold a second round of project reviews to check for any duplicate investments, possible overcapacities or financial risks. Instead, it has established a team of prominent promoters who are trying to remove national barriers to investment and recruit the missing funds from country budgets and the EIB.

The EU TIPMAC project applied a systems approach to test the macroeconomic impacts of the TEN-T programme. The result was that the overall economic benefit, taking into account the impacts of finance, was almost zero. This indicates that the investment programme includes several projects which are not viable from the economic point of view. Let us examine some mega-projects in more detail.

1) Transalpine corridors

The plans for transalpine corridors were developed about ten years ago when some forecasts pointed to an explosion in transalpine traffic of up to 400 million tonnes per year in 2040. Since then, the forecasts have decreased to about 50% of this figure for 2030. As a consequence, the construction of four high-capacity train corridors, two in Switzerland (Lötschberg, Gotthard), one in France/Italy (Mont Cenis) and one in Austria/Italy (Brenner) will result in overcapacity. The only chance of increasing freight transport demand for the Brenner and Mont Cenis corridors would be to increase the tolls for lorries on the transalpine routes dramatically, following the lead given by Switzerland. However, in a landmark decision against this policy, the European Court of Justice forced the Austrian company, ASFINAG, to reduce their charges for Brenner transit and to refund road haulage companies for past overpayments. In addition, the new Directive on motorway charges for heavy goods vehicles will not allow drastic mark-ups for transalpine transport, and has set the maximum surcharge at 25% above the average charge. This is far from enough to bring about a major shift from road to rail or to come anywhere near the projected patronage for the planned tunnels.

2) The Fehmarn Belt

Traffic from Sweden and East Denmark would flow, as the crow flies, directly to Germany if the Fehmarn Belt project were to go ahead. The problem is that a substantial share of the traffic on the Fehmarn Belt Bridge would be diverted traffic that would otherwise use the Great Belt Bridge and the Jutland rail network, which were upgraded in order to accommodate this traffic. In other words, the very traffic activities that were reckoned some years ago to justify the Great Belt Bridge are now considered to prove the benefits of the Fehmarn Belt fixed link.

3) The Pyrenees Crossing and the Messina Bridge

A brief glance at the economic figures of these projects reveals that their only justification is the regional structural policy argument. There is actually no chance that these projects can recoup a substantial share of investment through revenues from user charging.

4) Portuguese and Spanish high-speed rail projects and conversion to standard gauge

Looking at the western section of Map 1, one cannot fail to identify several cases of duplicate investment for the Portuguese and Spanish interurban rail networks. A closer look at the interurban rail network - consideration is being given to its reconstruction in order to take standard rail wagon and engine bogies - shows that the regional trunk lines are also included in the TEN-T network. The question is whether it is in the European interest to bring regional trunk lines up to European interoperability standards.

4.3. Motorways of the sea, seaports and hinterland connections

The Commission's forthcoming White Paper on Common Transport Policy will be more focused on logistics and freight transport. When it comes to international logistics chains, then seaports and airports play a leading role as hubs in the logistics network. Fortunately enough, the Commission had already included motorways of the sea as a sub-network of the TENs in its 2004 guidelines.

In 2004, 44.3% of tonne-kms in Europe were transported by road while 39.0% were transported by short sea shipping. Many parts of Europe have geographic characteristics which give them strong affinities for this kind of transport. Its modal share has been increasing lately. Looking at the rapid increase in long-distance container transport, it is not difficult to foresee that seaports will play a greater role in the near and long-term future, for two reasons. Firstly, some seaports are already developing hubs for international transport movements, and others will follow suit. Secondly, some transport distribution operations from the major hubs can be performed by short-sea shipping.

If the European seaports system is to fulfil these tasks, it will have to be improved substantially. First of all, an increasing share of maritime transport flows will be composed of containers carried by mega-liners. This will mean that the big players, like Rotterdam, Antwerp, Hamburg or Bremerhaven/Wilhelmshaven, will have to make access routes and port facilities ready to handle the new dimensions. Investment in deep-sea ports will therefore be necessary. Secondly, container handling capacity will have to be adapted for moving containers to processing gates for short sea and hinterland transport. Thirdly, hinterland connections that are spokes of the logistic system will have to be improved (see Map 3). Map 2 shows the main seaports in the European Union, while

Table 3 gives container transport volumes for the year 2005. For comparison, Table 4 shows the World's 15 largest container ports.

According to optimistic forecasts (New Opera, 2006) the volume of container transport in European seaports will almost double in the ten years from 2005 to 2015. How that growth will be distributed among the main ports will depend on their adaptation and extension of port facilities. If all capacity constraints can be removed, then there will be little change in the ranking of the biggest players. Rotterdam is expected to see growth of 81%, Hamburg of 89%, Antwerp of 82% and Bremerhaven of 88% (see Table 3). Facing these demand dynamics, an extension of port capacities will be necessary and can largely be financed by port handling fees. This means that the presently high public subsidies in port facilities can and should be reduced.

A fundamental requirement of modern logistics is the ability to monitor and optimise the supply chain from shipment origin to destination, which means that good port facilities are not enough. Good examples of this are the ports of Genoa and Goia Tauro (south of Naples). Although maritime traffic flows through the Suez Canal to Mediterranean ports are showing an above-average increase, these ports have only profited slightly from this development. While the total TEUs handled in Valencia grew by 106.5% from 2000 to 2005 (Algeçiras 58.3%, Barcelona 49.7%), in Genoa it increased by only 8.3% and in Goia Tauro by 19.1%. For both ports, very poor connections to the main railway - and in the case of Goia Tauro, road corridors - are major bottlenecks. In a bottleneck-free scenario, the port of Goia Tauro would more than double container transport volume over the period 2005 to 2015 (New Opera, 2006).

Fast growing seaport-hinterland transport opens up major opportunities for European railway companies, because these are high-volume, easily consolidated flows over long distances. The removal of bottlenecks and co-ordinated management of transport operations along the corridors would create broad market potential in this important segment.

Clearly, seaport-hinterland transport from Amsterdam, Rotterdam and Antwerp (the ARA seaports) is also the domain of inland waterway shipping. Inland waterway transport flows concentrate on the Rhine Corridor, which is most important for the Dutch and Belgium ports (Rotterdam, Antwerp). Some connecting canals are also very important and attract a major share of growing container flows; for example. the Elbe lateral canal with its connections to the East (Berlin) and to the West (Ruhr area).

The River Danube and its connection to the River Rhine and the North Sea, through the Rhine-Main-Danube canal, is mentioned as a main waterway corridor in the guidelines and other documents. However, there will be serious problems to be overcome. First of all, in the course of any one year, variations in water levels create different conditions which are detrimental to stable logistics patterns. Secondly, in order to improve on the water conditions, flow regulation measures would be necessary; these are costly and not readily accepted by environmentalists (e.g. the deepening of the river between Vilshofen and Straubing). Thirdly, in the medium-term, some of the neighbouring states will not be able to participate in the funding of the necessary investment. Fourthly, it will be hard to extend the Danube inland waterway corridor by connections to the River Elbe or the River Oder, as shown in optimistic plans for the extension of European waterways. The fifth problem is that the transport quality provided by the Rhine-Main-Danube Canal is insufficient because it only allows for the operation of medium-sized barges and two-tier container ships. The reason is limited lock capacity, which would require very high investment costs if adaptations were planned for the sixteen locks of the canal.

As well as the above, other inland waterways face major difficulties when it comes to adapting them to the needs of modern freight transport. For instance, the shipping of goods along the River Elbe is often disrupted by adverse water conditions. A policy decision has been taken not to canalise the river, but instead to upgrade it partially, for environmental reasons. This will not change the major quality deficit, indicating that investments in deepening the River Saale, building a new Saale lateral canal and extending port facilities are uneconomic. To conclude, expecting that there will be new waterway corridors that can accommodate major shares of seaport hinterland transport is not very realistic. The Rhine Corridor will extend its dominant position in inland waterway shipping, and the potential of the northern east-west canal connections will be high once bottlenecks are removed (Seine-Schelde, Magdeburg-Berlin). It will be important that the existing main waterway corridors keep providing high levels of service, which first and foremost means providing adequate water levels most days of the year. A combination of short sea shipping, existing and upgraded main inland waterway corridors and railway hinterland transport is more economic than providing new major inland waterway corridors by river regulation and canal construction. To give one example: a 30 000 tonne vessel would take no more than two weeks for a trip from the Black Sea to an ARA port, while the same transport would need three weeks and a fleet of 20 barges on the route via the Danube, the Rhine-Main-Danube Canal and the River Rhine. Taking into account the spatial distribution of freight transport demand it is evident that the combination of motorways of the sea and rail transport is much more flexible and time saving, as well as providing stable transport conditions independent of water level. Of course, this would presuppose a radical improvement in the quality and reliability of rail logistics services, and that is a major challenge for EU competition policy.

4.4. Telematics and Galileo

According to the Commission's plans, Galileo satellite navigation technology will bring low-cost positioning and timing services of unparalleled accuracy and reliability to all sectors of society. Beyond technological progress, which is modest compared with GPS or GLONASS, Galileo offers a unique opportunity of developing a satellite navigation system for non-military requirements. It is this option which makes Galileo one of the European undertakings that offers the most benefit.

Galileo offers new options for technology development in many sectors, not just in the transport sector (e.g. satellite-based control systems). It will actually foster economic development in all of the EU countries while in the first phase the highly industrialised countries will benefit most. Furthermore, one can expect high multi-modal network effects because – once the system is installed – the variable costs of use will be very low. It is precisely this wide range of advantages that gives rise to the major problem for the Galileo system: finance. Galileo is a club good and as such is an invitation to free-ride for all partners who refuse to pay but cannot be excluded from use. Therefore, although the investment costs appear rather limited (estimated at about EUR 3.5 billion) and the cost/benefit ratios come out very high (up to a ratio of 4:1) compared with physical mega-projects, there are still problems with allocating the financial burden to states or state-owned enterprises. This has already led to delays and uncertainties about the timing of activities in the implementation programme because final agreement has not been reached on the financial plan.

Galileo is closely related to the Trans-European Networks for Communication, the eTEN programme. eTEN is designed to help the deployment of telecommunication networks-based services (e-services) with a trans-European dimension. The programme focuses strongly on public services, particularly in areas where Europe has a competitive advantage. In the transport sector, the new services are encompassed under the term "telematics" and include, in the first instance, guidance, control, management, payment and driver assistance systems. As will be pointed out in Chapter 5, consistent use of new information technology, together with management techniques, can contribute substantially to mastering bottleneck problems in European transport networks.

4.5. Beyond Trans-European Networks

As global trade activities are developing rapidly it is becoming increasingly important to connect the Trans-European Networks to the main global corridors (see Map 4). As previously stated, seas are the gateways to these corridors. However, there are other possibilities, particularly if connections to Russia and the Asian continent are taken into consideration.

Sea transport from East Asia to Europe takes about 25 days. The Trans-Siberian route from Berlin via Warsaw, Minsk and Moscow to Vladivostok would cut transport time to about 12 days and thus improve logistics efficiency as well as saving on costs. The minimum time achieved in a test run was nine days.

At present, this rail route carries only 1% of the trade volume between Europe and Asia.

In the year 2000, about 40 000 containers were shipped along this corridor, which uses only 25% of its existing capacity. One of the reasons for this substantial under-use of the carrying capacity of the Trans-Siberian route is the low service quality and lack of reliability. Another reason is the tariff system for containers, which has not yet been standardized and is rather complex. The third reason is the high cost of freight transshipment at the Russian seaport of Vostochny. The fees are twice the amount charged by the Korean seaport Pusan, or by the port of Shanghai in China. This points to the likelihood that the high potential of this railway corridor will not be exploited because of inadequate management performance and short-sighted policy barriers.

With the prospects of an uncertain future for the Trans-Siberian alternative, rail routes linking China/Korea to Central Asia, Turkey and Europe - at least partly circumventing Russia - could gain in importance. The Fraseka Corridor, which links Central Asia to Europe via the Caucasus Mountains, could also be developed.

5. THE CHALLENGE OF MAKING BETTER USE OF INFRASTRUCTURE

Transport infrastructure is widely provided by the public sector. It therefore follows that in times of budget prosperity there is a tendency to over-invest, while in periods of budget depression investment in transport networks will be cut back. If one traces business cycles after the Second World War, it becomes apparent that there have been three decades of high investment activity between 1960 and 1990 followed by a cut-back in investment budgets over the past decade and a half. Reflecting the fact that politicians in general prefer to launch new projects rather than upgrade existing ones, it is safe to assume that new projects are still preferred even in periods of scarce budget funds, and upgrading, reinvestment and maintenance is neglected. In several countries there is empirical evidence for this hypothesis.

Against this background one may question the strategy of maximising investment in new and more expensive transport projects, financed predominantly by public money, while the quality of existing networks is deteriorating because of withdrawn funding. The alternative strategy would be to use available funds from transport taxes and charges predominantly for upgrading and maintenance of the existing network, while new investment would be financed mainly by private investors, in a bid to minimise financial contributions from the public purse. Such a strategy would reveal which new projects are really needed by the private market and which are aimed only at making outdated political dreams come true.

5.1. Road traffic management systems: the unresolved weaknesses

Concentrating on the existing network, the challenge will be to make more efficient use of capacity. In the case of roads this can be achieved by traffic management, which includes:

- Traffic information, guidance systems, fleet management;
- Flexible use of lanes and regulation of parking space;
- Road pricing.

In theory, it is easy to demonstrate that individual instruments are each a step in the right direction and that the combination of instruments generates a synergetic effect; practical experience is less encouraging. First and foremost, this is because the application of the instruments is incomplete. Take, for example, the present state of route guidance systems. They are well suited to guiding an uninformed driver through an uncongested network to his or her destination. As soon as the network becomes congested or bottlenecks occur as a result of accidents or construction work, route guidance systems recommend the wrong alternatives because they are static and cannot take into account the state of network loading if drivers begin to follow their recommendations. This leads to the well-known "self-negating prophecy" of guidance systems. If a bottleneck occurs on route I and the system recommends alternative route J, which may have less capacity, then if most of the drivers follow the advice, gridlock will shift from route I to route J and nobody will be better off.

The OVID research project, conducted by the German Ministry of Education and Research, was able to work out the necessary conditions for alleviating a network congestion situation: drivers need the assistance of several (software) agents, which collect all of the relevant traffic information, prepare route, timing or modal choice decisions for their master and inform the (software) agents of other drivers through an information trading mechanism, which works along the lines of a trading exchange. In this way, sub-optimal human decisions where information is incomplete can be reduced so that the end result of the process of interaction between agents is a Pareto improvement, in the sense that a subset of users will be better off and the remaining subset is not worse off. Of course this presupposes truth-telling among the agents, i.e. the absence of destructive strategies. The results of such an improvement are two-fold. Firstly, it reduces system congestion, resulting not only in a lower expected value of travel time but in a reduction of route variance, which might be even more important for commercial drivers. Secondly, the capacity of the network increases as the loading pattern improves, or, conversely, it will not be necessary to increase capacity proportional to traffic growth. The estimated savings in capacity are 10% on average, which is remarkable considering the investment costs which would be necessary for a 10% capacity increase.

The impact of better information systems can be radically improved by road pricing. This is because financial incentives make the recommendations more acceptable and prompt a series of user reactions in addition to the choice of other routes, including changes of time, destination, mode or of the activity combination which leads to traffic demand. However, incomplete road pricing schemes can lead to counterproductive impacts. Take, for example, motorway charges for heavy goods vehicles in Europe, in accordance with EC Directive 1999/62. In the first version of the Directive, pricing was restricted to lorries with a gross weight of 12 tonnes or more on motorways and roads of similar construction. These partial pricing schemes led to some undesired shifts: a shift from motorways to lower category roads or a shift to weight classes below 12 tonnes (manufacturers constructing HGVs with a gross weight of 11.99 tonnes). Therefore, the potential of the toll system to induce more consolidation, better load factors and fewer vehicle kilometres is not used to advantage.

This said, the present scheme can also provide positive incentives, particularly since the revision of Directive 1999/62/EC, which was transposed in June 2006. The new scheme allows for toll differentiation, according to traffic conditions or time of day, of up to 100% between the highest and lowest charge, and for differentiation according to emission categories (EURO classes), again by up to 100%. The incentive effects of environmental differentiation are much higher than from a marginal cost pricing scheme that includes external costs. This is due to the fact that road haulage companies are turning to new propulsion technology before writing off the existing truck fleet. It appears that the market has made the leap to EURO 5 vehicles, which are already available, although EURO 4 would be sufficient for new vehicles. Unfortunately member states that have introduced the HGV-tolling scheme are not making use of the possibility of differential tolling in line with congestion level or time of day. Therefore the potential of road pricing to remove bottlenecks and shift traffic to less congested times of day is largely unexploited.

In conclusion, the effect of a combined information/road pricing strategy on capacity savings can be estimated at 10 to 20%. It is possible to achieve this without negative impacts on economic growth, because additional revenues from pricing could be offset by a reduction in transport-related taxation. While this positive effect of pricing is underlined in the Commission's Green and White Papers, the reality looks different. The German Ministry of Transport secured the acceptance of hauliers' associations for its TollCollect pricing scheme, by announcing that part of the revenues would be used to reduce the fuel tax burden. This means that part of the fuel tax paid in Germany (by domestic as well as foreign haulage companies) would be paid back by the State. The European Commission found that such a compensation scheme would disadvantage foreign companies which fill their tanks in other countries and therefore would not benefit from the scheme. However, compensation for all companies using German motorways would be equivalent to a lower user toll on the motorways, which was finally the (temporary) solution to the policy conflict with the Commission.

This odd decision by the legal services of the Commission, which is contrary to the territoriality principle of market harmonisation, has an obvious impact: filling tanks in low fuel tax countries like Spain or Luxembourg creates a competitive advantage which should not be offset by a reduction in territorial taxes. This dramatically reduces the acceptability of an extension of the tolling scheme to other road and vehicle categories in Germany, and marks a big step in the wrong direction on the way to harmonized taxation/charging conditions.

5.2. European Train Control System: Looking for "white knights"

Interoperability is a major issue for European railway policy and is emphasized in the Railway Package Directives, as they are known. An association was established in conjunction with the UIC, the *Association Européenne pour Interopérabilité Ferroviaire* (AEIF[2]), one task of which was to analyse the technical specifications for interoperability (TSI). These include:

- Train control and signalling;
- The application of telematics to freight transport;
- Transport operation and management,
- Freight wagon technology;
- Noise emissions from vehicles and infrastructure.

The most important point on the above list is the interoperable train control and signalling system, known under the acronym ETCS (European Train Control System). ETCS is divided into three levels as follows.

Level 1: Widely identical to the block control system, with standardized technical components;

Level 2: Widely identical to the advanced block control system applied for high-speed trains, with standardized technical components;

Level 3: Flexible control system, independent of defined blocks, holding trains at braking distance, with options for automatic control.

At present, only levels 1 and 2 are relevant. Level 2 is obligatory for the mega rail projects which the EU is sponsoring: for instance, the Brenner Base Tunnel. The main problem for the implementation of the ETCS is that the system will afford little additional functionality for railway lines which have been constructed recently and already use state-of-the-art control technology. Yet the switch to ETCS would generate additional costs for these companies. That is why the big players (SNCF, DB, FS) argue that the change to ETCS would bring no benefit to them and in consequence should be financed by the EU and the Member States. As usual, the railway companies are looking to state finance as their "white knight", when it comes to investment in technology change.

The same argument can partly be accepted for high-speed train control technology. The technology has been developed to very different technical standards in Europe and it will be economical to change to hybrid systems and standardized control only on a few cross-border lines. In the freight sector, however, ETCS offers new opportunities to provide integrated services along the main corridors. Trains can be operated across borders, without changing engines and personnel if the technical standards (power supply, gauge) in the other country are suitable and personnel has been trained for operating conditions in other countries. Therefore, one would expect greater interest from freight railway undertakings in extending ETCS.

While cross-border co-ordination of train operations along West-East corridors is still in the trial phase, activities along the North-South corridor have already been commercially developed under the lead of Railion, a subsidiary of DB AG. Through alliances and mergers and with the support of a major logistics company (Schenker), transport performance has increased by about 10%. There is active competition on the market, the main competitors being the Swiss SBB and special liquid bulk carriers like Rail4Chem. Development in the competitive sectors of the railway market clearly show that intramodal competition is the healthiest way to improve service and cut costs with a view to strengthening the market position of the railways.

5.3. Rail transport: persistent need for fundamental reorganisation

Directives 2001/12-14/EC provided an opportunity to fundamentally reorganise the supply side of the European rail transport market. They gave free access to rail networks for cross-border freight transport to all EU companies. The last step in opening up the market will be free cabotage, scheduled for January 2007. This means that from the legacy standpoint all the necessary steps have now been taken (unfortunately about 10 years behind the road transport sector) and it is up to the Member States and their designated rail carriers to implement the structural changes.

Comparing the speed of progress in Member States, one cannot fail to notice that there are significant differences. Greece, Italy, Portugal and Slovenia have shown no sign of opening up their rail freight markets and the Commission has announced that it will bring them before the European Court of Justice. However, this is only the tip of the iceberg. Given that the incumbent companies are very closely integrated with the state, there is little impetus to change their structure, as they are protected from market forces by the state. As a rule, European railway incumbents are too small for European business and too large for regional business. Therefore they will have to be separated from the national flag-carrier. After this painful operation, some rail service segments, particularly freight, can be operated on a completely commercial basis such that rail's great potential to dominate long-haul freight flows along the main European land corridors can be fully exploited.

5.4. The importance of stable paradigms

While the White Paper "Time to Decide", issued in 2001, stressed the revitalisation of railways and shifting transport from road to rail, the forthcoming White Paper drafted by DG TREN lays more emphasis on developing the strengths of the individual transport modes in order to increase the efficiency of the European transport system. It has been reported that DG Environment has intervened and is putting the emphasis on the continuity of EU environmental policy in transport, favouring the more environmentally friendly transport modes.

While the White Paper is going through a new round of negotiations inside the Commission, some comments can be given from a technical standpoint. One of the Commission's strengths in the past was the definition and phased implementation of long-term, general policy issues, beyond all country interests and stakeholder influence. This held for liberalisation where the Commission was very successful. The approach was also beginning to show positive feedback in the environmental field when Community law forced national institutions to take action against environmental nuisance, for example, to transpose Directive 1999/30/EC which sets limits on particulates and NO_x concentrations.

Long-term sustainability issues prompted the Commission to promote long-term investment plans which clearly favoured railway and waterway investments for the TENs with the aim of strengthening the market position of the more environmentally friendly transport modes. This policy approach looked consistent in the long run, but suffered from inadequate implementation in the short and medium term. Changes in the organisation of the railways are taking much longer than expected, national and rail company resistance has been a frustrating experience for the Commissioners. The process of harmonizing market conditions is being hampered by narrow-minded legal interpretations of market fairness which are ultimately to the disadvantage of environmentally friendly modes. Decisions on details, for instance, the missing enforcement of social regulations in road transport, or preserving taxes along corridors, e.g. for fuel taxes, instead of gradually narrowing the gap, have always eaten up what little progress has been made on harmonisation in other fields (e.g. technical harmonisation).

As a consequence, the Commission's hope of promoting environmentally friendly modes through investment and harmonisation policy has not yet materialised, partly because expectations were too high, partly because of lack of support from Member States and their national companies, but also partly because of the Commission's own inertia in promoting harmonisation after the successful process of liberalisation.

Against this background, it is not clear why the Commission would give up its long-term policy approach of strengthening the more environmentally friendly transport modes, particularly at a time when the first signs of positive feedback are appearing: rising market shares for rail freight in some countries and on important European corridors. Therefore, what is now needed is to reconsider transport policy instruments and to promote harmonisation policy instruments in order to counter over-investment in mega-projects.

6. CONCLUSIONS: TRANSPORT INFRASTRUCTURE NEEDS RECONSIDERED

It has long been a political credo that transport problems can be solved by spending money on investments alone. The TEN-T concept follows this line. However, this strategy is only feasible if funding goes hand in hand with investment, and investment is financed by taxpayers' money. As soon as there is an attempt to change the financial paradigm, and many EU countries need to do so because government budgets are inadequate, the path of political convenience has to be left behind for two reasons. First of all, not all of the projects on the political shopping list of the Member States can be implemented. If a substantial share of investment is to be financed by private capital it will be necessary to revise the procurement mechanisms for the selection of candidate projects. It is fruitless to develop and award projects on the basis of public procurement criteria, make selections and then attempt to find private investors. Secondly, a shift to procurement schemes based on realistic expectations instead of political dreams reveals that the state can influence economic success from the market side.

As Wolfgang Roth, Vice President of EIB, has pointed out, the Brenner Base Tunnel does not make economic sense in the present transport policy environment, i.e. under the present regime of pricing and regulation. If the Commission would allow higher motorway tolls for lorries, then the market for rail-based services would grow and lead to improved capacity loading for the Brenner. This means that investment policy has to be accompanied and ring-fenced by appropriate pricing and regulation policy. Hence, the conclusion of this paper is not to change the paradigm of long-term sustainable transport policy, but rather to make it consistent by co-ordinating investment with pricing and regulation policy. Our concluding hypotheses are therefore the following:

(1) The TEN-T concept is a helpful approach to bundling international transport activities along the main axes on which environmentally friendly transport modes have a chance of attracting a substantial share of transport demand.

(2) The TEN guidelines overestimate demand for mega-projects. Therefore not all investment projects on the TEN-T list are financially viable.

(3) Instead of streamlining the investment programme, the Commission has hired prominent promoters to overcome barriers to project realisation. This will reinforce the tendency towards over-investment.

(4) The need for upgrading, reinvestment, maintenance and repair of the existing network is rapidly growing. Focusing on the new mega-projects will lead to a lack of funding for maintaining the network to high-quality standards.

(5) The biggest challenge is the development of freight, in particular, containerised transport. Passenger transport will develop more modestly and along the lines of trends experienced in the past.

(6) The most promising parts of the TEN-T programme are the motorways of the sea and Galileo. International freight and logistics are following the development of trade, which is growing much faster than GDP. Container transport is a highly dynamic segment of the transport market.

(7) In order to meet the increasing demand for container transport, seaports have to adapt by improving access and berth facilities as well as by developing seaport-hinterland routes.

(8) The Galileo satellite navigation system will provide a host of options for improving the organisation and management of transport operations. Therefore it warrants stronger promotion than mega physical infrastructure projects, and a clear decision with respect to investment and funding priorities.

(9) The Trans-European Networks will have to be combined with major corridors to Asia. Problems with interoperability and bottlenecks will have to be solved and a modest investment budget can do this. The main challenge will be to construct a reliable logistics chain along the Trans-Siberian routes.

(10) The major issues are not so much the development of mega-projects as the modernisation of the networks in the new Member States, upgrading and maintenance, the optimisation of trans-shipment in seaports and the organisation of hinterland transport via the main inland waterways and rail lines. Effectively combining the efficient parts of the modes is more beneficial than investing in maximising the efficiency of individual modes.

NOTES

1. This report refers to transport TENs only, which are referred to as TEN-T in official terminology.

2. *Association Européenne pour Interopérabilité Ferroviaire;* to be wound up after establishment of the European Railway Agency, ERA.

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ANNEX: TABLES AND MAPS

Table 1. **World trade: Rates of growth of volumes and values, 2003-2005**

	Exports			*Imports*		
	2003	**2004**	**2005**	**2003**	**2004**	**2005**
Volume						
World	6.8	10.9	8.5	5.6	10.2	7.75
of which						
North America	1.1	8.7	9	4.5	9.8	5.25
European Union*	1.5	6.9	6.5	4.3	7.6	7
Japan	9.4	13.5	5.75	5	6.7	2
Commonwealth of Independent States	11.4	10	7	15.8	14.2	14.5
Latin America and The Caribbean	6.3	10.6	5	1.6	14.1	8
Africa	11.8	8	7.25	7.2	8	8.5
Western Asia	8.5	6.7	6	4.7	7.8	12
East Asia	20.1	19.3	12	11	17.8	13
South Asia	10	12.7	11.5	10	15.1	14.75
Memo Items:						
Central and Eastern Europe and the Baltic States	9.7	14.5	11.5	9.6	15	11.25
Western Europe	1	6.2	6	3.8	6.8	6.5
China	34.4	29	18	31.1	32	21.75
Value						
World	16.3	18.5	10.25	15.4	19	9.25
of which						
North America	5.6	12.9	9.25	7.3	13.2	6.5
European Union*	18.7	18.2	9	20.3	20.2	8.5
Japan	8	12.3	3.75	4.6	11.3	2.5
Commonwealth of Independent States	24.9	29	28	21.4	31	25.5
Latin America and The Caribbean	8.9	21.5	7.25	5.7	18	10.5
Africa	25.2	23.5	7.25	18.9	16.9	8.25
Western Asia	16	21.2	5	14.5	18.7	8
East Asia	23.1	22.6	14.5	18	24.5	14.25
South Asia	13	23.3	17	15.9	19.3	19.75
Memo Items:						
Central and Eastern Europe and the Baltic States	29	31	19	27.4	28	18
Western Europe	17.58	17.3	8	19.5	19.2	7.5
China	34.6	32	19.5	39.9	38	22.5

Source: United Nations Project UNK. New Opera, 2006.
* All figures for the European Union take into account the 10 new Member States which joined in 2004.

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Table 2. **Value per tonne in international transport (in Euro/tonne)**

Product	Import	Export
P1- Agricultural products	504	614
P2- Food products	1 170	1 108
P3- Conditioned food	1 137	1 187
P4- Wood and paper paste	479	531
P5- Iron ores	54	66
P6- Petroleum products and coal	181	210
P7- Metal products	778	811
P8- Cement and manufactured building products	707	692
P9- Minerals and basic building products	44	40
P10- Basic chemical products	937	1 186
P11- Fertilisers	134	128
P12- Other chemical products (including plastics)	2 847	3 019
P13- Transport materials	8 331	8 871
P14- Equipment goods	14 196	14 886
P15- Textiles and clothing	7 757	9 651
P16- Other manufactured products	5 523	8 058
Total	*1 037*	*1 493*

Source: Reynaud *et al.*, D1.1 for New Opera, 2006.

Table 3. **15 main container ports in Europe, 2000-2005 (TEUs / 000)**

	Port	State	2005	2004	2003	2002	2001	2000	Growth 05/00
1	Rotterdam	NL	9.287	8.281	7.144	6.518	6.097	6.300	47.4%
2	Hamburg	D	8.100	7.003	6.138	5.400	4.689	4.250	90.6%
3	Antwerp	B	6.500	6.064	5.445	4.777	4.218	4.100	58.5%
4	B'haven	D	3.700	3.469	3.190	2.999	2.896	2.712	36.4%
5	Gioia Tauro	I	3.161	3.261	3.149	2.955	2.488	2.653	19.1%
6	Algeciras	E	3.180	2.937	2.516	2.229	2.152	2.009	58.3%
7	Felixstowe	UK	2.700	2.675	2.650	2.700	2.950	2.794	-3.4%
8	Valencia	E	2.398	2.145	1.993	1.800	1.500	1.161	106.5%
9	Le Havre	F	2.050	2.132	1.985	1.720	1.523	1.465	39.9%
10	Genova	I	1.625	1.629	1.606	1.531	1.526	1.501	8.3%
11	Barcelona	E	2.078	1.883	1.652	1.500	1.410	1.388	49.7%
12	Piraeus	GR	1.600	1.542	1.605	1.398	1.165	1.161	37.8%
13	Southampton	UK	1.375	1.441	1.378	1.275	1.164	1.063	29.4%
14	La Spezia	I	1.025	1.041	1.005	975	975	910	12.6%
15	Marseilles	F	900	908	916	813	742	722	24.7%
	Total		*49.679*	*46.411*	*42.372*	*38.590*	*35.495*	*34.189*	*45.3%*

Source: New Opera, 2006.

Table 4. **15 main container ports in the World, 2000-2004 (TEUs / 000)**

Port	State	2004	2003	2002	2001	2000	Growth 04/00
Hong-Kong	China	21.932	20.449	19.140	18.100	17.800	23.2%
Singapore	Singapore	20.600	18.100	16.940	15.520	17.040	20.9%
Shanghai	China	14.557	11.283	8.620	6.334	5.613	159.3%
Shenzhen	China	13.650	10.615	7.610	5.076	3.993	241.8%
Busan	Korea S.	11.430	10.408	9.330	7.907	7.540	51.6%
Kaohsiung	Taiwan	9.710	8.840	8.490	7.541	7.426	30.8%
Rotterdam	NL	8.300	7.107	6.518	6.097	6.300	31.7%
Los Angeles	USA	7.321	7.178	6.106	5.184	4.879	50.1%
Hamburg	D	7.003	6.138	5.400	4.689	4.250	64.8%
Dubai	Arab Em.	6.429	5.152	4.194	3.502	3.059	110.2%
Antwerp	B	6.064	5.445	4.777	4.218	4.100	47.9%
Long Beach	USA	5.780	4.658	4.524	4.463	4.601	25.6%
Port Kelang	Malaysia	5.243	4.840	4.533	3.760	3.206	63.5%
Qingdao	China	5.140	4.239	3.410	2.638	2.116	142.9%
N.Y./New Jersey	USA	4.400	4.068	3.749	3.316	3.050	44.3%

Source: New Opera, 2006

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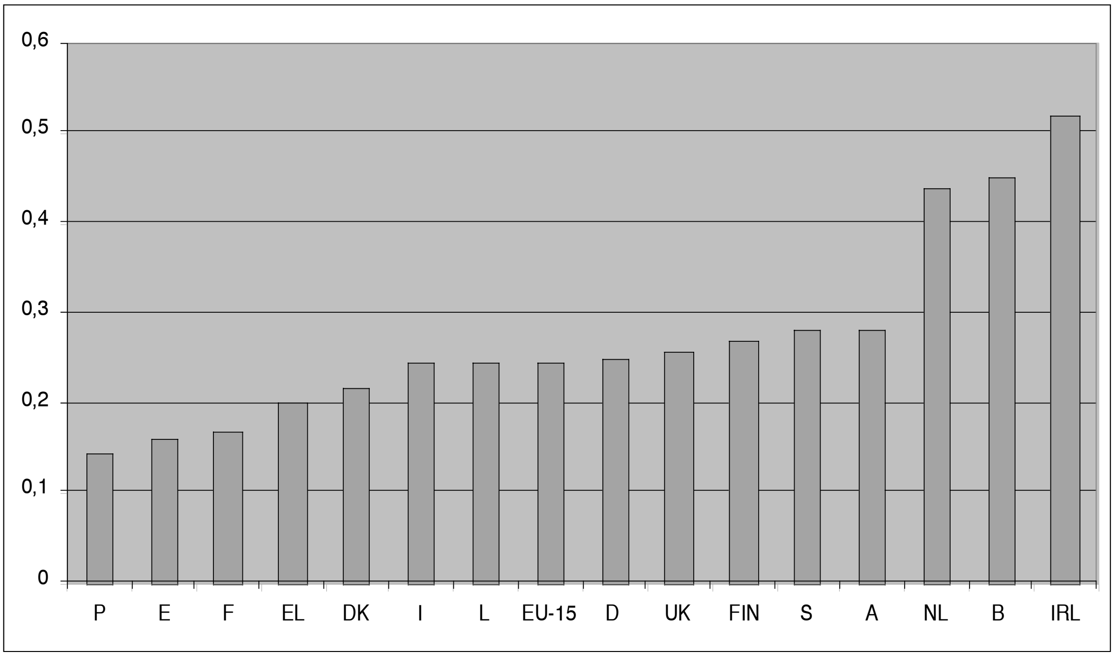
(see **http://www.internationaltransportforum.org**)

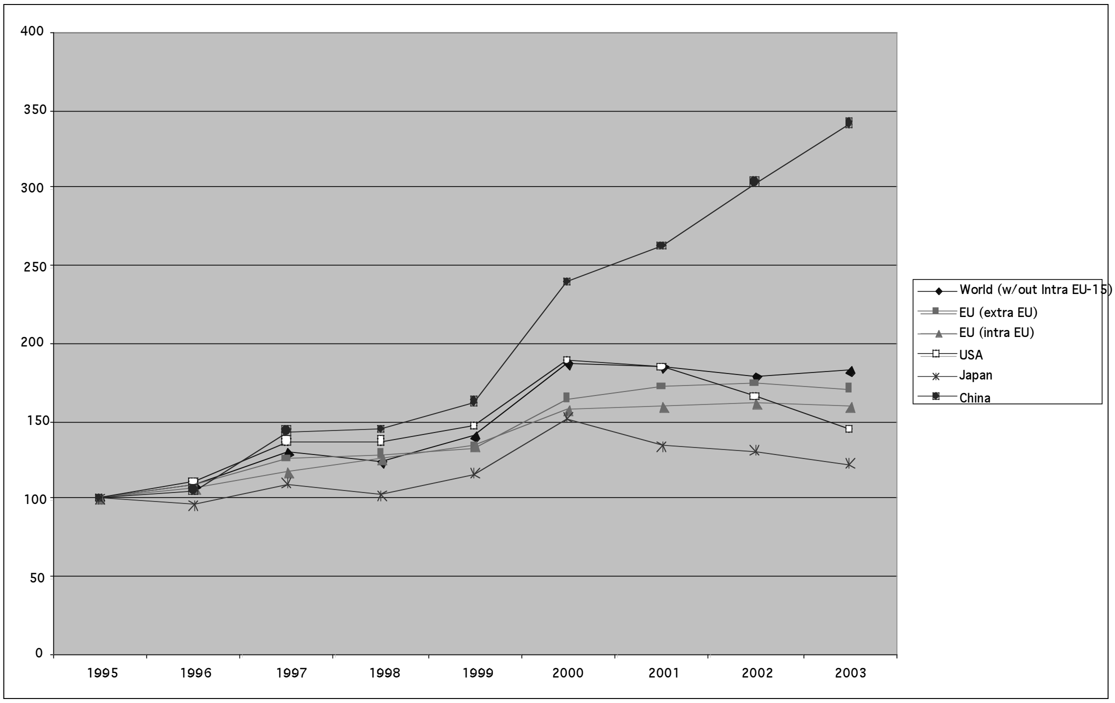
FIGURES

Figure 1. **Ratio of Trade to GDP, 2003**



Source: EUROSTAT, 2004.

Figure 2. **Export development by countries**



Source: EUROSTAT, 2004.

Topic II:

Globalisation and Transport Sector Development

Market Structure in Transport and Distribution Services, Goods Trade, and the Effects of Liberalisation

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SUMMARY

Tinbergen and Strathclyde, August 2006

INTRODUCTION

In this report we analyse how the structure of the transport sector interacts with international trade. We then consider the implications of market liberalisation in the transport sector as well as the interaction between trade liberalisation and the structure of the transport sector. Our analysis is supported by some empirical evidence on competition in different transport modes within the OECD countries.

While the paper is concerned with trade in international transport services, the basic analytics also apply to the full chain of services required to complete the transactions that turn exports into imports at the frontier. The paper itself is divided into two parts. The first contains an analytical model that illustrates some of the basic issues at stake with liberalization of transport services trade. This involves the implications not only for the profits of the particular transport industry, but also for levels of trade in goods and national gains from trade. Secondly, we supplement the analytics with some empirical evidence as to the level of competition (or the lack of it) across various modes of transport in several countries. We also offer econometric evidence that the market structure in the combined trade and transport sectors matters significantly for goods trade. Indeed this is most important in the context of trade preferences (e.g. ACP, AGOA, GPP) and regional trade agreements.

1. A THEORETICAL MODEL OF GOODS TRADE AND TRANSPORT SERVICES

We start with an analytical model of trade with transport costs. This is intentionally very simple, in order to illustrate the mechanisms that are at work when international trade requires the services of an intermediary industry, such as road haulage, airlines or the railways. The transport industry in question may or may not be perfectly competitive. The more imperfect the competition, the greater is the impact of the industry on producers and consumers.

The framework we develop has interesting policy implications. For example, we show that it is possible to use transport cartels as a second-best instrument for manipulating the terms of trade. An imperfectly competitive transport sector, particularly one where there is evidence of collusion, could partially recapture the market-access concessions made under multilateral tariff reductions. The rents would be split between the transport cartels and the importing country. If the cartels are themselves national firms, the recapture is complete.

The message about competition actually covers the whole logistics chain. Any choke point, in terms of competition, in the chain of services that facilitates trade can lead to the type of result developed here. If not resulting from the shipping operations themselves, it may arise due to corrupt port management or a monopoly on handling and loading.

1.1. The basic model

Much of the literature on trade and transportation has been focused on general-equilibrium patterns of trade and on the uniqueness of equilibrium (see, for example, Wegge, 1993). As we are concerned instead with market structure, we buy ourselves a great deal of analytical simplicity by working with a simplified, partial-equilibrium structure. The formal model that emerges provides a framework for our analytical discussion of equilibrium, given market power in the transport sector.

In order to illustrate the mechanisms at work, we adopt a simple model of international trade in a commodity[1]. The role of transport costs has become increasingly important in international trade research, especially in the analysis of the location of economic activity associated with the "new economic geography." However, the treatment of transport is generally simplistic, often taking the form of "iceberg" trade costs[2]. Such an approach implicitly assumes a perfectly competitive transport sector and is not useful for the task at hand. Instead, we need to specify an intermediation sector ("transport" or "shipping"), where the price of shipping is determined endogenously and may differ from the actual costs incurred by the transport sector[3]. This will permit us to examine how the market structure affects the volume of trade and gives a role for policymakers to intervene in the market for these intermediation services.

Within this framework, we emphasize the trade in a commodity that is produced in a given export market and then shipped, at some real cost, to the import market where it is sold. Let the quantity of the export commodity traded be q. In order to keep our focus on the intermediary, transport sector, producers of the good are assumed to be small, perfectly competitive firms located in one or several countries. The industry supply curve for exports is assumed linear in producer prices p_p [4]:

$$p_p = a + bq \tag{1}$$

The shipping industry provides the service of transforming exports into imports at the dock. This service is provided at a price (the shipping margin, essentially the difference between the f.o.b. and c.i.f. prices) that depends on competitive conditions in the transport industry[5]. We assume that the transport industry is imperfectly competitive, with n identical, profit-maximizing firms in competition with one another. The shippers have large fleets of vehicles and an extensive route network. From this stock, they choose to allocate a certain quantity to service this particular trade. Thus the shipping firms compete in quantities.

Consumers in the foreign market have a linear inverse-demand function for imports, relating the price they are charged p_c to the quantity traded q as follows:

$$p_c = x - yq \tag{2}$$

We assume that the good faces an import barrier in the form of an *ad valorem* tariff of t[6]. The price paid by consumers in the destination consequently exceeds the price received by producers, as a result of both the shipping margin and the tariff . Rewriting this as an expression for the shipping margin, we get:

$$\sigma = \frac{p_c}{(1+t)} - p_p \tag{3}$$

The total revenue of a representative firm i producing quantity σq_i is . We assume that the shipping firms are identical and behave as Cournot competitors. Substituting (1), (2) and (3) into total revenue yields an expression for the perceived marginal revenue of a firm:

$$MR_i = \frac{x}{1+t} - a - \frac{(1+s)\left[(1+t)b + y\right]}{s(1+t)} q_i \tag{4}$$

where $s = 1/n$ is the market share enjoyed by each of the shipping firms. We assume that if the real costs of shipping (insurance and freight) are constant, the marginal cost of transport is[7]:

$$MC = c \tag{5}$$

Solving (4) and (5) provides the equilibrium quantity of the good supplied:

$$q = \frac{x - (a+c)(1+t)}{\left[b(1+t) + y\right](1+s)} \tag{6}$$

while the equilibrium shipping margin is[8]:

$$\sigma = \frac{\left[x - (1+t)a\right]s + (1+t)c}{(1+t)(1+s)} \tag{7}$$

The associated prices of the good for consumers and producers, respectively, are:

$$\begin{aligned} p_c &= \frac{x\left[b(1+t)(1+s) + ys\right] + y(a+c)(1+t)}{\left[b(1+t) + y\right](1+s)} \\ p_p &= \frac{b\left[(as-c)(1+t) + x\right] + ay(1+s)}{\left[b(1+t) + y\right](1+s)} \end{aligned} \tag{8}$$

If $s = 1$, the shipping industry is a monopoly. As s becomes smaller, the firms' perceived demand for the good becomes more elastic and they lose market power. With s close to zero, each firm has a tiny share of the market and its behaviour is almost perfectly competitive.

There are two elements to the market power of a firm. Firstly, they charge consumers a price that exceeds the shippers' marginal costs. Thus the transport sector exercises its market power with respect to consumers, who are forced to pay higher prices for their imports despite the original supply of the good being perfectly competitive. In addition, the shippers exploit their monopsony power with producers. The upwards-sloping industry supply curve represents increasing marginal costs in the provision of the good. Consequently, the shippers restrict the quantity that they transport, lowering the price that they have to pay for the good. Thus the transport sector operates on both sides of the market, driving up their profits, the shipping margin.

1.2. Effects of increased competition

We simulate the effects of increasing the level of competition through a change in n, the number of firms in the transport industry. Such increased competition may follow from GATS-related liberalization of the route itself, or from related liberalization somewhere else in the logistics chain.

If n rises, the market share s of each incumbent firm declines. They will perceive their market demand to be more elastic and will consequently behave more competitively. If, however, the number of firms were to fall, the industry will become more concentrated and the remaining firms will exercise the increased power from a growing market share.

Of course, there need not actually be a change in the number of firms. Rather, s can instead be viewed as an indicator of the degree of competitiveness in the shipping market. In this interpretation, a fall in s reflects a more competitive environment: as n becomes larger, market shares decline and the shippers' margin gets closer to marginal cost. This could occur if the transport industry's ability to maintain high rates were to decline, or if its activities became subject to antitrust rules. An increase in s would indicate that the industry was exerting greater influence in the market, resulting in more collusion.

Figure 1 shows the effects of changing s on prices, quantities and profits. As the transport industry shifts from behaving as perfect competitors to acting as a cartel or monopolist, the consumers pay an increasing price and the volume shipped declines. Given that less of the product is being demanded, the price received by the producers falls. The (shaded) growing gap between the producer and consumer price is , the margin captured by the shippers, and this rises monotonically from zero as the industry becomes increasingly concentrated. Thus, when the industry behaves competitively, the shipping margin equals c, the marginal cost of shipping. The margin reaches its highest level when there is complete collusion and the transporters fully exploit their monopoly power with both producers and consumers.

1.3. Benefits of trade liberalization

How does the tariff affect the trading situation? With a competitive transport industry, the beneficiaries of trade liberalization would be the consumers in the importing country and the exporting producers. With a less-than-perfectly-competitive shipping industry, the benefits of the more liberal trade regime are partially captured by the shipping firms. Figure 2 illustrates the equilibria that arise with a duopolized transport industry for various levels of tariff[9].

As the tariff is reduced the quantity traded rises, as the consumer price has declined. This rise in demand results in a higher price being received by the producers. However, the benefits of the trade liberalization are not fully passed through to producers and consumers. The international transport industry is able to take advantage of the more liberal trade regime, replacing part of the trade-tax wedge (between consumer and producer price) by one of their own — a greater monopolistic markup. As the tariff continues to fall, the transport firms receive a larger margin over their marginal costs, resulting in increasingly large profits.

The relationship between the concentration of the shipping industry, the tariff barrier and the optimal shipping margin is illustrated in a contour plot in Figure 3. The more concentrated the industry (or the stronger the cartel) and the lower the tariff barrier, the greater is the shipping margin. This means that, the more liberal the trade regime, the more serious the lack of competition in the transport sector becomes. In other words, the market-access benefits of tariff reductions in export markets are inversely related to the degree of market power exercised by the international trade sector and the domestic trade and distribution sector serving the export market. Further, the benefits of past market-access concessions can be offset by future increases in the degree of market power exercised by these sectors. Increased concentration, if accompanied by greater market power, may nullify and impair past market access concessions in goods.

1.4. Domestic distribution and transport activities

In general, international trade in goods depends on the domestic trade and distribution sector that facilitates this trade, in addition to the corresponding international sector. We now extend our basic framework to consider such domestic transport activities. We keep the same structure as before, except that tariffs do not drive up domestic transport costs and the profits from domestic trade and distribution activities are clearly captured domestically. To maintain clarity, we assume that there are now no international transport costs, only domestic, and that the latter have a marginal cost of *d*. Making these adjustments, our equilibrium quantity expression (6) then becomes the following:

$$q = \frac{x-(1+t)a-d}{\left[(1+t)b+y\right](1+s)} \tag{9}$$

It is evident that the service-sector firms still have power on both sides of the market. On the input side, the price they pay for the imported good depends upon the total quantity q and the sensitivity of supply to quantity. Similarly, on the demand side, the price at which they sell to consumers is a function of total quantity brought to market. By restricting their trading, the firms are able to both drive down costs and drive up prices, widening the price-cost margin and raising profits. The shipping margin for domestic transporters amounts to:

$$\mu = \frac{\left[x-(1+t)a\right]s+d}{(1+s)} \tag{10}$$

where μ is the unit mark-up. Clearly, mark-ups over marginal cost will decline with the tariff. As in the case of international transport, any attempt on the part of the government to exercise its monopoly power in trade eclipses the ability of the domestic transport and distribution sectors to exercise their market power.

2. A FACTOR ANALYSIS OF REGULATORY STRUCTURES

In this chapter, we work with the OECD's regulation database to examine the structure of competition and regulation in the transport sector across the OECD. The goal is to make a comparison of the regulatory status of the sector. For this chapter, we use an analysis of the OECD's (2000) International Regulation Database, based on factor analysis (see Francois, 2005). The OECD database includes over 1 100 variables for each OECD member country, on both economy-wide product market regulation as well as regulation at the sector level. For our purposes, it includes data on regulation in road transport, national and international air transport and rail transport. Detailed descriptions of the data can be found in Nicoletti, Scarpetta and Boylaud (1999). In general, the data we are concerned with are centred around 1998.

While the database may contain over 1 100 variables, only a limited number apply to transport. In addition, many remain unanswered by a large number of member countries, and many others simply defy quantification. For this reason, the full set of transport questions is reduced to the set covered in Table 1. The table lists 18 variables for air transport, classified into domestic competition, international competition and government ownership and regulation. For road transport, we have

15 variables, roughly classified into domestic competition and government ownership and regulation. For railways, we have six useable variables, again classified into domestic competition variables and government ownership and regulation variables.

Within each set of variables, we assign values ranging from 0 to 6 (so that for dummies, "yes" is generally 6 and "no" is 0), and weights have also been assigned based on the number of variables in a sector:category set. This scaling means that, when factor analysis is employed, the result is a set of regulatory indices ranging from 0 (generally open, competitive regimes with minimal regulation) to 6 (generally more regulated, with little or no competition). This corresponds roughly to the role of *s* in the theoretical analysis where a small market share (*s* close to zero) represented a competitive transport sector, while higher values (*s* close to 1) reflected a concentrated, less competitive intermediation industry.

To analyse the variables summarised in Table 1, factor analysis is used. Multivariate factor analysis is a standard technique for summarising patterns in regulatory data (see Nicoletti *et al.*, 1999 and Boylaud, 2000). Factor analysis yields factors that are linear combinations of the variables we observe, and that in theory identify latent variables or indicators which lurk behind the observed data. In the present context, this approach permits the construction of indices of regulatory frameworks in the sample. This approach involves first applying factor analysis to the regulatory variables grouped by sector and type of regulation. This yields a set of indicators for road freight, air transport and the railways. These sector indicators are listed in Tables 2A, 2B and 2C below.

Another set of indicators, for the transport sector broadly defined, is presented in Table 3. Like Tables 2A, 2B and 2C, these are also based on a factor analysis of the regulatory variables. In this case, the full set of sector indicators in the tables above have been combined to yield a set of factors that are used to construct the composite index. This yields both a set of overall regulatory indicators for competition, regulation of industry structure, public service obligations and financial involvement of government, as well as an overall index, based on these four indicators and aggregated using rotated factor loadings. In this case, these four factors explain roughly 90% of the regulatory variable variance (as they are constructed from sector indicators). For the overall index, the most important summary indicator is competition and price regulation (37.4%), followed by regulation of industry structure (23.2%), public service obligations and regulation of customer access (22.5%), and finally indicators of government ownership and bailouts (16.9%).

The sets of indicators in the tables are summarised in Figures 4-6. Figure 4 presents an overview of the general degree of regulation and competition in the major transport sectors across OECD member countries. In road transport, for example, there is significant variation. The air transport sector is consistently less market-based than the road and rail sectors. Across a given sector, like road transport, there is also significant variation. From our discussion above, this implies that the benefits of "equal" market access concessions will also vary across OECD member countries, depending on these sector variations. This is because these sectors facilitate reaching the actual intermediate and final consumers that market access concessions provide better access to.

Figure 5 presents an alternative view, based on composite regulatory indices. These depend on the weighting shown in Table 3. This reveals that the variation across OECD member indices itself follows from variations in the underlying indices. Canada, for example, is similar to the United States in terms of public service obligations and government ownership, while significantly different when it comes to competition and price regulation. Across the EU we also see substantial differences in regimes of competition and price regulation, as well as in government ownership and bailouts.

For the present context, what is most important is the degree of competition and price regulation. In particular, following from our discussion of the importance of competition in the sector above, how does this actually vary by OECD member and by sector? This is shown in Figure 6. In the figure, we have plotted the competition and price regulation indices for all OECD members and all sectors in the sample. What we see, again, is substantial variation, but also some patterns. Switzerland, for example, has a relatively low degree of competition in all modes of transport, while Turkey has a competition-based road transport sector, with less price competition in rail and air. Canada and the United States have relatively competitive sectors across the board, while Mexico does not except for road[10]. Based on these indices, Greece apparently has the regime least friendly to price-based competition in road transport in our sample, while several countries share this distinction in rail transport.

We know from our recent work on the distribution sector (Francois and Wooton, 2005) that variations of this type in competition can have important implications for the volume of international trade. We expect, given our analytical discussion and the variations pointed to above in actual regimes, that there should also be an interaction between apparent market access and the variations highlighted in Figure 6. This should be especially true for trade between free trade partners (i.e. in the NAFTA and EU contexts). A logical extension along this line of research is therefore detailed analysis of how bilateral trade patterns interact with these measures of price competition.

3. TRADING COST EQUIVALENTS

We turn next to a short empirical exercise involving estimating reduced-form gravity equations of bilateral trade flows, based on tariffs, distance, and country-specific effect variables. (See Feenstra 2004 Chapter 5; and Hummels 1999). We include measures of distribution sector competition, as a check on our theoretical results developed above. We admit from the start that the data are very crude, and, given this, we simply focus on whether the basic effects we have discussed—imperfect competition in distribution affecting market access in goods—matters in an empirical sense.

Our basic data for this exercise are summarized in Table 4. From the OECD (2000), we work with two estimates of the degree of competition in the road freight and retail distribution for some, but not all, OECD members. This includes an index of barriers to entry in the sector, and also what can be interpreted as an overall or composite index of the degree of competition in the sector. These estimates are a one-off, in that we only have a single set for of indexes for the late 1990s. For trade, we work with bilateral merchandise trade data extracted from UNCTAD's COMTRADE database and matched to import protection data from the GTAP6 database (GTAP 2005). These data are for 2001. They offer the advantage of including a bottom-up concordance from detailed tariff data to aggregate bilateral trade flows, including preferential tariff rates. We also have estimates of the trade-tax equivalent of export barriers as part of the basic trade barrier data. In addition, bilateral export data have been adjusted to reflect estimated freight margins. For 69 countries as exporters, we have matched bilateral import data to other country-specific data for the 22 OECD importers covered by our set of OECD indexes on the distribution and freight sectors. We also incorporate data on distance, common language, and common borders from Gaulier, Mayer, and Zignago (2004). Finally, we also include data on importer GDP and per-capita income from the World Bank (2002). After matching trade data to our competition data, we have 1,725 bilateral trade flows to work with involving OECD countries as importers in 2001.

Our estimating equation is a reduced-form gravity equation, augmented to reflect our observations based on equation (6). Since we are working with a single year, we impose a price normalization, with f.o.b. prices set at unity. Value flows then map to quantities. Defining imports by country *i* from country *j* as $Imports_{ij}$, we work with the following equation:

$$\begin{aligned} Imports_{ij} = {} & \alpha_0 + \alpha_1 \ln(GDP_i) + \alpha_2 Distance_{i,j} + \alpha_3 \ln(Tariff_{ij}) + \alpha_4 Comlang_{ij} \\ & + \alpha_5 Border_{ij} + \alpha_6 \ln(Index_i) + \alpha_7 \ln(Index_i) * \ln(Tariff_{ij}) \\ & + \sum \alpha_{8j} D_j + \alpha_9 NAFTA_{i,j} + \alpha_{10} EEA_{ij} + \alpha_{11} \ln(PCI_j) * \ln(Index_i) * \ln(Tariff_{i,j}) + \varepsilon_{ij} \end{aligned} \tag{11}$$

The α_{8j} terms are dummy variables assigned to each exporter, to reflect the set of exporter-specific variables that remain fixed across importers. The variables $NAFTA_{ij}$ and EEA_{ij} are also dummies, capturing joint membership in either the North American of European free trade block. The terms $Distance_{ij}$ and $Tariff_{ij}$ measure bilateral distance and import barriers (trade-weighted import tariffs and trade tax equivalents of export restraints) as a share of total import value. We expect the coefficients applied to these variables, α_2 and α_3 both to be negative. Recall that the $Index_i$ term is meant to capture, at least qualitatively, the effects related to σ in the discussion above. From the expressions in (8), we expect α_6 to be negative as well. We expect the interaction term α_7 to be positive, based on equation (8) and observation (3). We have also included the further interaction term α_{11} to allow for possible variations in the impact of tariff and competition-related barriers depending on the level of development of the trading partner. We explore this issue further below with split-sample regressions.

Table 5 presents robust regression results for equation (17), based on both versions of our competition index. We have reported robust regression results because the Breusch-Pagan (1979) Chi-squared test statistic (as implemented in STATA) leads us to reject the hypothesis of homoscedasticity at any conceivably reasonable level of significance. Further examination with Szroeter's (1978) test statistic (a recent STATA addition) points to a pervasive problem, involving roughly half of the right-hand-side variables. Many of these relate to the exporter fixed-effect variables, indicating for example greater variance in the data involving some exporting countries than others. This is not surprising, as we have included relatively small aggregate trade flows (all flows over $10,000), usually involving a range of least developing countries. In these cases, bilateral trade flows may be a function of historical/structural variables unique to a given country pairing. Given the pervasiveness of the problem, there is a not an obvious single adjustment to be made to the data. We therefore resort to robust least squares, involving Huber's (1981) robust regressions as implemented in STATA. These results are what are shown in Tables 5 and 6.

Turning first to Table 5, this reports the results for equation (17) with both indexes. Relevant coefficients are significant in the 0.05 to 0.01 range or better, with the sign predicted from our theoretical analysis for the direct effect from competition.[11] An F-test for the joint significance of the competition coefficients α_6 and α_7 rejects the null hypothesis that the coefficients are zero at the 0.001 level. Country fixed-effect coefficients are not shown, though they are all generally significant at the 0.001 level across all regressions. The pattern of results for competition fits expectations.

Basically, these results suggest that tariffs and reduced competition both have a dampening effect on estimated trade flows.

Table 6 presents a further decomposition of patterns in the data, based on split-sample regressions. Implicit in the analysis above is that competition matters more as importers have more market power. In terms of the previous section, this depends on the relative slopes of the supply and demand schedules, in conjunction with the general level of competition in the service sector itself. In a more general sense, we may expect importing/distribution firms to have more market power vis-à-vis smaller suppliers. At the same time, exporters in lower income countries may be less organized, and less adept, in holding their own against market power exercised by buyers.[12] In Table 6 we explore this issue by making the following splits in the data. The first split involves OECD trade with low-income countries (defined as having a per-capita income below $1000 in 2001 dollars), and all other trade. For the second split, we divide the sample into OECD trade where the importer is large (with a nominal GDP greater than $500 billion) and the exporter is small (defined as having a nominal GDP below $100billion), versus all other trade. For the final split, we examine OECD trade where the importer is large and the exporter is both poor and small. In all cases, we find that the correlation in the data between exports to the OECD and competition is greater when there is likely to be greater market power, in the sense that it matters more for smaller and poorer exporters. The structure of the retail and distribution sector in the OECD countries is more of a trade barrier for small and low-income countries than it is for exporters from higher income and larger economies.

Finally, Table 7 is our attempt to convey a sense of the magnitudes involved, not so much statistically but rather economically. In this table, we have taken the tariff coefficient from Table 5, combined with sample values for EU competition indexes and a competition coefficient estimated for the intra-EU15 subset of our full sample. We have used these to calculate a trading cost- or tariff-equivalent from changing the degree of competition in the sample of EU countries, for intra-EU (i.e. duty-free) trade. Hence, for example, from the first column of numbers in Table 7, moving France to the average level of competition in distribution across the EU would be comparable to eliminating a 4.2 percent tariff for its EU partners. Moving to the most competitive level in the sample would correspond to the elimination of an 8.4 percent tariff. In the table, these trading cost equivalents range between 0.0 and 8.4 percent of the value of trade, with most between 3.0 and 4.0 percent of the value of trade.

The patterns of results in Tables 4-7 suggest that variations in the degree of competition matter. Indeed, problems with competition in domestic distribution and trade activities are likely to themselves act as barriers to trade. In a European context, this means that continued competition exemptions for automobiles, for example, should indeed be expected to hinder trade substantially. This also means that GATS-based liberalization of these service sectors may also mean improved market-access conditions for affected goods sectors along the lines developed here.

4. CONCLUSIONS

Our goal in this paper has been to examine the importance of market structure in the transport sectors for the distribution of gains from trade and the benefits of trade liberalization. We have shown that the presence of an imperfectly competitive intermediary can have a significant effect on trade flows and the allocation of gains from trade. Trade liberalization in the absence of some form of deregulation of the transport sectors will not result in the increased benefits that would otherwise be imagined, as the shipping firms will grab a portion of the gains from trade.

Our theoretical results lead us to expect a linkage between service-sector competition and goods trade. At least in theory, an imperfectly competitive domestic service sector can serve as an effective import barrier. Regulatory data, in turn, suggest that there is substantial variation in price competition across OECD members in the transport sectors. In our view, this points to a need for further research on the linkages between transport regimes, transport services trade, and the pattern of and gains from trade in goods. We offer econometric results in this direction. They point to statistically significant linkages between effective market access conditions for goods and the structure of the service sector. From back-of-the-envelope calculations, they also point to economically/qualitatively significant effects. (See Table 7.) What all this means is that, by ignoring the structure of the domestic service sector, we may be seriously overestimating the market access benefits of actual tariff reductions given the existence of imperfect competition in the margin sectors. We also find that the competition of margin sectors matters more for poor and small exporters than for others. Finally, our results suggest that GATS-based services liberalization may boost goods trade as well.

NOTES

1. This analysis is based upon our earlier papers, Francois and Wooton (2001, 2005) which focused on impact of maritime shipping conferences, and the impact of competition in domestic distribution sectors, on trade and the effects of liberalization under the GATT and GATS.

2. Under this assumption, a fraction of the finished good "melts" between production and delivery. The higher the transport costs, the larger the share that melts, requiring producers to increase the quantity produce in order to provide consumers with each unit of the good.

3. In this example, there is only one stage of intermediation (transport) though the analysis can be extended to consider a chain of intermediation.

4. We assume supply and demand curves to be linear simply for clarity. Our results would be qualitatively identical if this assumption were relaxed to some degree.

5. Note here that the relevant cost is that of full transformation of exports into imports, which includes the shipping margin on the outbound and inbound journey. Analytically, we solve here for a total value for this margin, though of course it may technically be shared across the inbound and outbound journeys.

6. Brander and Spencer (1984) examine the optimal trade restriction for an importing country when faced with an imperfectly competitive supplier. They show that, dependent upon demand conditions, this policy may take the form of a tariff or a subsidy. When demand is linear (as is the case in our model), Brander and Spencer find that a positive tariff is the appropriate instrument, but this will change with other configurations of demand. Their model has constant marginal costs for the supplier. In contrast, because we assume increasing opportunity costs for exports, our shippers face increasing marginal costs. As a result, a tariff becomes the preferred instrument for a wider range of cases than in the Brander and Spencer model. In any event, our focus is not on rediscovering the optimal strategic interactions between large players. Instead, we choose to consider the implications for the market of exogenous reductions in tariffs resulting from a round of trade liberalization.

7. We do not consider changes in these real costs of transport, our focus being on the additional margin charged by shipping firms as a result of their market power.

8. This shipping margin is essentially the "best response" of the transport industry to the import tariff.

9. The figures for different numbers of shipping firms are qualitatively very similar, except in the case of competition when shipping industry profits are zero at all times and, consequently, all the benefits of trade liberalization accrue to the producers and consumers.

10. We are not dealing with cross-border market access, but with the apparent degree of domestic price competition given current regulatory regimes.

11. Where we have expectations of sign, the one-tailed significance results in the table are appropriate. This includes both competition indexes.

12. Imagine WalMart negotiating supplier contracts in Jamaica, as opposed to doing so in Canada.

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TABLES AND FIGURES

Table 1. **Variables from the OECD Regulatory Dataset**

OECD survey question number	QUESTION	Variable name
	AIR TRANSPORT	
	Domestic Competition	
547	Domestic market share of the largest airline (incl. Subsidiaries) (more than 500000 passengers a year)	ATDC1
548	Domestic routes (All): Share of traffic (passenger/ km) of the incumbent carrier	ATDC2
619	Herfindahl concentration index in domestic market	ATDC3
	National Regulations and Government ownership	
17	Do national, state or provincial government holds equity stakes in business company?	ATOR1
52	Do national, state or provincial laws or other regulations restrict in at least some markets the number of competitors allowed to operate a business?	ATOR2
572	Government ownership in largest airline (%)	ATOR3
573	Government golden share in a major airline	ATOR4
579	Government loss make-ups in major airlines in the past 5 years	ATOR5
580	The largest airline has public service obligations?	ATOR6
611	Domestic market deregulated?	ATOR7
1120	Ceiling on foreign ownership allowed in national air transport carriers	ATOR8
	International Competition	
558	International routes (All): Share of traffic (passenger/ km) of the of the largest carrier in the international traffic of national carriers	ATIC1
566	Is the largest operator in international routes also the largest operator in domestic routes? (all routes)	ATIC2
567	Share of 100 international routes with more than 3 carriers	ATIC3
612	Open Sky Agreement with US?	ATIC4
613	Open Sky Agreement older than 6 years?	ATIC5
618	International market share of the largest airline (incl. Subsidiaries) (more than 500000 passengers a year)	ATIC6
620	Herfindahl concentration index in international market (%)	ATIC7

OECD survey question number	QUESTION	Variable name
	ROAD FREIGHT	
	Domestic Competition	
48	Do national, state or provincial laws or other regulations restrict in at least some markets the number of competitors allowed to operate a business?	RTDC1
505	Does the regulator, through licenses or otherwise, have any power to limit industry capacity?	RTDC2
515	Do regulations prevent or constrain: Backhauling?	RTDC3
516	Do regulations prevent or constrain: Private carriage?	RTDC4
517	Do regulations prevent or constrain: Contract carriage?	RTDC5
522	Does the government provide pricing guidelines to road freight companies?	RTDC6
	National Regulations and Government ownership	
13	Do national, state or provincial government holds equity stakes in business company?	RTOR1
492	Is there a firm in the road freight sector that is publicly-controlled (i.e. national, state or provincial governments hold the largest single share)?	RTOR2
493	Is registration in any transport register required in order to establish a new business in the road freight sector?	RTOR3
494	In order to operate a national road freight business (other than for transporting dangerous goods or goods for which sanitary assurances are required) do you need to be granted a state concession or franchise by any level of government?	RTOR4
495	In order to operate a national road freight business do you need to obtain a license (other than a driving license) or permit from the government or a regulatory agency?	RTOR5
496	In order to operate a national road freight business do you need to notify any level of government or a regulatory agency and wait for approval before you can start operation?	RTOR6
513	Are there any regulations setting conditions for driving periods and rests?	RTOR7
520	Within the last five years, have laws or regulations removed restrictions on: Commercial, for-hire shipments?	RTOR8
521	Are retail prices of road freight services in any way regulated by the government?	RTOR9

OECD survey question number	QUESTION	Variable name
	RAILWAYS	
	Domestic Competition	
45	Do national, state or provincial laws or other regulations restrict in at least some markets the number of competitors allowed to operate a business?	RRDC1
528	Freight transport: Total number of operators:	RRDC2
	National Regulations and Government ownership	
10	Do national, state or provincial government holds equity stakes in business company?	RROR1
538	Please indicate if the government has any liability for losses made by a railway company (excluding subsidies related to service obligations)?	RROR2
539	Did the government in the past 5 years make up for any losses made by railway companies?	RROR3
540	Are companies operating the infrastructure or providing railway services subject to universal service requirements (e.g. obligation to serve specified customers or areas)?	RROR4

Note: Questions have generally been rescaled from 0 to 6, with 0 being a positive indicator (more competition, less regulation, less participation by government through ownership, golden shares, price setting, etc.). Questions have also been assigned inverse weights (i.e., if there are 4 domestic competition questions for air, each gets a 1/4 weighting for the domestic competition for the air transport factoring and scoring exercise).

Table 2A. **Regulation Indices for Air Transportation**

	Overall Index	Government ownership or management	Government bailouts	Regulation and limits on restructuring	Public service obligations and custom guarantees	Domestic competition	International competition	International reservation for dominant domestic carrier(s)
United States	2.1	2.5	2.7	1.7	0.8	1.1	2.4	3.7
Japan	3.6	2.5	2.6	1.3	0.9	2.2	4.7	3.8
Germany	4.6	2.7	2.5	2.7	1.5	3.4	5.9	4.0
France	3.8	4.7	3.5	2.1	1.3	2.5	5.7	3.4
Italy	4.1	4.6	3.5	2.1	2.2	3.1	5.8	3.5
United Kingdom	3.7	2.7	1.7	2.3	2.8	1.9	4.7	4.4
Canada	3.4	2.5	1.9	0.7	1.2	2.3	4.7	3.2
Finland	4.0	4.4	1.4	2.4	1.2	3.4	6.0	2.8
Greece	4.2	4.7	3.4	1.5	2.2	3.8	5.9	3.0
Mexico	2.1	4.2	3.5	1.7	1.1	2.0	3.4	1.8
Netherlands	4.0	4.0	2.2	3.7	0.2	3.6	5.4	3.2
New Zealand	4.5	2.7	2.7	3.5	1.2	3.7	6.0	3.0
Norway	3.3	4.3	1.4	2.4	1.1	2.2	5.6	1.9
Portugal	4.2	4.7	3.4	1.5	2.2	3.9	5.9	3.1
Spain	3.7	4.7	3.6	2.9	1.0	2.5	5.6	3.1
Sweden	4.0	4.2	2.1	2.8	0.7	3.1	6.0	2.9
Switzerland	4.2	3.7	1.4	1.6	0.5	3.5	6.0	3.0
Turkey	4.1	4.8	1.3	1.6	2.2	3.7	5.8	3.3
Czech Republic	3.8	4.7	1.3	1.7	1.3	3.8	5.9	1.9
Hungary	2.8	4.4	1.3	1.8	1.1	2.6	4.9	1.0
Korea	3.9	2.6	2.5	2.1	1.5	3.2	4.8	3.6
Poland	3.7	4.9	1.3	1.6	1.3	3.7	5.7	2.1

Note: Indices range from 0-6, and are based on rotated factor loadings. The overall index is based on the first two factors for the summary indices, with 88 per cent of the variance explained.

Table 2B. **Regulation Indices for Road Transportation**

	Overall Index	Government licensing	State ownership/ concessions	State concession requirements and price regulation	Regulatory approval required for establishment	Other regulations	Limits on backhauling, private carriage, and contract carriage	Limits on competition (including price guidelines)
United States	1.4	4.7	1.9	1.3	1.8	1.2	0.8	1.7
Japan	1.2	4.7	1.4	2.3	0.6	1.4	0.5	1.7
Germany	1.6	4.6	2.3	1.2	2.1	1.3	1.2	2.4
France	1.0	4.9	3.5	1.1	0.3	1.3	0.5	1.7
Italy	2.1	4.4	1.6	3.9	1.8	2.0	0.7	1.5
United Kingdom	1.9	4.6	1.8	1.4	1.7	2.1	0.9	1.7
Canada	1.4	4.7	1.9	1.3	1.8	1.2	0.8	1.7
Finland	2.1	4.4	2.2	1.3	1.2	2.2	1.2	3.9
Greece	2.4	4.4	1.6	3.9	1.8	2.0	0.7	4.1
Mexico	1.0	4.8	1.7	1.2	1.8	0.2	0.7	3.4
Netherlands	1.8	4.5	1.8	1.4	1.0	2.1	0.8	2.9
New Zealand	2.8	3.0	1.8	1.4	2.7	2.1	0.0	1.7
Norway	2.8	3.2	3.9	1.1	2.2	2.3	0.2	2.1
Portugal	1.4	4.7	1.9	1.3	1.8	1.2	0.8	1.7
Spain	1.2	4.6	1.9	1.3	1.1	1.2	0.8	1.8
Sweden	1.7	4.5	1.8	1.4	1.0	2.1	0.8	1.7
Switzerland	2.2	1.8	1.8	1.6	0.6	1.4	0.9	3.4
Turkey	2.3	1.8	2.3	1.5	1.6	1.5	1.4	1.7
Czech Republic	1.5	4.6	4.2	2.6	1.9	1.1	1.1	1.7
Hungary	2.1	4.6	1.8	1.4	1.7	2.1	0.9	3.2
Korea	0.6	4.7	1.7	1.2	1.1	0.2	0.6	1.7
Poland	1.4	4.5	4.2	2.6	1.2	1.1	1.0	1.7

Note: Indices range from 0-6, and are based on rotated factor loadings. The overall index is based on the first factor for the summary indices, with 90 per cent of the variance explained.

Table 2C. **Regulation Indices for Rail Transportation**

	Overall Index	Government financial/ operational interventions	Government ownership	Domestic competition
United States	2.6	1.9	1.7	0.2
Japan	1.7	1.7	1.8	1.3
Germany	1.2	1.7	1.8	1.9
France	1.9	3.4	1.8	1.3
Italy	2.0	3.4	1.8	1.2
United Kingdom	0.9	2.2	0.3	1.3
Canada	1.8	1.9	1.7	1.2
Finland	1.9	1.3	2.2	1.3
Greece	2.1	3.0	2.2	1.3
Mexico	1.3	1.7	1.8	1.8
Netherlands	1.6	2.3	1.4	1.3
New Zealand	0.7	1.3	1.1	1.9
Norway	1.9	1.3	2.2	1.3
Portugal	1.9	3.4	1.8	1.3
Spain	1.9	3.4	1.8	1.3
Sweden	1.9	1.3	2.2	1.3
Switzerland	1.9	3.4	1.8	1.3
Turkey	1.9	3.4	1.8	1.3
Czech Republic	1.4	3.4	1.8	1.9
Hungary	1.9	3.4	1.8	1.3
Korea	0.3	2.2	0.3	1.9
Poland	1.7	1.9	1.7	1.3

Table 3. **Summary Regulatory Indices for All Transportation Modes**

	Overall Index	Competition and price regulation	Regulation of industry structure	Public service obligation, regulated customer access	Government ownership and bailouts
United States	2.3	2.2	2.8	1.7	2.7
Japan	2.8	4.3	1.7	2.0	2.4
Germany	3.7	5.3	3.3	2.1	2.8
France	3.5	4.4	3.0	2.6	3.3
Italy	3.7	4.8	2.8	3.2	3.2
United Kingdom	3.4	3.8	3.6	4.4	1.1
Canada	2.7	4.4	1.4	1.9	1.8
Finland	3.5	5.0	3.1	2.5	1.9
Greece	3.7	5.2	2.0	3.2	3.2
Mexico	3.1	3.6	3.0	2.5	3.1
Netherlands	3.5	4.7	4.5	1.4	2.0
New Zealand	3.8	5.4	3.9	2.1	2.3
Norway	3.1	4.1	3.0	2.5	1.8
Portugal	3.7	5.2	2.3	3.2	3.1
Spain	3.6	4.5	4.0	2.1	3.3
Sweden	3.4	4.9	3.3	1.9	2.4
Switzerland	3.0	5.1	2.3	1.4	1.7
Turkey	3.5	4.6	2.7	3.4	2.0
Czech Republic	3.3	5.3	2.6	2.1	1.5
Hungary	2.8	4.0	2.8	2.2	1.0
Korea	3.5	4.9	3.3	3.0	1.5
Poland	3.3	5.0	2.6	2.5	1.6
weight		*0.374*	*0.232*	*0.225*	*0.169*

Table 4. **Database Overview (value data reported in logs)**

		Mean	Max	Min
GDP	Importer gross domestic product in billions of dollars in 2001 Source: World Bank (2002).	12.797	16.126	10.858
PCI	PPP-based per-capita income, dollars, 2001 Source: World Bank (2002).	9.675	10.517	7.709
Imports	Millions of U.S. dollars in 2001 Source: UNCTAD COMTRADE and GTAPv6.2 databases.	4.695	12.011	-4.605
Tariff (= 1 + *t*)	MFN trade-weighted tariff (with adjustments for trade preferences where available, as reflected in concordance of WTO, UNCTAD, and MACMAPS tariff data Source: GTAPv6.2 database	0.028	0.670	-0.123
Distance	Distance between national capitals, as reported in the CEPII database of distance measures. Source: Gaulier, Mayer, and Zignago (2004)	8.332	9.884	2.821
Border	Sharing a common border. Source: Gaulier, Mayer, and Zignago (2004).	0.041	1	0
Comlang	Sharing a common language Source: Gaulier, Mayer, and Zignago (2004).	0.059	1	0
Index	1. Overall index of competition in the retail/distribution sector	0.735	1.548	-0.223
	2. Index of barriers to entry in the retail/distribution sector Source: OECD (2000)	0.747	1.705	-0.357

Note: The scale of competition indexes in levels ranges from 0-6, for least-restrictive to most-restrictive regimes. For countries reported as an interval by the OECD, the mid-point has been used. Countries for which index data are available are: Australia, Austria, Belgium, Canada, Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, Korea, Mexico, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. Trade data are grouped by these 22 importers and by 69 exporting countries. Applied tariff data and distance data have been matched to these bilateral trade pairs.

Table 5. **Robust Regression Estimates of Gravity Equation of Bilateral Trade**

		Model 1 General Index	**Model 2 Barriers to Entry Index**
α_1:	ln(*GDP*)	0.959 (62.86)***	0.956 (62.33)***
α_2:	*Distance*	-1.057 -(28.51)***	-1.046 -(28.11)***
α_3:	ln(*Tariff*) = ln(1+*t*)	-1.836 -(3.30)***	-1.994 -(3.60)***
α_4:	*Comlang*	0.599 (7.19)***	0.595 (7.14)***
α_5:	*Border*	-0.033 -(0.30)	-0.001 -(0.01)
α_6:	ln(*Index*) = ln( )	-0.300 -(7.73)***	-0.242 -(7.80)***
α_7:	Interaction of ln(*Tariff*) and ln(*Index*)	4.527 (1.00)	8.020 (2.24)**
α_9:	*EEA*	-0.105 -(0.99)	-0.158 -(1.48)
α_{10}:	*NAFTA*	0.631 (1.92)*	0.684 (2.09)**
α_{11}:	Interaction between ln(*PCI*), ln(*Tariff*) and ln(*Index*)	-0.778 -(1.46)	-1.185 -(2.77)
Summary statistics for robust regressions:			
Variables		78	78
Observations		1701	1633
Df		1622	1554
F, H_0:Pr($\alpha_1 = ... = \alpha_{10} = 0$), Pr > F		328.86, 0.0	318.59, 0.0
Summary statistics for ols regressions:			
R-squared		0.878	0.877

Note: Robust regressions are estimated using Huber method as implemented in STATA, with default convergence criteria. *t*-statistics are reported in parentheses *, ** and *** indicating 0.10, 0.05, and 0.01 levels of significance for a two-tailed test—or 0.05, 0.025, and 0.005 where a one-tailed test is instead appropriate, as discussed in the text.

Table 6. **Robust Regression Estimates, Competition Coefficient with Split Samples**

	Model 1 **General Index**	**Model 2** **Barriers to Entry Index**
Exporter is poor	-0.339 -(3.72)***	-0.328 -(4.43)***
Rest of sample	-0.271 -(6.46)***	-0.193 -(5.78)***
Large importer, small exporter	-0.366 -(4.65)***	-0.269 -(4.48)***
Rest of sample	-0.286 -(6.93)***	-0.239 -(6.77)***
Large importer, small poor exporter	-0.327 -(2.46)***	-0.299 -(2.75)***
Rest of sample	-0.279 -(7.00)***	-0.208 -(6.43)***

Note: Robust regressions are estimating using Huber method as implemented in STATA, with default convergence criteria. *t*-statistics are reported in parentheses *, **, and *** indicating 0.10, 0.05, and 0.01 levels of significance for a two-tailed test—or 0.05, 0.025, and 0.005 where a one-tailed test is instead appropriate, as discussed in the text.

Table 7. **Trade-cost Equivalents for Intra-EU trade of Changes in Competition Levels by Member States, percentages**

	Move to Average EU regime	**Move to Most Competitive EU regime**
Austria	-3.4	-7.5
Denmark	-1.3	-5.3
Finland	-1.5	-5.6
France	-4.2	-8.4
Germany	3.9	0.0
Greece	-0.4	-4.4
Ireland	3.0	-0.9
Italy	-1.7	-5.8
Netherlands	3.0	-0.9
Portugal	-0.6	-4.7
Spain	-0.4	-4.4
Sweden	1.9	-2.1
United Kingdom	-0.4	-4.4

Note: Based on competition index 1, and Table 4 coefficient for tariffs, and a split-sample regression estimate of the competition index for the sub-sample of intra-EU trade.

Figure 1: **Effects of Market Share**

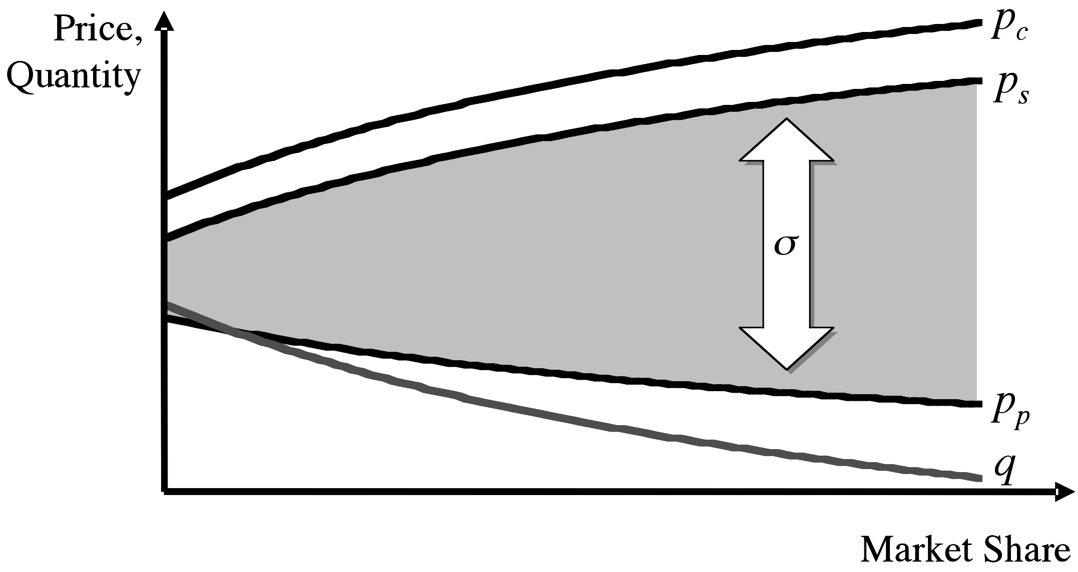


Figure 2: **Effects of Trade Liberalisation**

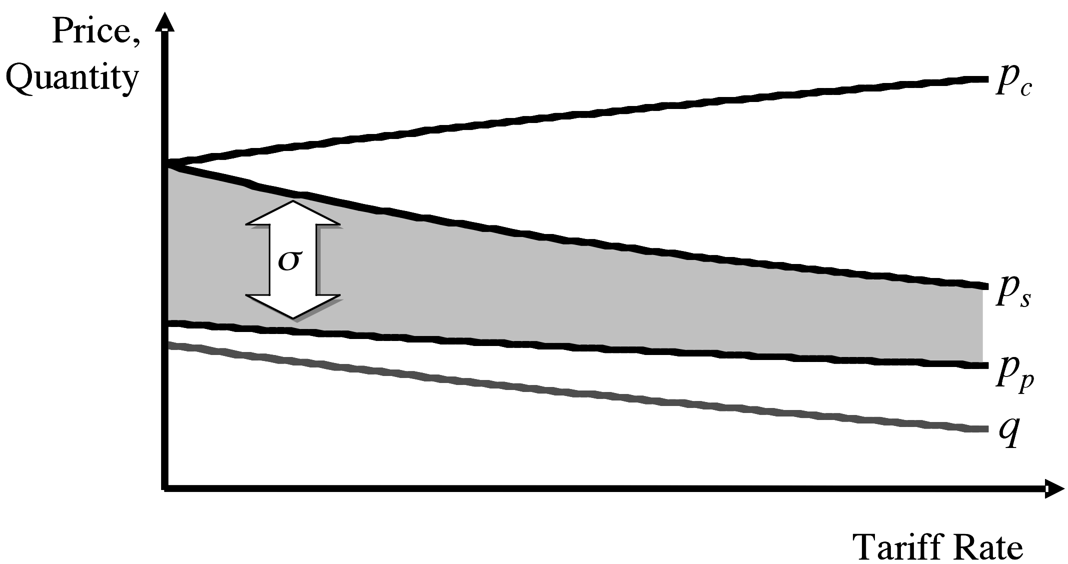


Figure 3: **The Shipping Margin**

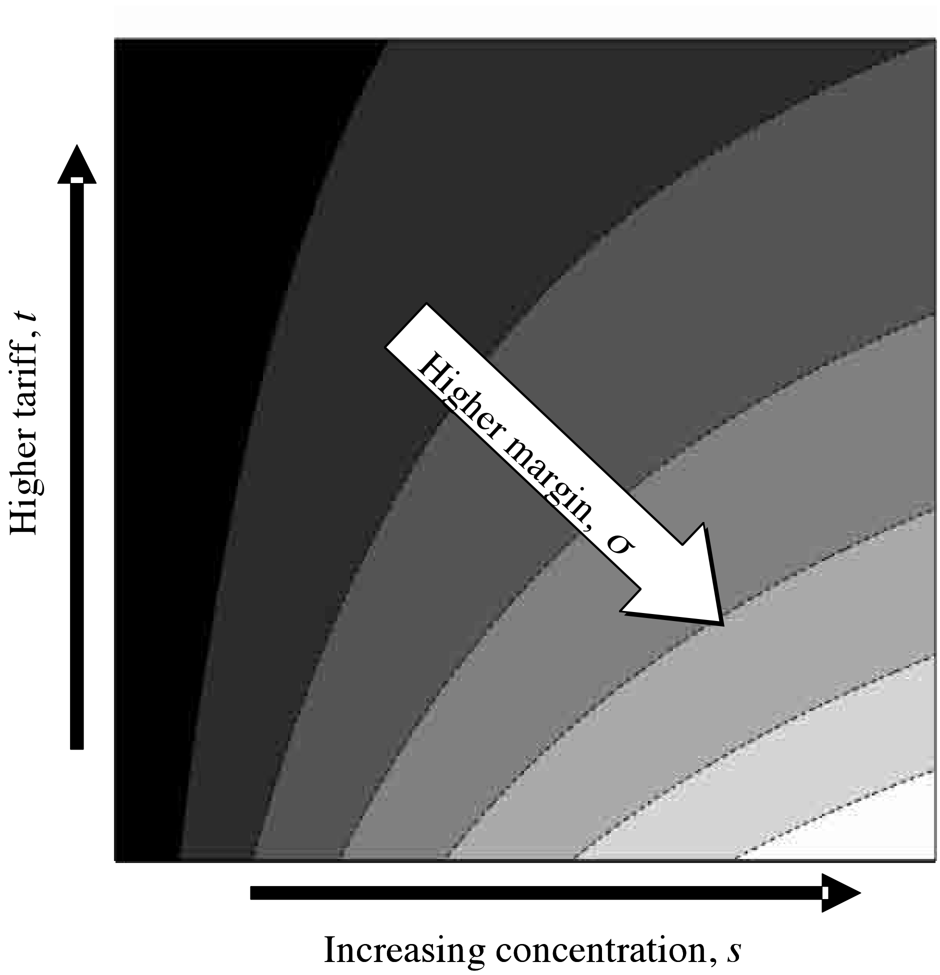
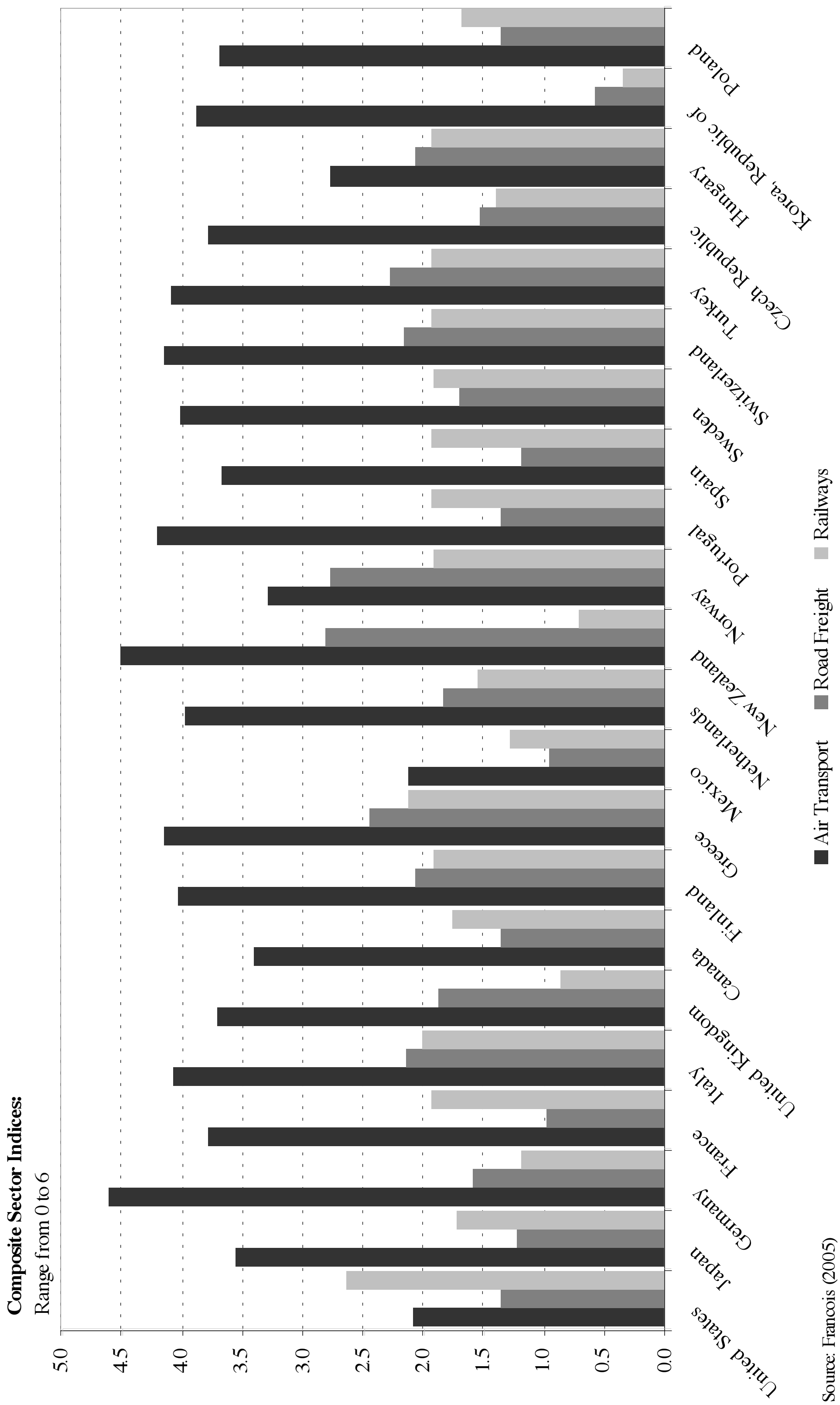
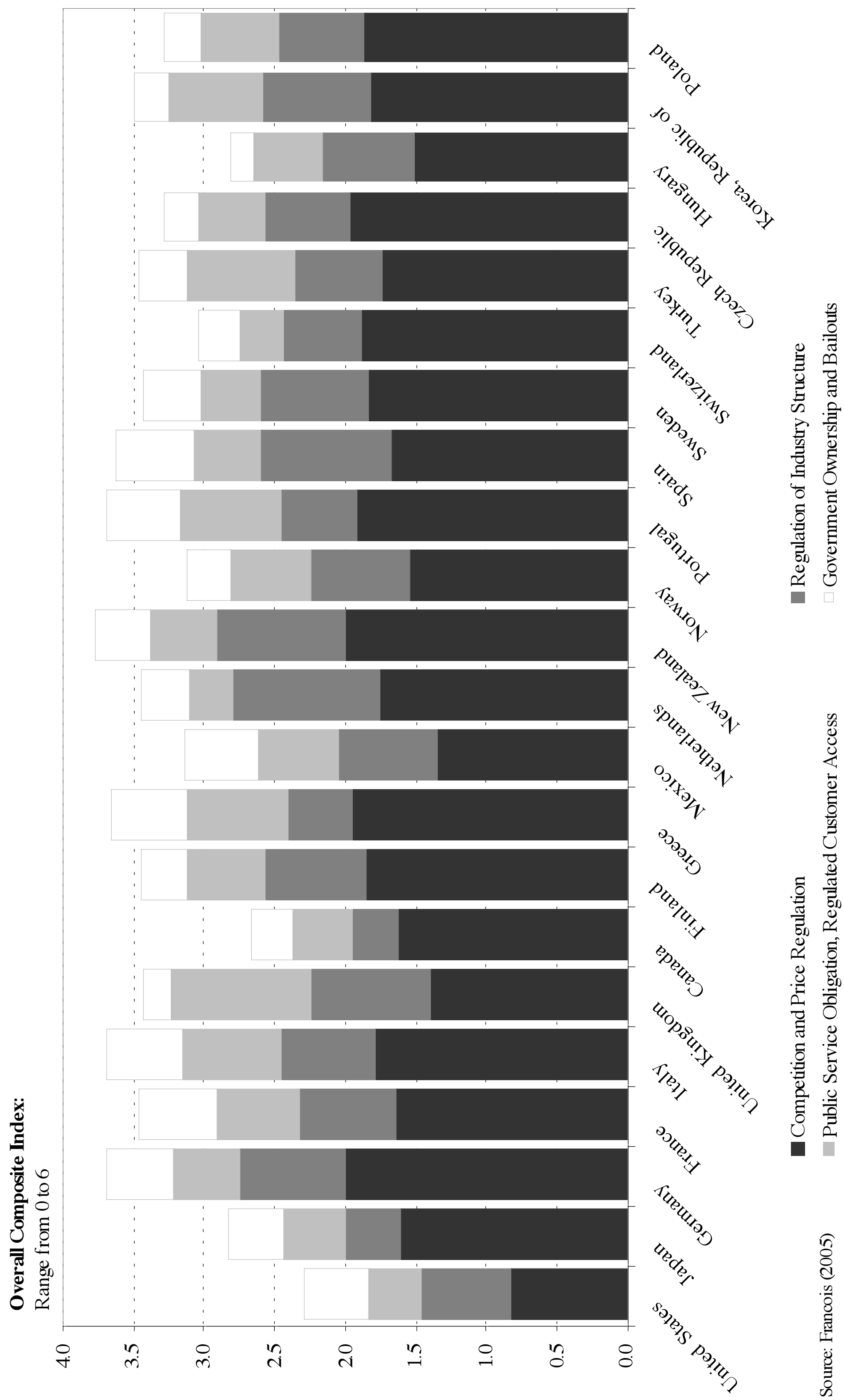


Figure 4: **A Comparison of Regulatory Regimes**



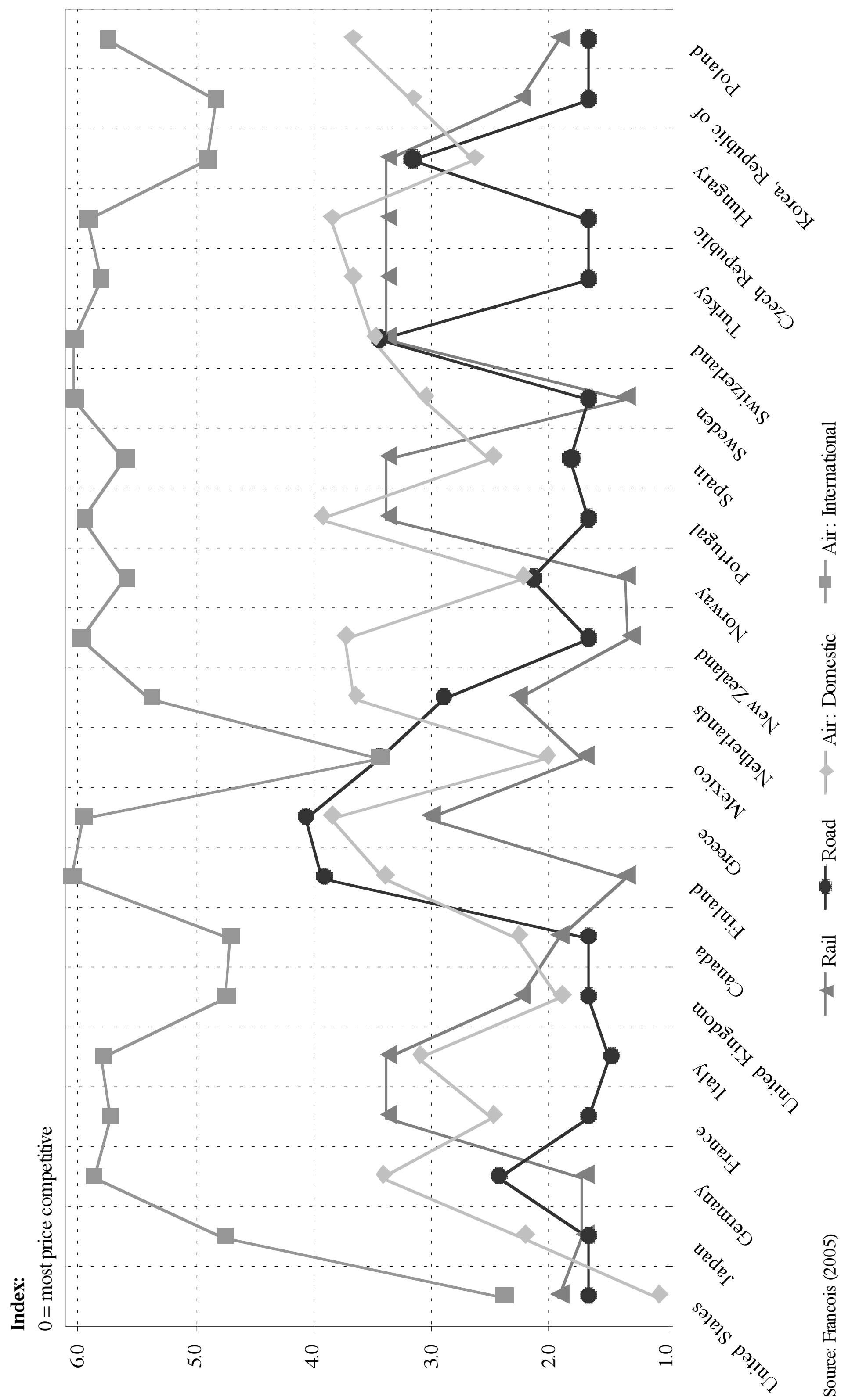
Source: Francois (2005)

Figure 5: **A Deconstruction of the Overall Regulatory Index**



Source: Francois (2005)

Figure 6: **Competition and Price Regulation in Transport**



Source: Francois (2005)

Emerging global logistics networks:
Some consequences for transport system analysis and design

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SUMMARY

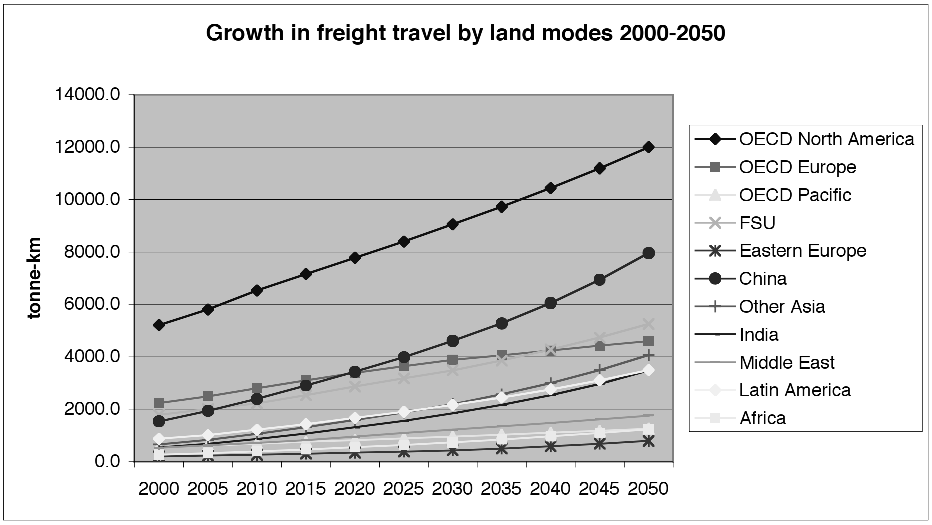
Delft, June 2006

1. INTRODUCTION

The internationalisation of freight flows is a mega-trend, stimulated by a large number of underlying developments. The way in which individual trends manifest themselves varies according to the geographical scale at which companies and markets are operating. Complex global trading networks have evolved, primarily, to exploit labour cost differences and the availability of raw materials in particular countries. Their development has also been facilitated by major regulatory and technological trends. Trade liberalisation, particularly within trading blocks such as the EU and NAFTA, has removed constraints on cross-border movement and has reduced related "barrier costs".

For the coming decades, we expect a continued growth of global freight flows. Some sources predict a doubling of present flows within half a century (WBCSD, 2004). Although this growth will be most visible in the emerging Asian economies (especially China and India), flows are expected to increase steadily in all regions of the world.

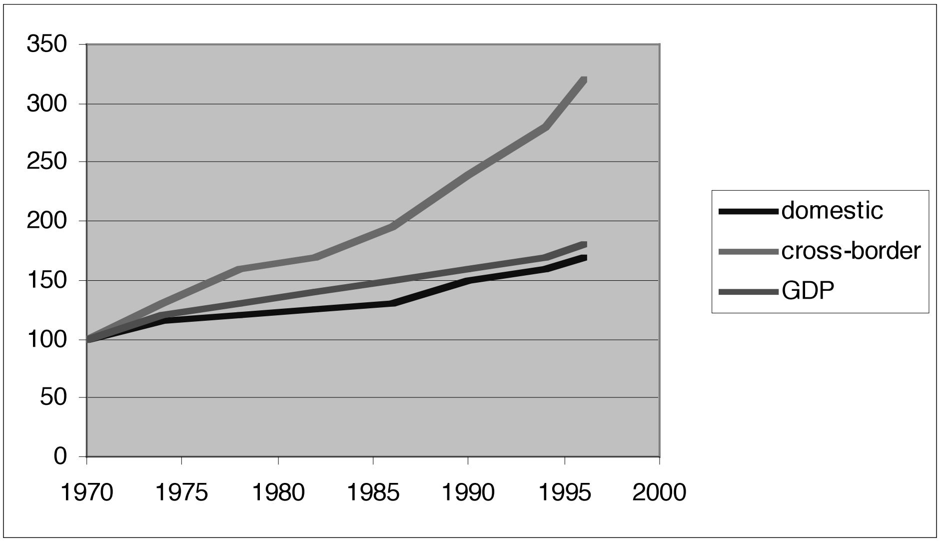
Figure 1. **World trade forecasts**



Source: WBCSD.

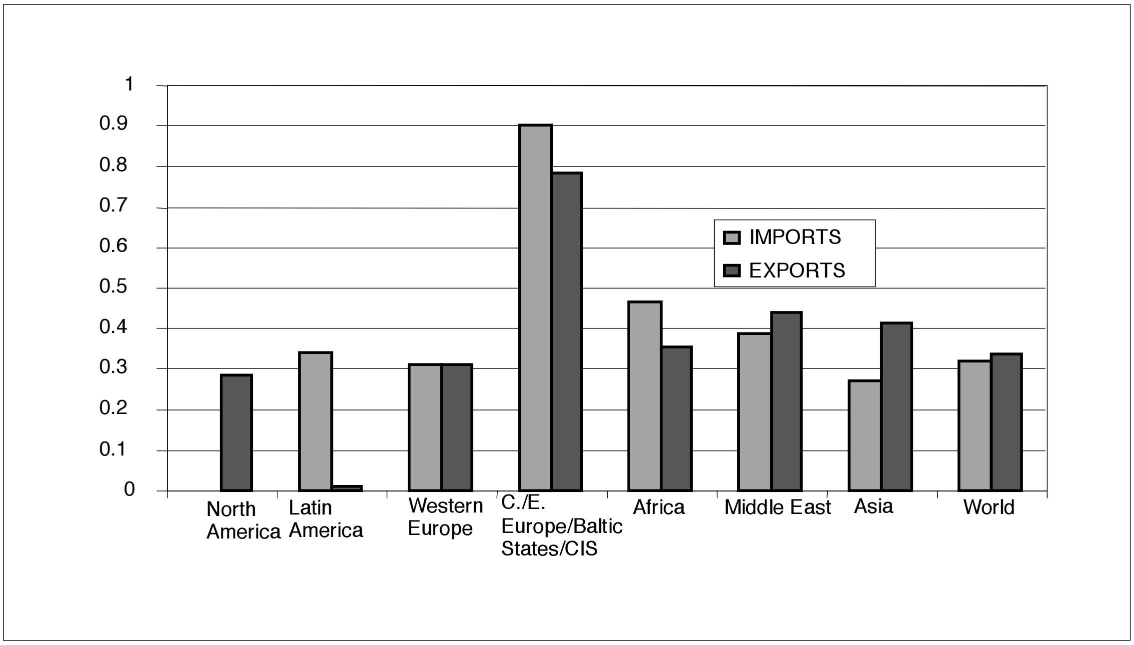
Within the EU, freight transport has doubled within a period of thirty years and forecasts are still equally strong (Kernohan, 2005). Apart from economic growth, this growth of freight travel is also explained also by changes in intercontinental trade and a decrease of barriers within the European continent. In the past decades, growth in cross-border flows, and in particular East-West, is twice as high as the growth in domestic transport, and surpasses GDP growth by far (Figure 2). The decrease of trading impediments has been the most rapid between East and West Europe, leading to almost a doubling of trade in this period (see Figure 3).

Figure 2. **Growth of freight transport within the EU**



Source: European Commission.

Figure 3. **Growth of trade with Western Europe, 1999-2003**



Source: WTO.

International trade goes hand in hand with technological and logistical innovations. Advances in telecommunications and information technology have given companies the means to manage the physical movement of product over long, often circuitous, routes. Many carriers have invested heavily in "track and trace" systems, to be able to establish the location of any consignment at any time, thus improving the visibility of the global supply chain to shippers and their customers (see, e.g., HIDC, 1998). The consequences for the spatial patterns of settlements of production and logistics sites and the resulting freight movement are potentially huge. A compilation of a large number of logistics surveys (Sangam, 2005) reveals high expectations for the immediate future of the global logistics industry, which all point to a strongly dynamic market, where global trade and logistics are in positive interaction:

- Growth figures of around 10% per annum in the logistics outsourcing industry in the US and the EU; 15% per year in the Asia Pacific region;

- A warehousing market in Europe growing from €18.5 billion (2003) to €25.4 billion (2012);

- An expected 150% increase in revenues for logistics service providers in eastern Europe in the period 2003-2006.

This paper explores the logistics dimension of these changes, and develops some thinking around the possible consequences for transport systems: what new requirements will these emerging logistics networks place on our intermodal transport systems? What do we need in order to build new scenarios for strategic decision-making in the public sector that take these developments into account?

The paper is organised as follows. In the next section we discuss the logistics trends that are key to a globalising economy. Section 3 treats the implications of these trends on the spatial configurations of logistics networks. In Section 4 we describe the requirements that these new network forms impose upon intermodal transport systems. Section 5 records the consequences for methods of modelling and simulation, as a means to inform decision-makers. We conclude our paper with a brief summary of the key findings and some recommendations in Section 6.

2. HIGH-QUALITY LOGISTICS NETWORKS ARE KEY TO A GLOBALISING ECONOMY

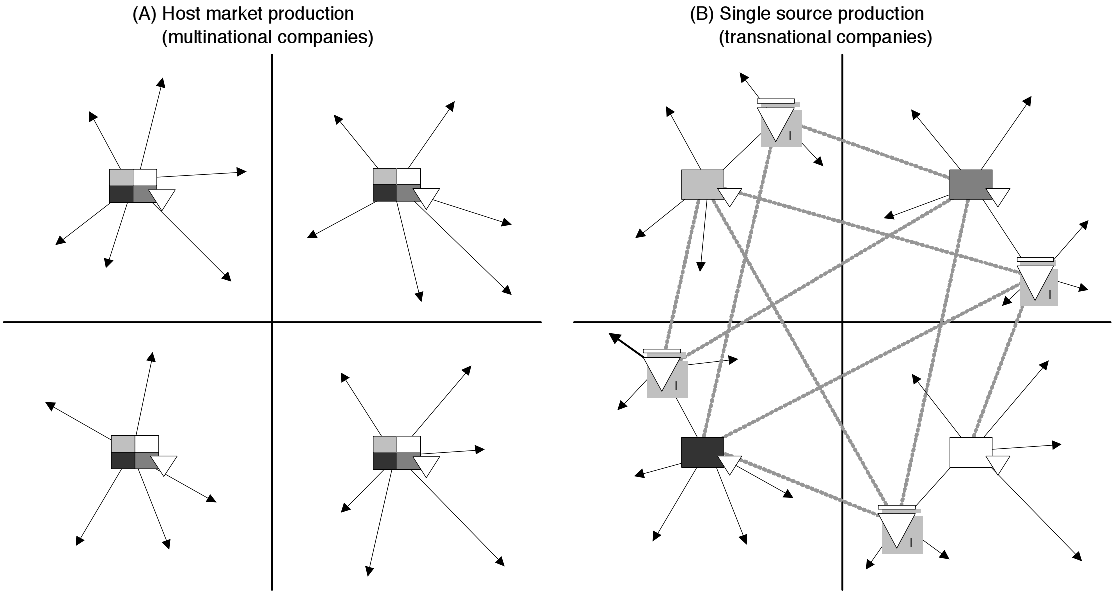
The evolution of logistics networks during the last decades can be characterised by a strong rationalisation of business processes. Companies have become more aware of the impact that their logistics organisation can have on the costs of doing business and on the degree of satisfaction of their customers. Facilitated by the advent of information and communications technology and the lowering of trade barriers, companies have sought to optimise their logistic processes by continuously restructuring distribution networks and logistics partnerships. Logistics costs have fallen world-wide by 20-40% in the last fifteen years (ELA, 2002). Companies have found that one of the instruments to save resources and improve performance is to outsource logistics tasks to specialised service providers. Over a longer term, we can see that companies have been withdrawing to their core business by sourcing transport services (the so-called 3PL) and wider logistics services (4PL) from outside. At the same time, many external drivers have steered the development of logistics services. The series of production steps of goods is increasing, as the firms that produce goods tend to become more and more specialised, searching to reap economies of scale. The so-called "focused factories" (producing only one specific, specialised item) are an extreme example of this. The increased technological possibilities to offer highly customised goods and to deliver these at short notice to markets worldwide are much appreciated by the consumer, and firms now compete to surpass each other in the area of logistics performance, instead of competing on product prices or physical product quality alone.

Over the past years there has been a sustained trend towards the globalisation of business. Ohmae (1985), for example, points to the trend of several life-style preferences around the world which creates ever-wider markets for products. Upstream in the market, there are also several important factors which drive the process of globalisation. Increasingly, it is too expensive to duplicate best manufacturing practice in each of an organisation's major markets. Manufacturing facilities have therefore become more focused, both by product specialisation and geographical location. Inevitably, as the process of globalisation continues, the character of companies must change.

The multinational and transnational or global corporations are not the same thing. The multinational corporation operates in a number of countries and adjusts its products and prices in each country - at high relative costs. The global corporation operates with resolute certainty - at low relative costs - as if the world (or major regions of it) were a single entity; it tries to sell the same products in the same way (Levitt, 1983).

Achieving economies of scale in business has been an important parallel development, in line with the changes in globalisation and manufacturing. If economies of scale exist that extend beyond the size of national markets, then there is a potential cost advantage to companies through centralised production (Lee, 1986). In other words, it will be worthwhile manufacturing in one location, to serve a number of markets, rather than to have national manufacturing units. This has been the strategy of companies such as Procter & Gamble, Kimberly-Clark and Unilever. A vital point about single sourcing of production is that it distances many final customers from production, as shown in Figure 4.

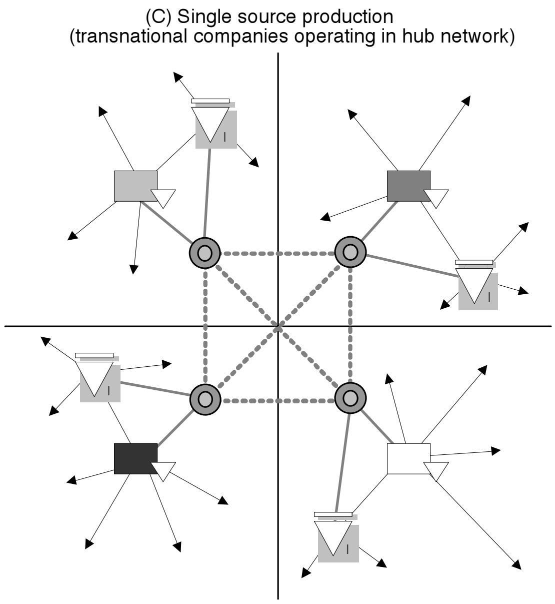
Figure 4. **Host-market production versus single source production**



Source: Adapted from Dicken, 1986.

For the multinational company operating a host-market production strategy, customers and production are in close proximity. As Figure 5 shows, this is less true for a global or transnational company practising single-source production; it follows that there are major implications for logistics management in this transition from multinational to global operations, leading to a growing fragmentation of flows and increased transport distances.

Figure 5. **Single source production operating in a hub network**

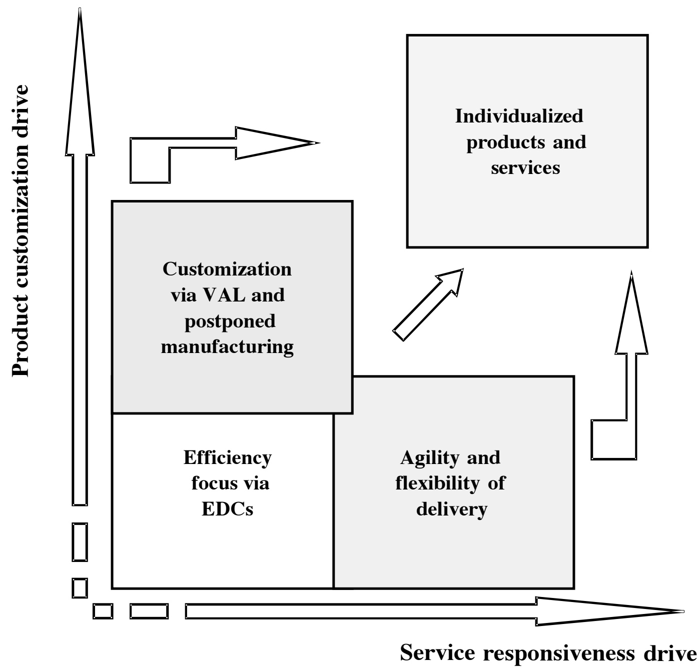


The above trends have introduced an important dilemma into logistics thinking – weighing logistics costs against logistics service quality. The supply chain management discipline embodies this strive to balance these two sides of the equation in order to raise profits, shareholder values and market shares. Especially when considering which changes in logistics networks are yet to come, this dilemma involves a tension between increasingly complex consumer demands and logistic costs. More specifically, on the one hand, the firm is faced with a fragmentation of flows because of smaller, customised shipments in higher frequencies; on the other hand, the need to maintain control over cost levels through benefits of scale in the logistic process is as high as ever. Typically, companies are now turning outside the boundaries of the firm and are seeking horizontal co-operation to bundle flows and save costs. Before we look at these co-operation issues, we first describe the spatial changes in logistics networks that accompany these globalised flows.

3. THE EVOLUTION OF LOGISTICS NETWORKS RESULTS IN NEW SPATIAL INTERACTIONS

Figure 6 shows how, from a consumer perspective, the two main "megatrends" in terms of the evolution of logistics networks, namely "customisation" and "responsiveness", are melting together to form new structures which satisfy the above demands.

Figure 6. **Market drivers for new logistics concepts**



Source: Vermunt *et al*., 2000.

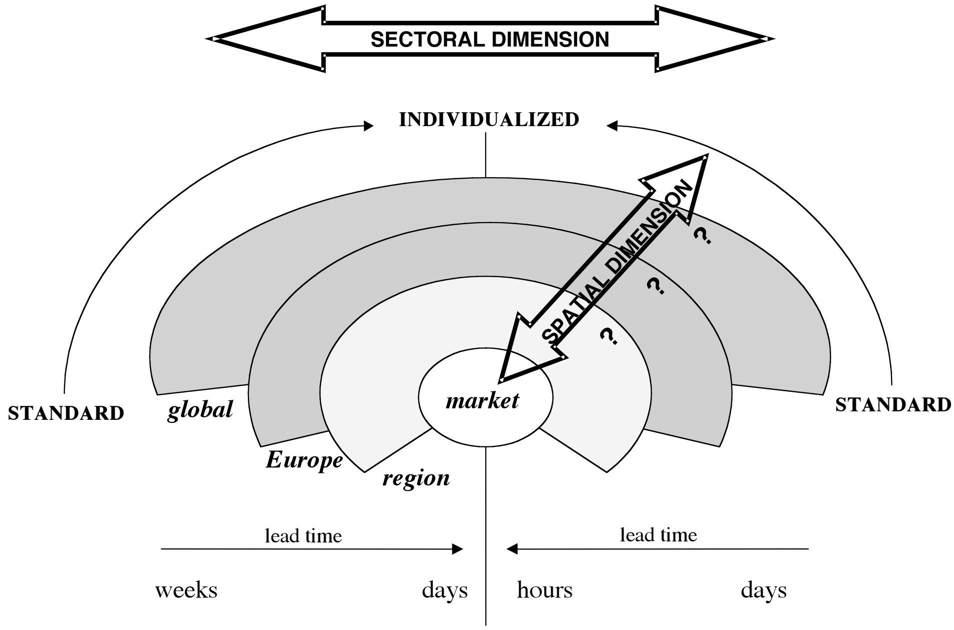
We see an increase in product variety, up to the level of individualised products and services. Eventually, this will go hand in hand with an improvement of lead times to the extent that customised products have the same responsiveness as standardised products have now. Note that the two main axes for development, "service responsiveness" and "customisation", can be operationalised using practical performance criteria like lead time or reliability, shipment size or frequency.

The question that needs to be answered is how these trends in logistics concepts are related to the global spatial economy. These relations are bi-directional, i.e. logistics structures depend on spatial economic structures and also influence them. We have two perspectives from which we observe these relationships:

1. *The sectoral perspective*: which logistics structures will evolve as a result of the above trends? We describe these changes in the remainder of this section.

2. *The spatial perspective:* what is the implication of long-term changes in logistical structures upon economic growth and economic development at various spatial levels (local, regional, continental and global)? (Figure 7).

Figure 7. **Interrelationships between logistics structures and spatial economic structures**

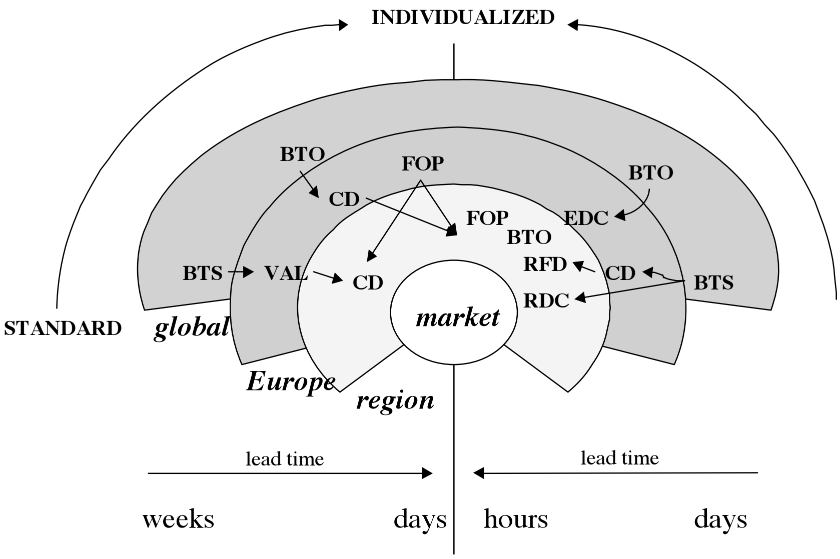


Source: Adapted from Vermunt *et al*., 2000.

The horizontal, i.e. sectoral, dimension in the figure combines the two trends of responsiveness (translated into order lead time) and customisation. The higher the degree of both responsiveness and customisation and the higher the importance of individualised products and services, the nearer we are to the central axis of the figure. The spatial dimension is built up as concentric rings around the central area of consumption, the market. Figure 8 shows how different production and distribution concepts result in this spatial layout, from the global scale towards the local market.

These network structures vary according to the degree of customisation and the degree of responsiveness required. Typical trends are the moves from European distribution, based on production to stock, towards production to order, where delivery takes place directly or through cross-docking. Also new concepts like rapid fulfilment depots (for low-demand but urgent products) and flexible order production (allowing fast switching in batch size and end-product specifications) are being introduced to allow for better responsiveness. The changing of distribution concepts is accelerated by wide-reaching, Internet-based planning and management systems. These do not only include the new business-to-business and business-to-consumer applications, but business-internal applications as well. The Cisco spare-part delivery network guarantees fulfilment of any order anywhere in the world within two hours; this is only possible through a seamless connection between external linkages and the internal logistics processes.

Figure 8. **Logistics structures by demand segment**



Legend

short	Detail
FOP	flexible order production
BTS	built to stock
BTO	built to order
RDC	regional distribution center
EDC	European distribution center
CD	cross-docking
RFD	rapid fulfillment depot

Source: Adapted from Vermunt *et al.*, 2000.

This is a mere illustration of the state-of-the-art transport requirements for products with a high degree of customisation, short lead time and small shipments. In the next section we will describe in some more detail these requirements of increasingly global logistics networks upon the management of transport systems.

4. GLOBAL NETWORK MANAGEMENT: NEW DEMANDS UPON TRANSPORT SYSTEMS

The management of the intricate networks (in terms of planning and operations) described in the previous chapter, places high demands on the freight service industry. The expanding worldwide economy helped the Top 25 Global Logistics Service Providers (LSPs) towards strong double-digit growth in 2004. In turn, the large LSPs are prosperous enough to invest in high-quality systems, processes and logistics networks that have allowed the world's largest companies to implement efficient supply chains stretching from Asia to North America and Europe. This synergy between the major LSPs and their customers has been highly beneficial to both sides and is likely to continue. Continuation of this trend towards concentration is anticipated. "*The big Third-party Logistics Providers are expected to continue to get the big opportunities* (Foster *et al*., 2005)."

The present situation on the supply side of the market for logistic services, however, is still characterised by fragmentation, both in terms of market share and in terms of specialisation. The top-25 LSPs in the world only have a limited market share, and usually generate most of their turnover in specific markets. These market specialisations of LSPs may concern a specific product or mode of transport (e.g. ocean shipping, express delivery) or geographical coverage.

On a global level, the big LSPs are by definition intermodal companies. For intercontinental transport, intermodal transport, especially container-based intermodal transport, is the only way. On a European continental level, however, intermodal transport is of only limited importance for the big LSPs. Only a few LSPs have integrated intermodal transport into their intra-European service offerings. Examples of LSPs that do make use of intermodal transport on a substantial scale include Stinnes (part of Deutsche Bahn) and P&O Nedlloyd/Maersk Sealand (operating the ERS rail shuttle). Most of the LSPs, however, are very much road oriented.

As a result of the increasing sophistication required for logistics systems to fulfill the growing demands from their users (or clients of these users), there is an increasing need for flexible logistics structures that aim towards:

- Cost and asset efficiency;
- Responsiveness towards changing customer requirements;
- Obtaining marketing advantage.

The first objective is driven even more by the last two, because only if logistic structures are efficient can they offer feasible solutions in today's ever more competitive environment. Consolidation and Collaboration (horizontal as well as vertical co-operation between chain partners) are the most logical ways to generate lower costs per unit of freight. Through consolidation of flows, larger vehicles can be used and the loading efficiency is optimised. Also through collaboration, the planning of logistic activities is synchronised, which results not only in a much smoother, seamless flow of goods through the logistic system, and therefore higher utilisation, but also in the possibility of using cheaper and slower modes of transport, thus avoiding the need for safety stock (Groothedde, 2005).

The high level of responsiveness required could possibly conflict with the above-mentioned need for slower and smoother flows of goods, but avoiding this possible conflict is one of the biggest challenges in the design of logistic networks. The set-up of hybrid networks (which create different possibilities for flows to reach their final destination) for production, warehousing and transportation, creates the flexibility required. Some of the production, with a demand pattern that can be predicted well in advance, comes from far-away locations using low-cost labour. The remainder is postponed to the last possible moment in locations close to the customer.

Valuable products with a very low demand frequency (C-goods) are stocked centrally and can be shipped quickly over long distances if the reduction in inventory costs outweighs the additional transport cost of small lot sizes using express transport. The utilisation of cheap and slow modes in combination with faster means of transport can sometimes be much more advantageous than that of high-speed, expensive transport modes, especially for products with a low value density and a high level of demand certainty. As such, hybrid networks can combine the advantages of both network alternatives, and thus create higher levels of efficiency and flexibility.

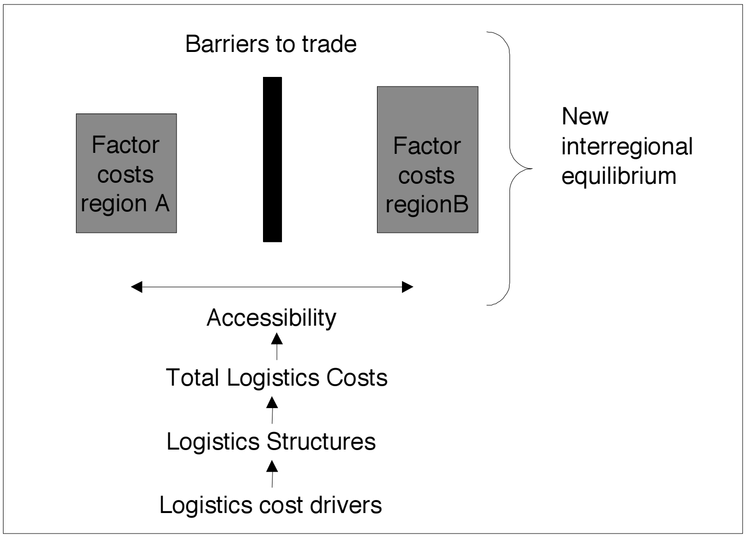
Note that in such a network the Logistic Service Provider (LSP or 3PL) plays a crucial role. This party has to make sure that the commercial contracts of the producers that have created a consortium to deliver their products in a synchronised way to their customers (the retailers) are performed according to the service level agreements they have agreed. This means that in order to work efficiently and effectively the LSP has to know what specific logistic agreements exist between all parties concerned, and has to know the orders and production plans timely in advance. Also he has to make sure that the utilisation of the resources is optimised and that pro-active action is taken if unplanned actions occur that obstruct the current plan. It is clear that such a hybrid network asks for a good coordination and synchronisation of the actions of each of the partners in the logistics network.

5. EXTENDING THE BOUNDARIES OF FORECASTING AND MODELLING

Clearly the above will have repercussions for the way in which we prepare our strategic information base to support the policy making process. When preparing scenarios for globalised transport and forecasting the consequences of policy measures, we need to take into account the interrelations between transport, logistics and trade. We need to progress from a way of thinking which is mostly focused on transport to one that includes the advance logistic network forms discussed in this paper. In this section we discuss some consequences for our approach towards analysing this integrated transport-logistics-trade system.

The development of international trade is influenced by differences in factor costs in the respective regions as well as by the barriers to trade, both regulatory and generated through the distance between these regions. From this perspective, neoclassical equilibrium theory is an excellent starting point to forecast globalising transport patterns. Considering what has been said earlier in this paper, the only extension with this theory is that, instead of distance and transportation costs being used as measures of resistance between regions, one introduces the concept of total logistics costs (Figure 9).

Figure 9. **Conceptual model linking logistics and trade**

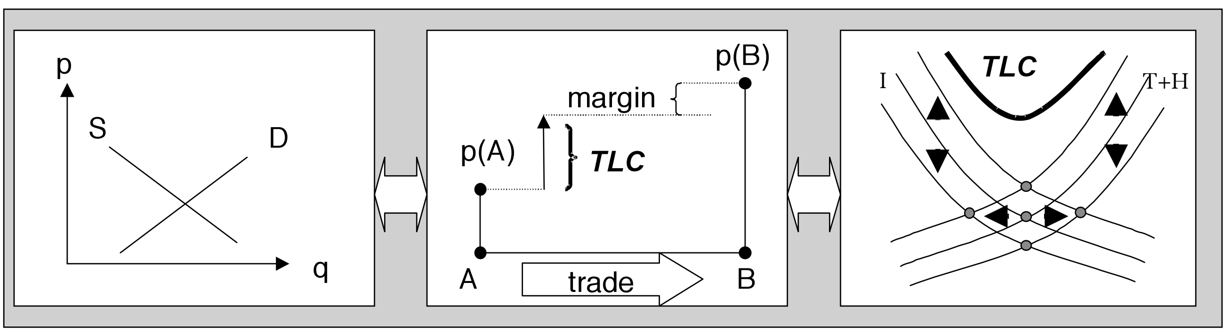


These costs reflect not only transport-related elements but also all relevant logistics costs which include storage, handling and inventory costs. In a situation where travel costs decrease and differences in factor costs remain high, globalisation can be expected to continue. Should production costs differences diminish and transport costs increase, however, the opposite would be likely.

The relationship between logistics and transport is explained by the logistics costs function, which is defined by the trade-off between transport, inventory and handling costs. Structures with many depots and small but frequent shipments will emerge when firms are primarily service-oriented, and will generally be preferred when transport rates are high. While the decrease in transport costs has placed increasing pressure on firms to centralise their inventories, the increasing emphasis placed by firms on quality of service is leading to growing pressure to decentralise operations.

GCE modelling, already used before and more so since its development by Venables and Gasiorek (1996), is now available as a means of predicting the welfare effects of transport investment and policies. Despite the research problems which remain to be solved (see Lakshmanan *et al.,* 2002 and Tavasszy *et al.,* 2002), progress continues to be made in integrating transport models and CGE approaches into more comprehensive tools for assessment. In order to sharpen our insights into future logistics structures and their relationship with economic development, we propose to include total logistics costs into the CGE framework, thus giving a wider interpretation to what is now – in CGE terms – referred to as 'transport costs'. Logistics structures can be modelled along the lines of the SMILE model (Tavasszy *et al.,* 1998) which provides a picture of how logistics structures are affected by regional and product characteristics. Figure 10 provides a rough outline of the components of this multiregional spatial logistics model.

Figure 10. **Rough outline of a spatial logistics equilibrium model**



At the network level, more detail will be required in terms of the logistics demands of goods. The models described above only provide a crude picture of networks in that they only include intermediate warehouses (continental or national distribution centres). The optimisation models from Groothedde (2005) were developed to design hybrid, collaborative networks. They produce more sophisticated network forms and thus also create information sufficiently detailed to develop a multimodal micro-simulation of flows based on dynamic shipment, vehicle and client characteristics and routing requirements. As these optimisation models are valid for very specific sectors or markets, the next challenge will be to aggregate and generalise these behavioural rules towards a picture that is representative of all flows using the European transport network.

6. CONCLUDING REMARKS

In this paper we provide an overview of the changes in supply chains and networks that occur as a result of globalisation of production, trade and services. While logistics costs have dropped dramatically in the last decades, flows have grown twice as strongly internationally as they have within national borders. Together with the growing capability of firms to individualise their products and services, this has created new network architectures that can span the entire globe. We describe these network forms and derive some consequences for transport system planning.

On the one hand transport systems will need to adjust better to a globalising economy, with a higher variation in different types of networks than ever before. The splintering of flows that occurs due to the demands of customisation and increased responsiveness will force firms to look outside their company borders for co-operation and, in the end, for scale. Thus, transport systems will need to become more flexible and acquire a more hybrid nature to accommodate both slow and large scale flows as well as small scale, just-in-time shipments.

These changes also have consequences for the scenarios that need to be built. We argue that the models that supply scenario information and policy assessments are not up the task of accounting for changes in global logistics networks. Necessary improvements include not only the extension of transport models to a global level, but also, and in particular, the proper linkages between models for global trade and transport and the inclusion of the necessary amount of logistics detail in freight transport models.

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Topic III :

Transport Policy and Regional Integration

Trade in Transport Services in the NAFTA Region: A Free Trade Area?

by

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SUMMARY

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ABSTRACT

The paper begins with some background on the North American Free Trade Agreement (NAFTA) and the development of trade and transportation in the more than 10 years since its implementation. It will identify that, unlike the Single Market initiative in Europe, NAFTA is a trade agreement, not a border-minimizing political union. Its treatment of transport issues is noticeably focused on one mode, trucking, with less than satisfactory treatment of other modes. This paper then uses the maritime sector to illustrate the challenges inherent in the existing regulatory climate, and then concludes with a discussion of what the future likely holds.

Keywords: North America – transportation – policy – economic integration – short sea shipping

1. INTRODUCTION

In 1992, Canada, the US and Mexico signed a trilateral agreement for freer trade, the North American Free Trade Agreement (NAFTA), with effect 1 January 1993. The agreement contained numerous clauses to reduce tariffs, to implement a dispute resolution mechanism and to establish the terms and conditions of a new trade and investment relationship between the three countries. It also contained provisions to address trade in services, but not all transportation services were included; in fact, marine and air transport were specifically excluded.

The NAFTA has been a qualified success from a trade perspective. Over the 1990s, the total trilateral volume of trade (in value terms) expanded at a significantly faster rate than growth in total world trade (WTO, 2004). As a percentage of global exports, intra-regional exports rose from 7.9% in 1995 to 10.9% in 2000, but then dropped to 8.3% in 2004 (WTO, 2005). Therefore, the simple conclusion is that from 1993 to 2000, the NAFTA was a success in generating trade. Trefler (1999) concluded that tariff removal explains most of the success, but not all. Clausing (2001) and Schwanen (1997) argued to the contrary. Factors such as Canada's currency depreciation (in the 1990s), its subsequent appreciation (in the last two years) and the mid-1990s Peso crisis in Mexico, as well as a restructuring of foreign direct investment through the period, also contributed to changing the trading relationships.

While those outside North America might assume that the NAFTA trading area is similar to the EU in its treatment of transport, nothing could be further from the truth. Between Canada and the US, it was the earlier Canada-US Trade Agreement, 1988 (CUSTA) that altered conditions affecting Canada-US trucking and rail operations. Air transport access continued to be negotiated under existing bilateral arrangements, and, as desired by the Americans, marine transport was not included in either CUSTA or NAFTA.

The CUSTA liberalized access to international transport markets for Canadian and US transport companies, but retained existing cabotage restrictions on domestic traffic. Investment restrictions were lifted and, as a result, Canadian and American trucking companies invested in each other's businesses and consolidated operations in the much more competitive environment that the earlier deregulation brought to both countries (Brooks and Ritchie, 2005).

The NAFTA extended the CUSTA to Mexico. The NAFTA negotiators hoped to mirror the success that the CUSTA granted Canadian and American trucking and rail companies; as a result, the NAFTA locked in gains already made in Mexico, and established timelines for phasing-in regulatory reforms and changes to the investment provisions, to bring them into alignment with what already existed between Canada and the US (Cameron and Tomlin, 2000). While the NAFTA promised to extend investment access to Mexico, the promise was not delivered (Brooks, 2001). The phased-in reform plan was not executed as agreed; the Mexican trucking dispute stalled all progress on access and investment in the trucking sector[1]. Mexico had passed the legislation, but when denied trucking access, did not implement the legislation.

The critical difference between the European "single market" approach and the NAFTA philosophy was the extent of the freedom of access acquired by transportation companies[2]. In dismantling their internal borders, the Europeans developed a phased process for the liberalization of transport services, including air and maritime transport. They also developed support programmes to enhance European transport networks, networks that support and enhance trade. This approach was not adopted in the NAFTA negotiations.

This paper will present some facts about NAFTA's impact on transportation services. Then, it will focus, as an illustration, on one particular mode that was excluded from the agreement – the marine sector. It will then look to the future and comment on what is likely to be the future in trade in transportation services in the North American "free trade area".

2. NAFTA AND TRANSPORTATION

In theory, NAFTA made significant gains in opening international point-to-point traffic to trucking and rail carriers. It proposed timelines and milestones for market liberalization but did not include changes to cabotage restrictions; domestic traffic would still be required to use national carriers. It did not address the uneven playing field in terms of subsidies to transport users, immigration and access to capital, nor critical differences like rules regarding exit from the market (bankruptcy, abandonment of right of way or conveyance), corporate taxation or governance. Brooks (1994) identified four issues that were important to transport companies but not fully addressed in the agreement: these were non-tariff barriers; access to cargo; ownership and investment regulations; and investment screening. Many of these barriers were left to a newly-created institution, the Land Transportation Standards Subcommittee (LTSS), to continue the negotiations and seek trilateral resolution.

By 2000, the LTSS had concluded agreements in the areas of, among others, legal driving age, driver logbooks (format and contents), applicable medical standards, language of jurisdiction and regulations governing hazardous materials transport, although not within the tight time frame proposed by the agreement. Since 2002, no progress reports have been published, although each country has a separate web site detailing the multiplicity of applicable equipment standards in the trucking industry. As a result, equipment standards remain a significant non-tariff barrier for truckers, with carriers facing more jurisdictions and combinations than is reasonable to expect any geographically dispersed company to comprehend, let alone provide. Furthermore, both Canada and the US recently but separately developed new trucking hours of service regulations without any visible effort to harmonize requirements on a bilateral basis.

Because rail provides its own infrastructure (unlike the other modes), the railways have always had the ability (although not necessarily the funds) to invest in infrastructure to resolve bottleneck issues and, while the investment regime prevented controlling investment in Mexican railways, the railways have not experienced as many of the challenges arising from the NAFTA that were felt by the other modes. Since the terrorist acts of September 2001, the rail industry has worked collaboratively with the Department of Homeland Security to develop systems and procedures to meet US security concerns. The industry is now well-positioned for future profitability within its existing continental network. The future will be constrained by the elimination of redundancies over the past decade, and so the rail network may not be able to expand at the pace necessary to assist other modes in coping with the looming capacity constraints they face.

Air and marine services were specifically excluded from the NAFTA. With respect to the former, it is interesting to note that Canada concluded its first "open skies" agreement with the US in 1995, although it was not considered as such by the US, who recorded its 11 November 2005 "open skies" agreement with Canada as its 73rd. With respect to the marine mode, Canada and Mexico signed annexes for liberalization of marine bilateral services as the US opted out of including the marine mode in the body of the agreement.

As already noted, the NAFTA was a trade success, particularly in its earlier years. While the NAFTA negotiators envisaged a growth in trade arising from liberalization, the impact of this growth on transport infrastructure at the border was not adequately considered. Investments in border personnel and physical infrastructure were minimal, and the capacity of the border infrastructure to handle the resulting growth in trade has proven to be inadequate. Because the NAFTA did not contain any institutions of a bi-national nature to address border infrastructure investment, such investment was left to each country to determine and the development of new infrastructure has been the subject of jurisdictional debate. There was no vision of a trilateral infrastructure investment mechanism, as is the case with Europe's Trans-European Networks programme. The biggest challenge today, according to Canadian trucking companies, is shipment delays at the Canada-US border and their economic cost (DAMF, 2005). This conclusion confirms earlier work by Taylor *et al*. (2004) in that delay has become an economic challenge that must be addressed.

More trade means more goods for transport companies to carry (unless that trade growth is in services). North American Transportation Statistics (2006) data on trans-border trade by mode of transport (in tonnage terms) for the three trading partners are presented in Table 1. With the exception of a well-developed pipeline network for Canadian oil and gas sales to the US, road transport is a key player in the continental transportation system. However, road's modal share in Canada-US trade has been stagnant, being 20.2% of tonnage in 1995 and 19.2% of tonnage in 2004. The tonnage carried by road southbound has been essentially flat since 2000. In the other direction (US-Canada),

Table 1. **North American Trade by Mode (in 000 metric tonnes)**

Route/Year	1990	1995	1998	2000	2002	2004
Canadian Imports from the US	**U**	**87 758**	**131 836**	**122 814**	**128 865**	**167 481**
Air	U	1 527	1 765	1 796	1 814	4 988
Water transport	U	27 236	36 477	33 410	36 067	26 187
Road	U	45 734	72 291	67 847	68 918	94 721
Rail	U	12 180	14 067	17 624	18 103	19 974
Pipeline and other	U	1 080	7 236	2 136	3 963	21 613
Canadian Exports to the US	**176 424**	**271 905**	**303 830**	**335 136**	**347 324**	**364 132**
Air	201	563	477	734	759	660
Water transport	40 060	45 273	49 084	53 191	60 585	66 273
Road	39 164	54 923	64 624	70 808	71 097	70 047
Rail	32 327	48 476	56 309	63 690	64 381	74 845
Pipeline and other	64 672	122 670	133 337	146 712	150 503	152 306
US Exports to Mexico	**N**	**N**	**N**	**51 000**	**48 652**	**U**
Air	30	28	62	86	69	57
Water transport	9 027	8 632	18 553	25 157	23 061	20 267
Road	N	N	N	N	N	N
Rail	N	N	N	N	N	N
Pipeline	N	N	N	N	N	N
US Imports from Mexico	**N**	**N**	**N**	**110 888**	**123 110**	**136 013**
Air	18	36	60	80	55	63
Water transport	43 115	63 719	81 734	83 232	93 606	101 633
Road	N	N	17 496	20 688	21 214	25 586
Rail	N	N	5 430	6 636	7 816	8 457
Pipeline	N	N	57	117	5	8
Canadian Exports to Mexico	**698**	**2 278**	**2 781**	**3 653**	**2 766**	**4 182**
Air	8	32	11	13	20	63
Water transport	459	1 893	2 421	2 992	1 874	2 573
Road	83	176	183	302	400	481
Rail	149	176	166	346	472	1 066
Pipeline and other	NS	NS	NS	NS	NS	NS
Canadian Imports from Mexico	**1 373**	**2 209**	**3 600**	**3 743**	**3 923**	**4 392**
Air	22	44	56	88	119	119
Water transport	846	617	1 863	2 141	786	1 320
Road	346	624	1 558	1 212	1 556	1 901
Rail	141	275	118	298	280	419
Pipeline and other	18	649	5	4	1 183	634

Note: Because each country defines and collects merchandise trade data differently, these numbers should be treated as approximate only. Detailed use should rely on the original data available at the NATS web site. This table is an amalgam of Tables 6-2a and 6-2c. N = Data are nonexistent, U = Data are unavailable.

Source: Selected from North American Transportation Statistics (NATS) database, January 2006.

there has been a recovery and the share has grown from 52.2% in 1995 to 56.5% in 2004. DAMF (2005) reported on the significant cost of delay due to compliance with US import security measures. Security is considered by companies competing in the trucking sector to be a significant market access problem.

Canadian and Mexican tonnage to the US by marine transport has grown since the signing of the NAFTA. In the case of the southern border, cross-Gulf of Mexico trade in petroleum products is the key explanation; on the northern border, the cross-Great Lakes trade is also strong, with the Canada-US transport by water share growing slowly from 16.6% in 1995 to 18.2% in 2004. However, while the southbound volume by water is growing, its share of the total tonnage has deteriorated steadily from 31% in 1995 to 15.6% in 2004. It is believed that the shifting market situation is due to greater participation by foreign flag vessels in trans-border trade, and cannot be attributed to the NAFTA as it did not perceptibly alter access rules.

The freight transport markets in the three countries (Table 2) clearly illustrate the asymmetrical nature of the relationship with respect to the transport sector. The importance (and dominance) of both rail and road to US domestic transport is evident. Also noticeable is the volume of US domestic shipping, both brown water (inland) and blue water (coastal), with coastal shipping at ten times the size of Canadian and Mexican shipping combined, and inland at twenty times that of Canada's inland shipping.

Table 2. **Freight Transport (billion tonne-kilometres) 2003**

	Rail	**Roads**	**Inland waterways**	**Pipelines**	**Total inland freight**	**Coastal shipping**
Canada	317.9	185.0	24.7	303.5	831.1	17.5[a]
Mexico	23.7	195.2	..	..	..	22.2
United States	2 200.2[c]	1 534.4[a]	506.7[c]	855.8[c]	5 464.4[a]	384.9[c]

Notes: .. = not available; -- = not applicable; a. 2001; b. 1998; c. 2002; d. 1999; e. 2000.

Sources: *Trends in the Transport Sector*, ECMT, Paris 2005; IRTAD: www.irtad.net, as cited by the OECD (2005), *OECD in Figures (OECD Observer 2005, Supplement 1)*, http://www.oecd.org, last accessed 24 February 2006.

Like Europe, North America has an extensive coastline and inland river system. It also has the largest freshwater lake system in the world, and the Gulf of Mexico region boasts that it is home to 59 million in population and seven of the 12 busiest US ports (Springer, 2005). However, the pattern of modal choice in the transport sector differs substantially from that seen in Europe; road accounts for 44% of the European Union's goods transport market, while short sea shipping accounts for the next largest share at 41% (European Commission, 2001: 12, 24). These facts indicate that short sea shipping could, and some might even say should, be a stronger transportation mode for the continent. The balance of this paper will focus on the marine mode in particular within the context of the NAFTA.

3. THE SPECIFIC CASE OF MARITIME TRANSPORT IN NAFTA

As can be seen from Tables 1 and 2, marine transport is a player in NAFTA transport but not as large a one as might be expected, given continental geography. Problematically, most of the international trade between the three is carried in foreign flag vessels. Participation of Canadian and US owners is through foreign flag tonnage. Canadian owners in international shipping activities prefer to choose a foreign flag, with 57.6% of the Canadian-owned fleet registered under foreign flags; the US percentage is even higher at 77.8% (UNCTAD, 2005: 33). That said, the US flag fleet is significant with 5.3% of the world fleet measured in deadweight tonnes; the Canadian-registered fleet is only 6.5% the size of the US-registered fleet, while the Mexican fleet is smaller still, at 2.8% the size of the US fleet (UNCTAD, 2005: Annex IIIb). Given the sheer size of shipping owned by US interests, and the industry expertise held by Americans, the US' stance on protecting their market from Canadian and Mexican shipping interests is surprising.

Chapters 24 and 27 of the US *Merchant Marine Act of 1920* (also known as the *Jones Act*) state that cargo may not be transported between two US ports unless it is transported by vessels owned by citizens of the US, built and registered in the US, and manned by a crew of US nationals. While protection of coasting trade is contrary to the overall liberalized trade intentions of both the NAFTA and the CUSTA, the US was not prepared in either negotiation to open the market by providing access in shipping. While many countries do impose restrictions on domestic shipping, "the scope of US restrictions is almost certainly unparalleled" (Hodgson and Brooks, 2004: 62).

The US is not alone in its approach to domestic shipping. Both Canada and Mexico practice protectionist policies. With the passage of the *Coasting Trade Act* in 1992, Canada closed domestic shipping to all but Canadian ships, albeit with a waiver provision, reconfirming "the same protectionist philosophy that has existed ever since Canada inherited its coasting trade regime from Britain" (Hodgson and Brooks, 2004: 51).

Mexico too wishes to protect its small and aging domestic fleet. This means that North American cabotage policies are significantly at odds with trends in European shipping. In Europe, the interplay between international and domestic shipping means each aspect of the business is able to support the other through an adverse business cycle. Such is not the case in either Canada or the US.

To compare North America shipping with European maritime transport is like comparing night with day. The Cockfield Report (Commission of the European Communities, 1985: 30) envisioned a Single European Market in maritime transport services. To achieve this end, a strategy for the phasing out of restrictions was planned so that the European shipping industry could become internally fair and externally competitive against other flags (Brooks and Button, 1992). While the implementation was protracted, any EU flag ship that is eligible to engage in its own coasting trade is now able to engage in coasting trade activities in any other EU State. Some States, including the UK and Norway, have no restrictions on the use of ships of any flag in their cabotage trades.

In addition, tonnage tax, or an equivalent, is available in the large majority of European States; this effectively reduces corporate tax to very low levels. Many states also provide varying degrees of relief from income tax for seafarers. Formally endorsed as EU-wide policy, this type of State aid effectively reduces or eliminates any differential in the cost of conducting operations between the domestic and the international sectors of the industry. The unrestricted movement of ships from one sector to the other is in sharp contrast to the separation between the sectors imposed by Canada's implementation of its international shipping corporation tax regime (Brooks and Hodgson, 2005).

In 2001, the Canada Transportation Act Review Panel recommended that Canada make clear to the US its preference for eliminating the restrictions on entry to domestic shipping in the *Coasting Trade Act* and offer to negotiate equivalent bilateral elimination (Public Works and Government Services Canada, 2001: 146). The opportunity to do so has either not arisen or Canada has not shown the political will to engage its NAFTA partners on the issue. It is highly likely that here too, events have conspired to move the agenda forward in a different way, and that is the recent and growing interest shown by all three governments in short sea shipping.

On 6 November 2003, the three NAFTA countries signed a *Memorandum of Cooperation on Sharing Short Sea Shipping Information and Experience between the Transportation Authorities of Canada, Mexico and the United States of America*. The objective was to collaborate on examining the future potential of this transport option to all land transportation. Looking to Europe, North Americans were impressed by the ability of Europeans to develop modally integrated options to get trucks off congested roads and onto more environmentally friendly short sea operations.

Depending on the location, the development of short sea shipping in North America may or may not be hindered by cabotage regulation. Large parts of the current market – the Gulf of Mexico, Great Lakes, East Coast or West Coast routes – operate under foreign flag. Unlike Europe's examination of a European flag, a NAFTA flag option has not been examined critically. Enthusiasm for future changes to the marine cabotage regime is checked by Mexico's clear indication at the North American Marine Conference in Vancouver in April 2006 that cabotage rules must be retained to afford Mexican nationals the opportunity to rebuild their small domestic fleet for short sea purposes. As US labour has long been clear that the Jones Act is sacrosanct, changing Canada's *Coasting Trade Act* unilaterally costs Canada without reciprocal gain.

Brooks and Frost (2004) identified a number of impediments to the development of short sea shipping between Canada and the US; these include the Harbor Maintenance Tax on shallow draft vessels, advance notification rules that were designed for transoceanic moves applicable to short sea operations, Canadian Customs charges at new operations, and the maintenance of severely restrictive cabotage rules. Brooks, Hodgson and Frost (2006: iii) concluded, as a result of a detailed examination of the current policy environment, that the government should give some consideration to fixing these through regulatory convergence. Of particular interest, Brooks, Hodgson and Frost (2006: 63) found that:

> *under the current national shipping policy regime, the commercial benefits flowing from the provision of short sea service, beyond those accruing to the shippers and ports, would only likely be of modest benefit to Canada. At the same time, the shift of cargo off the land routes would presumably negatively impact land-based Canadian transportation service providers, be they truckers or rail services. Thus, unless there is some change in Canadian shipping policy, a successful transition to a short sea shipping service, for a given level of cargo transportation demand, is likely to result in a net loss of business to Canadian transportation service providers.*

In other words, the key beneficiary of a successful short sea service would be car drivers on congested US highways, at the expense of Canadian trucking companies.

Another irony of the existing situation is the effect of the US Harbor Maintenance Tax:

> *[The tax] may be viewed as working, at least theoretically, in Canada's favour since, by unloading US-bound cargo in Canadian ports and moving it overland, the tax is avoided, thus making Canadian ports attractive in relation to their US counterparts. ... However, it serves to stimulate rather than discourage a shift to the use of land modes, and therefore works at variance with the thrust of the arguments for encouraging short sea shipping* (Brooks, Hodgson and Frost (2006: 71).

Moreover, the primary purpose of the tax is to fund dredging activities, but most short sea services use shallower draft vessels in ports not requiring dredging. A rethink of the tax in the context of not just US domestic shipping, as is currently happening with discussion of HR 3319[3], but in a NAFTA-wide context would increase the probability of adoption of short sea as a trans-border congestion mitigation solution.

The US Government Accountability Office (2005) recognized the serious congestion problem the US faces in handling future freight requirements and yet, in spite of its recognition of this problem, the agency did not look beyond its borders and think continentally. The GAO report defines short sea as a domestic mode. It is further evidence that continental perspectives are not first and foremost in the mindset of the country that dominates the North American free trade relationship.

4. CONCLUSIONS

As should be clear from this paper, sometimes the countries in the NAFTA region make decisions trilaterally, sometimes bilaterally, but usually domestically. The supranational institutions are weak, lack sufficient autonomy and are under-funded or just not there. The mindset of most politicians in the region still seems to reflect a protectionist self-interest that fails to see the benefits of larger economic integration and trade facilitation for the region as a whole. In spite of this, the region is strongly integrated, particularly in some sectors like energy and auto production.

> *Canada depends more on the (mainly US) regional market than Belgium and Luxembourg depend on the European market. ... [It] is unlikely that* NAFTA *will evolve in the near future towards more than what it currently is, a free trade area* (Coiteux, 2004: 189).

One could add to this quote: "and a transport market that is relatively protected in spite of the NAFTA."

For Canada, trade facilitation is its principal interest in the Canada-US and Canada-Mexico relationships. For the US, security is the national priority and trade is clearly second. Mexico, meanwhile, seeks to bring the informal economy into its formal economy, improving transparency and living standards. As a result of this, the NAFTA partners need to make any changes a "win" for Mexico in order for it to be a win for all. Both Canada and Mexico need to see transportation liberalization and investment in transportation services infrastructure as an important component of their plans for participation in future growth in the North American economic region.

Making changes to the NAFTA will be just about impossible from a political perspective. Congress is not in favour of opening up the agreement and progress on implementing the original deal has stalled. Furthermore, the failure of the dispute resolution to resolve either the Canada-US softwood lumber dispute (ultimately resorting to a negotiated settlement), or the Mexican trucking access issue, call into doubt the willingness of the US to abide by the institution that so many thought would secure the region from political interference and provide stability to the relationship.

That does not mean that there is no potential for further development in the transport field. In spite of the failure of the LTSS to make progress in the post-9/11 period, there has been the formation of the Trans-Border Working Group to grapple with issues of infrastructure inventory and border management. It is disappointing that this approach has meant two bilateral institutions rather than one trilateral arrangement.

In 2005, the three governments signed the Security and Prosperity Partnership of North America (2005). This document sets out a plan of actions, committed to by the three government leaders, to push for further developments within the NAFTA free trade area. There is little action planned in the area of maritime transport, except as it relates to maritime security. On the maritime side, though, the *Memorandum of Cooperation* does provide a limited institution through which maritime issues can be addressed, albeit only as a sharing of experience. The three governments recommitted to this in April of 2006 when they signed a Declaration in Vancouver at the North American Marine Conference to form a steering committee to facilitate the aims of the MOC and further specify areas of cooperation.

As solving infrastructure problems unilaterally does little to address border bottlenecks, there is a strong need for bi-national, if not trilateral, solutions to border infrastructure issues. While the Trans-Border Working Group is not as strong an institution as is needed to be effective, it is at least a start. The Working Group, the Security and Prosperity Partnership, and the conclusion of a new air bilateral are all signs that the neighbours are talking over the fence, although the conversation includes no mention of reopening the NAFTA agreement itself as a way to make progress. Now that Canada has elected a more right-leaning federal government, the Canada-US relationship has improved. All North Americans are now waiting to see what happens in the July 2nd Mexican elections before transport discussions are likely to gain any traction. As far as trade in transportation services is concerned, North America still has a long way to go to be considered a free trade area.

NOTES

1. The NAFTA promised complete access to international cargo by trucking companies of all three countries within NAFTA by 1 January 2000 in a three-phase process; in December 1995, the Mexican Government stopped action on investment liberalization when the Clinton administration failed to deliver the first phase of Mexican trucking access to the US market. President Bush campaigned in 2000 on honouring the NAFTA obligations, and he has not fulfilled his promise. On 7 February 2001, the NAFTA Arbitration Panel issued a final ruling that removed barriers preventing Mexican trucks from operating in the US; because of failure to develop the implementing regime, access remains closed to the Mexican trucking industry.

2. The right to provide transportation services freely within the region was a key tenet (para. 108) of Europe's Common Transport Policy.

3. In 2005, Congressman David Weldon introduced a bill, the Short Sea Shipping Tax Exemption Act of 2005 (H.R. 3319) to waive the tax for containers and trailers between US mainland ports. As of June 2006, it sits with the House Committee on Ways and Means, to which it was referred after introduction.

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State-owned Enterprises: A Challenge to Regional Integration

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SUMMARY

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1. ASEAN IN A NUTSHELL

The Association of Southeast Asian Nations (ASEAN) was established in 1967 by five member countries — Indonesia, Malaysia, the Philippines, Singapore and Thailand. It is one of the most successful regional groupings among developing countries to date. The Association was later joined by five more countries, namely Brunei (1984), Vietnam (1995) Lao PDR and Myanmar (1997) and Cambodia (1999). In 2005, the region hosts a combined population of 580 million, making it the most populous emerging market regional trade area. Its GDP totalled US$2.53 trillion, roughly 4.5% of World GDP, while its exports, at US$500 billion, contributed to 6% of global exports[1].

ASEAN has made great efforts in liberalizing trade within the region under the ASEAN Free Trade Agreement (AFTA). In January 2003, tariffs between member countries were reduced to 0-5% for all products, except a few on the general exception and sensitive list of each member country[2]. Intra-regional trade now stands at roughly a quarter of the region's total international trade. The region has also been forging closer economic ties with the rest of Asia. It has signed an FTA with China and South Korea and is working on one with Japan and India.

Unlike trade, however, regional liberalization in the service sector, including transport, has not been as forthcoming. This is because most member countries still hold a very much protectionist stance when it comes to the service sector. Stephenson and Nikomborirak (2002)[3] found that member countries' commitments in the AFAS (ASEAN Free Trade Agreement in Services) are marginally better than those made in the GATS, reflecting lack of willingness to liberalize regional services trade. Why are ASEAN members so averse to regional liberalization of their service sector?

Anecdotal evidence suggests that less developed member countries are often reluctant to open up their domestic service markets to more economically advanced member countries. This may be the case because key service sectors - i.e. financial services, transportation, telecommunications, utilities, etc. - require large fixed investments and a global network that naturally places multinational companies at a clear comparative advantage over domestic providers. Hence, foreign competition would be prohibited to preserve local providers. Even for the least developed economies, which are starved of much needed funding for infrastructural development, selective joint ventures rather than broad market liberalization are the preferred means of mobilizing foreign capital and expertise. From a mercantile point of view this equates a country's welfare to that of domestic service providers rather than consumers; liberalization will lead to a very much skewed distribution of benefits in favour of more developed countries and thus is not desirable. It is then no surprise that service sector negotiation in ASEAN, where there is a marked discrepancy in the level of economic development among member countries, has not achieved much success thus far.

The development gap is indeed glaring. In the year 2005, the GDP per capita of the most economically advanced member state, Singapore, was estimated to be US$28 100 (PPP), while that of the least advanced nation, Myanmar, was US$1 700, as can be seen in Table 1. The gap in transport services is just as conspicuous. Singapore stands out as the member with the most advanced transport sector, with by far the largest number of both commercial maritime and aviation fleets. The gap between older members and new members, i.e. Lao PDR, Cambodia, Myanmar and Vietnam, even excluding Singapore, remains overwhelming.

Table 1. **Basic Indicators for ASEAN Economies and their International Transportation Services**

Country	**(1) Population (million)**	**(2) GDP (PPP) US$ billion**	**(3) GDP per capita (PPP)**	**(4) Maritime Fleet (no. of container vessels)**	**(5) Aviation Fleet (No. of aircraft)**
Brunei	379 444 *(July 2006 est.)*	6.842 *(2003 est.)*	23 600 *(2003 est.)*	0	10 *(2001)*
Cambodia	13 881 427 *(July 2006 est.)*	30.65 *(2005 est.)*	2 200 *(2005 est.)*	12 *(2005)*	n/a
Indonesia	245 452 739 *(July 2006 est.)*	865.6 *(2005 est.)*	3 600 *(2005 est.)*	41 *(2005)*	n/a
Laos (landlocked)	6 368 481 *(July 2006 est.)*	12.13 *(2005 est.)*	1 900 *(2005 est.)*	0	n/a
Malaysia	24 385 858 *(July 2006 est.)*	290.2 *(2005 est.)*	12 100 *(2005 est.)*	45 *(2005)*	101 *(2001)*
Myanmar	47 382 633 *(July 2006 est.)*	78.74 *(2005 est.)*	1 700 *(2005 est.)*	0	n/a
Philippines	89 468 677 *(July 2006 est.)*	451.3 *(2005 est.)*	5 100 *(2005 est.)*	7 *(2005)*	35 *(2001)*
Singapore	4 492 150 *(July 2006 est.)*	124.3 *(2005 est.)*	28 100 *(2005 est.)*	196 *(2005)*	111 *(2001)*
Thailand	64 631 595 *(July 2006 est.)*	560.7 *(2005 est.)*	8 300 *(2005 est.)*	20 *(2005)*	81 *(2001)*
Vietnam	84 402 966 *(July 2006 est.)*	232.2 *(2005 est.)*	2 800 *(2005 est.)*	4 *(2005)*	n/a
Total	580 845 970	2 652.662	92 400	325	328

Sources: (1) – (4) *The World Factbook,* CIA.

(5) *Statistical Yearbook 2004*, UNESCAP.

For example, a regional open-sky would likely benefit more developed member countries with major regional airlines and an extensive global network, such as Singapore Airlines, Malaysian Airlines and Thai Airways. On the other hand, liberalization of the haulage industry would likely benefit less developed member countries with lower wage rates, such as Lao PDR, Cambodia and Vietnam, threatening higher cost operators in neighbouring countries such as Thailand and Malaysia. Presently, imports of goods from Lao PDR into Thailand are required to reload onto Thai trucks at the border to be transported to Bangkok. Laotian trucks cannot operate beyond the border province of Thailand. This story echoes that found in the NAFTA, where to date the United States have not yet opened up its borders to Mexican haulage companies since the agreement was signed in 1994.

The development gap drove service sector liberalization agreements to the sub-regional level, as members with comparable levels of development are more willing to liberalize among themselves. For example, goods from or in transit through Vietnam to Laos and *vice versa* can be transported by vehicles of either country[4]. Cambodia, Lao PDR, Myanmar and Vietnam (CLMV countries), the new members of ASEAN, decided to have an air service agreement just among themselves. Singapore, Brunei and Thailand, on the other hand, signed an agreement that opened up their air cargo industries in 2004.

The lack of progress in AFAS thus far has frustrated certain members who advocate a more liberalized transport industry. Singapore and Malaysia both signed open-skies agreements with the United States. Singapore also signed such agreements with Australia and Sri Lanka. Other ASEAN countries such as Thailand are also negotiating a free trade agreement with the US with the hope of obtaining preferential market access for their manufactured trade in exchange for service-sector liberalization. Such cross-sector bargaining is not available in AFAS given the relatively small size of intra-ASEAN trade.

Lack of competitiveness is the often quoted reason for delaying liberalization, but in fact a casual glance at the market structure of the ASEAN transport industry would reveal a striking dominance of state enterprises in many transport service sub-sectors. The proliferation of state-owned enterprises is common among developing countries.

The author of this paper believes state-owned enterprises to be the greatest challenge to regional liberalization and integration in transportation in the ASEAN region. This is because, from an economic viewpoint, such enterprises do not operate on a commercial basis, which can easily distort competition in the market. Moreover, they are often endowed with various privileges - such as subsidies, guaranteed loans and captive state procurement markets - that are likely to further disrupt the level playing field.

From a political viewpoint, state enterprises are a major and secured source of revenue for the government in countries where the tax base is narrow and corporate and personal income tax collection is inefficient. Monopoly rents generated from state operation in key services such as transport, telecommunications and energy can be substantial, not to mention the state enterprises' role as political machinery for certain governments.

In view of these shortcomings of public enterprises, privatization would appear to be a pre-requisite for regional integration in transport. If privatization is too ambitious a goal and too sensitive an issue politically, then clear rules and regulations would need to be established to ensure that state enterprises and foreign investors could compete on an equal footing in a liberalized regional market. Unfortunately, ASEAN countries have not made visible progress on the privatization front. Certain attempts to privatize state-owned airlines in the Philippines and Malaysia failed miserably. In Thailand, the privatization of the Airport Authority of Thailand was relatively successful. But in most transport service segments, state enterprises continue to wield market power with impunity due to restriction to market entry and lack of rules and laws governing fair competition. Indeed, this does not bode well for the prospect of regional liberalization and integration in transport.

The remainder of this paper consists of three sections. The second section provides an overview of the role of state enterprises in the ASEAN transport sector and spells out key competition concerns that may arise from state operation. The third section examines the extent and nature of these concerns in the context of ASEAN countries. The fourth section assesses the adequacy of laws and regulations that may address such problems. The final section provides policy recommendations concerning key policies that member countries need to agree upon and steps that each country will have to take in order to ensure effective competition in a liberalized regional transport market.

2. THE ROLE OF STATE-OWNED ENTERPRISES IN ASEAN TRANSPORT SECTOR AND RELATED COMPETITION CONCERNS

State-owned enterprises still represent a substantial part of GDP, employment and investment in many ASEAN countries, in particular in the utilities and infrastructure industries such as transportation, telecommunications, water utilities and energy. The role of state enterprises is even more prominent in very small and least developed member states such as Myanmar, Lao PDR and Cambodia.

Many transport sub-sectors in ASEAN are still dominated by state enterprises in both the operation of transport services and infrastructure, as can be seen in Tables 2 and 3 below.

Table 2 reveals that, bar Philippines Airlines, all ASEAN international carriers are majority owned by the government. Malaysia's past attempt to privatize MAS failed miserably such that the airline had to be nationalized and re-privatized after the government had injected substantial equity into the airline. The other two main regional airlines, namely, Thai Airways and Singapore Airlines, are partially privatized in that private investors are allowed to hold a minority share in the airlines, securing state control over the public enterprise.

In shipping, only some larger ASEAN countries promote national liner shipping services, namely Malaysia, Thailand and Singapore. These countries joined the bandwagon in the late sixties when developing countries established national shipping lines in fear of the growing dependence on powerful western shipping lines which colluded to maintain high freight rates. However, as national shipping lines proved uneconomical and too costly to maintain, many developing countries decided to relinquish state ownership in maritime services. Against the global trend in privatization of state-owned shipping lines since the late eighties, ASEAN governments continue to hold on tight to their ownership in national shipping companies. As a result, most major airlines and shipping lines in ASEAN countries have remained mostly state-owned until today.

The Philippines' case is somewhat different. Initially the State was not involved in the shipping business but had had to nationalize the failing private shipping company.

All transport infrastructures are owned by the government, but some are managed by private contractor. All major international airports in original ASEAN-5 countries are operated by the state of public enterprise. The Bangkok International Airport is the only one where the state-owned enterprise operating the airport, the Airports of Thailand PCL, has been partly privatized and listed in the Thai stock market. New terminals and expansion of airports more recently have been contracted off to private concessionaires. The Philippines had contracted out the third terminal to a private company, but had had to nationalize the project after the company's failure to complete the airport on time.

Table 2. **National Airlines and Shipping Companies**

Country	**State Owned Enterprise**	
	International Aviation	**International Shipping ****
Brunei	• Royal Brunei Airlines – 100% owned	No national shipping line
Indonesia	• Garuda Indonesia – 100%	No national shipping line
Malaysia	• Malaysian Airlines – 69.34%	• Malaysian International Shipping Corporation – 62.4% held by state-enterprise Petronas and 13% by state investment and retirement funds.
The Philippines	• Philippines Airlines (PAL) – privately owned	• Galleon Shipping – 100% state-owned
Singapore	• Singapore Airlines – 56.76%	• Neptune Orient Line – 100% state-owned
Cambodia	• Royal Khmer Airlines – joint venture between the Government of Cambodia and a Singaporean Company.	No national shipping line
Lao PDR	• Lao Airlines - 100 % state-owned	No national shipping line
Myanmar	• Myanmar Airways International - (joint venture between the Government of Cambodia and a Singaporean Company)	No national shipping line
Vietnam	• Vietnam Airlines – 100%	No national shipping line
Brunei	• Royal Brunei Airlines – 100%	No national shipping line
Thailand	• Thai Airways International – 54.2%	• Thai Maritime Navigation Co Ltd. – 100% state-owned

Source: * Mahani Zainal-Abidin *et al.* (2005), ASEAN Aviation in a Globalized World: Ownership Rules and Investment Issues, Report prepared for the ASEAN Secretariat. Final Report (edited). Available at www.aadcp-repsf.org/docs/04-008-FinalOwnership.pdf
** own data collection from various sources.

Unlike airports, seaports in ASEAN countries are a mixed-bag of various forms of state-private partnership. Different seaports in the same country may be owned and operated differently: some are built and managed by the state, others by the private sector as can be seen in Table 3.

Table 3. **State-owned Airports and Seaports**

Country	**State Owned Enterprise**			
	Airport	**Ownership share**	**Seaport**	**Ownership share**
Indonesia	Soeharto-Hatta International Airport	100% invested and operated by the Government of Indonesia	Tanjung-Priok (Jakarta) Tanjung-Perak	1) Owned by the State and managed under long-term lease by state-owned PT Pelindo II) Owned by the State and managed under long-term lease by state-owned PT Pelabuhan III (second terminal will be constructed and operated by private company)
Malaysia	Kuala Lumpur International Airport (KLIA)	100% invested and operated by the Government of Malaysia	1) Port Klang 2) Penang 3) Jahore	1) State ownership, private management) State owned, operated by state enterprise, Penang Port Sdn Berhad 3) Owned by the State and managed under long-term lease by private company
The Philippines	Ninoy Acquino	100% invested and operated by the Government of the Philippines.	1) Manila 2) Betangas	1) State ownership, private management) State owned and operated by the Ports Authority of the Philippines.
Singapore	Changhi Airport	100% invested by the Singaporean Government and operated by the Civil Aviation Authority of Singapore (CAA)	Singapore/Jahore	100% invested by the Singaporean Government and operated by the Port of Singapore Authority
Thailand	1) Bangkok International Airport 2) New Bangkok International Airport (Suwannapoum Airport)	Airports of Thailand PCL, which operates both airports, is 70% owned by the State.	1) Bangkok 2) Laem Chabang	1) Owned and operated by the Ports Authority of Thailand) Private ports

Source: Own data collection.

The fact that a large portion of the region's transportation sector remains in the hands of state enterprises do not bode well for a prospective regional transport integration for several reasons.

First, state-owned enterprises face multiple objectives and thus, do not necessarily operate on a commercial basis. State owned enterprises may pursue not only commercial, but also political or social objectives such as employment creation or universal access to low cost services. Sappington and Sidak (2003) demonstrates — by means of mathematical proofs — that state-owned enterprises (SOE) that are concerned less about maximizing profit and more about maximizing revenue[5] than private enterprises, have stronger incentives to pursue activities that disadvantage competitors. These include pricing below costs, misstating cost and choosing inefficient technologies to circumvent restrictions on predatory pricing — i.e., technologies that require large fixed cost and small variable costs. It should be noted that the conventional "predatory pricing" test that give importance to the likelihood that the alleged violator would raise prices after the exit of competitor is not applicable to state enterprises whose objective is not to maximize profit at any point of time.

Second, *state-owned enterprises often receive state subsidies in order to pursue social service objectives*. Since traditionally, government uses state enterprises to provide public services, subsidies are an integral part of a state enterprise operation and existence. But in the absence of a clear separation between the enterprise's commercial activities from social services and a detailed cost allocation scheme, it becomes difficult to determine whether the enterprise is over-compensated for the delivery of social services. To make things more complicated, subsidies may come in different forms such as direct operational subsidy, interest-free loans, loan guarantees or tax exemptions. The author notes that the issue of state subsidies is not exclusive to state enterprises, but the problem would tend to become more complicated when the enterprise is state-owned and performs social functions.

Third, when required state subsidies are not forthcoming, state-owned enterprises are often compelled to resort to cross-subsidization in order to raise funds to finance their social service obligations. Cross-subsidization requires a SOEs to generate "monopoly rents" from a market to.

Cross-subsidization is the most common source of financing for service obligations in least developed countries where financial allocation from the general budget is not market so that rents generated from the particular market can be used to subsidize social service obligations. This may give rise to competition problems if the latter is a competitive one. Cross-subsidization may lead effectively to predatory pricing in the "non-reserve" market, posing a barrier to entry. At the same time, cross subsidization requires the maintenance of state monopoly in the "reserve" market and prohibition of competition that would compete away the much needed rents. Cross-subsidization can be detrimental to competition and therefore, incompatible with a liberalized market.

Fourth, state-owned enterprises are often endowed with certain "privileges" that private competitors do not enjoy. Again, these privileges are justified on the basis that public enterprises perform social functions and hence, need to be compensated. Such privileges may include captive state procurement market, exclusive rights to provide certain services, or even exemptions from certain state laws or regulations.

Fifth, the incumbent state enterprise — privatized or not — is likely to inherit a dominant position in the market from its monopoly days. Market liberalization in many cases is not preceded by a well-planned market restructuring that would help curb the market power of the incumbent. New competitors are thus likely to face abuse of dominance practices as the incumbent would undoubtedly defend its market share. Where competition and regulatory rules are effective, investors may expect prompt protection from the competition authority. Unfortunately, regulatory and competition regimes in markets dominated by state enterprises are likely to be relatively undeveloped as will be discussed later.

Sixth, *many state-owned enterprises perform regulatory functions that lead to conflicts of interest*. That state-owned enterprises perform both regulatory functions is not uncommon in newly deregulated or partially privatized markets in developing countries. This is because of the legacy of state monopoly days where sector-specific technical experts congregated in public enterprises. When state enterprises are both player and arbitrator, the establishment of fair competition is unattainable.

For example, the state enterprise may hold the authority to determine tariffs or fees, set technical standards and specify the terms and conditions for third-party access to a public network. These enterprises normally derive their regulatory power from laws that were enacted way back when the enterprises were the sole service provider in the market such that conflict-of-interest problems do not arise in the absence of competing suppliers in the market. SOEs regulatory power may also be secured through concession contracts[6]. It is often the case that, even when the enterprise is partially privatized and the market open to private competition, such regulatory power remains in the hands of the incumbent.

To conclude, the presence of state-owned enterprises can pose a plethora of competition problems that pose major hurdles to any liberalization plans. All key problems mentioned above would need to be properly and thoroughly addressed preceding any ambitious move towards a integrated regional transport market. It is of utmost important to recognize that regional transport policy is not formed in isolation. Rather, it is intricately intertwined with member country's philosophy, approaches and policy towards state enterprises' policy and its competition and regulatory regimes.

The next section will examine these SOEs-related competition concerns in the context of ASEAN member countries in order to assess the amount of preparatory work that would be required to facilitate an eventual establishment of regional transport market.

3. SOES-RELATED COMPETITION PROBLEMS IN THE TRANSPORT SECTOR IN ASEAN

This section examines the nature of competition problems associated with state-owned enterprises operating in the transport sector in the ASEAN region in order to assess the domestic institutional, legal and policy work that would be required to facilitate the realization of an effective regional integration in transport services.

3.1. State subsidies

In the WTO, trade in goods has protection against subsidies in the GATT, but trade in services do not enjoy the same protection under the GATS, unless the service concerned is linked to an exported good. However, work is currently underway to collect information on types of service subsidies implemented in member countries so as to be able to categorize subsidies into those that are prohibited, not-prohibited but subject to retaliation, or allowed; similar to the agreement on countervailing duties in the GATT.

In the absence of a multilateral discipline on service subsidies, most regional and bilateral trade agreements, too, do not include subsidies in the cross-border services chapter, be they NAFTA or US free trade agreements (FTAs) with Singapore and Chile signed in 2003. This implies that foreign versus domestic, or state versus private, service providers in the same market may not be competing on a level playing field where state subsidy is present.

ASEAN countries have had their share of state subsidies in the aviation industry. The Philippines airline (PAL), Indonesia's Garuda and Malaysian airlines (MAS) all have received large bailouts from the state in the past. In 1998, the Indonesian government provided the national airline with a US$ 100 million loan guarantee and extended US$ 400 million worth of equity loans. In 2002, the government wiped out most of MAS' 2.4 billion debt after an unsuccessful privatization that led to renationalization of the national flag carrier. While the Philippines government had provided the privately-owned national flag carrier with a sleuth of subsidies including guarantees of all loans, debt write offs, exclusive use of government owned and controlled airport, non payment of take off and landing fees, and tax exemptions on all inputs and other operating expenses.

Indeed, airlines on the brink of bankruptcy worldwide also receive support from the state, including those in the United States and the EU. But where there is free competition across borders, the issue becomes more sensitive as subsidies can put a national flag carrier ahead of that of the other state. Hence, rules are required to ensure that state aid do not lead to distortions in competition. For example, the European Commission (EC) adopted a common guideline on state aid in the aviation sector. Aid for restructuring is allowed, but not so for operation. It recommended that the aid should be:

- a one-off measure;
- linked to a restructuring plan, to be assessed and monitored by independent professionals appointed by the Commission;
- should not be used to buy new capacities;

and that the State needs to:

- refrain from interfering in commercial decision-making by the airline;
- ensure that the interests of other carriers are adversely affected.

Aldaba (2005) found that in the case of the Philippines, the dispensed state aid did not comply with the EC guideline. Specifically, the debt write-off was undertaken in the absence of any conditionality with regard to firm restructuring such as capacity reduction, or future debt redemption. As a result, management was able to expend the cash at its own discretion. Moreover, the exclusive use of the new airport and the reduction in take off and landing fee are clearly discriminatory and constitute a continual operational subsidy rather than a one-time restructuring subsidy.
Many other transport services provided by state enterprises in ASEAN are also subject to state aid, in particular rail and public mass transportation.

The development of a domestic shipping industry is also central to the maritime policy in ASEAN countries, bar Brunei, Cambodia and Lao PDR, which is landlocked. Consequently, many ASEAN countries provide subsidies relating to the construction and/or purchase of vessels, tax concessions for using domestically owned vessels and preferential tax treatment for Seamen. The Philippines government offered preferential mortgage loans for financing construction, acquisition or initial operation of vessels. Similarly, in 1979 Malaysia set up an Industrial Development Bank (IDB) to provide low interest loans to ship-owners, ship-builders and ship-repairers. In Singapore, ship-owners, regardless of nationality, have access to low-cost financing for the purchase of new vessels from Singapore shipyards that matched rates offered by other Asian countries. The scheme was designed to promote the development of Singapore shipyard, rather than the expansion of Singaporean fleet.

In addition to subsidized financing, ASEAN states also provide an extensive list of tax privileges to various individuals and entities involved with maritime transport as can be seen in table 4. Thailand, Singapore and Malaysia are most heavy users of such incentives. All three countries exempt corporate income tax for liner shipping companies in the national registry. Crews who work on ships flying the national flag and providing international services are also exempted from personal income tax in these countries. In Singapore and Malaysia, dividends disbursed by liner shipping companies are also tax exempt. A flurry of other tax incentives are also available as can be seen in the table.

State-owned transport infrastructure, in particular airports and seaports, where there is a mix of private and state owned ones, pose a contentious issue for future regional integration. As seen from table 3 earlier, many ASEAN airports and seaports remain state-owned and managed. In terms of the transport infrastructure, most airports and seaports are still owned and operated by state authorities or state owned enterprises. In Thailand, the Airport Authority of Thailand (AAT), which operates 5 international airports in Thailand, including the New Bangkok International Airport (NBIA) that is due to be opened by the end of 2006, is a public company listed in the stock exchange of Thailand. Concerns have already been raised that since the AAT needs to operate on a commercial basis, the airport fees charged on a cost-recovery basis will likely be high compared with the rates quoted by competing state-owned airports in the neighboring countries.

To briefly conclude, in the absence of rules and guidelines governing state subsidies, ASEAN countries are likely to encounter competition problems in the liberalization of its transport industry, in particular the aviation and maritime segments, where state aid proliferates as each member country competes to promote own industry's interests. Hence, a regional agreement to open up the transport industry will need to accompanied by preparatory work on laying rules and regulations governing state aid. Perhaps, coordination and cooperation in containing the size or scope of competing subsidies catered to these services to prop national providers ahead of others can better serve to save member states' money and ultimately, benefit their economies as a whole.

Table 4. **Tax exemptions offered to registered liner shipping companies in the ASEAN 5**

	Import tax	Corporate income tax	Personal income tax	Other tax
Thailand	*Exempt import duty from the Thai Board of Investment Promotion (BOI).* *Exempt import tax for ship up to 1,000 gross tons.*	Exempt for 8 years	Exempt for crews who work in a Thai ship that operates internationally. Facilitate speedier value-added tax refund	Exempt tax on ship leasing Exempt income tax on proceeds from used ships Exempt income tax on income put aside for planned purchase of a ship
Singapore	Exempt	Exempt	Exempt tax on dividends from shares in liner shipping companies registered in Singapore. Exempt income tax for crews who work on a Singaporean ship that operates internationally on condition that most work is outside Singapore.	Exempt tax on the value added of a ship when it is sold. Exempt tax on ship rentals if ships are leased from domestic company, with a special rate if ship is leased from overseas. Exempt tax on freight for a company based in Singapore.
Malaysia	Exempt	Exempt	Exempt tax on dividend from holding shares in liner shipping company registered in Malaysia. Exempt for crews who work in a Malaysian ship that operates internationally	Exempt VAT when ship is sold. Exempt tax on ship rentals if ships are leased from domestic company Exempt tax on freight for a company based in Malaysia. Allow accelerated depreciation. Of 60 per cent in the first year and 40 per cent for the second year.
Indonesia	Exempt customs tax and commercial tax for machines and tools imported from other countries.	None	Exempt for crews who work in an Indonesian ship with special rate between 47.88 and 191.52 US$/year depending on responsibility and number of family member	n.a.
Philippines	Exempt import duty for BOI member. Exempt duty and import tax for machines and tools used in ship maintenance in a dock registered with Maritime Industry Authority.	None	Exempt for crews with special rate of 5–10 per cent of revenue	n.a.

Source: Nikomborirak, Deunden (2005), “The Shipping Industry ”, in: Erlinda Medalla (ed.), *Competition Policy in East Asia*, Routledge Publications, New York, pp. 170-185.

3.2. Cross subsidies

As mentioned earlier, cross subsidy constitutes the most convenient — albeit non-transparent — source of financing for social service provisions in developing countries. It is convenient because the government needs not commit financial resource out of its budget, which is a boon for governments facing financial constraints. That is, as long as the operator, often state-owned, is financially viable, the state needs not be bothered about the size of the subsidy. Such a scheme is opaque however, as the reasonable size of subsidy required to fulfil the public service obligation is never estimated, and the actual cost of the subsidy is rarely made explicit.

The presence of cross subsidization has two competition implications. First, the new private entrant that may emerge out of a liberalized market may face predatory pricing as a result of, or in disguise of, cross subsidization undertaken by the incumbent. Second, competition in the market traditionally "reserved market" for the state enterprise may erode monopoly rents that used to fund social services. For example, the owner of PAL claimed that the airline's massive loss was a result of President Ramos' decision to open up many international routes to foreign carriers. Singapore airlines was even granted the fifth freedom right to pick up passengers in Manila on the way to Seoul and Osaka. It claimed that these foreign carriers did not have to service unprofitable domestic routes[7]. As a result, all loss-making routes were eventually abandoned. Similarly, inter-city bus service providers in Malaysia complained that as a result of many new licenses issued by the state authority, it was not able to sustain the provision of services on subsidized routes. (Lee 2004).

In order to ensure fair competition, an overhaul of the member country's subsidy regimes in the transport industry will be necessary. Opaque cross subsidy regimes would have to be replaced by a more transparent subsidy scheme that require (1) clear definition of a public service obligation for which the state enterprises is responsible; (2) availability of cost data that allow efficient cost allocation across different services, in particular social services and commercial services and (3) transparent calculation of required subsidy. In the absence of the mentioned preparatory work, SOEs can easy manipulate numbers to ensure over-subsidization.

Phasing out the existing cross-subsidy schemes in transportation is likely to be a herculean task as state-owned enterprises in the region are unaccustomed to allocating costs to different services that they provide. Worse, in most cases it is not even clear what constitutes a "social service" as written "public service contracts" of the kind found common in more developed economies are rare. Usually, all loss-making services are conveniently defined as social services without a thorough examination of the cost and benefit of providing and maintaining these services.

3.3. State-owned enterprises' "privileges"

Besides financial subsidies or monopoly rights that would guarantee rents to be used for cross subsidization, state-owned enterprises are often also endowed with other privileges that serve to lower the cost of their operation, such as loans guarantee and the use of government land and property, or those that enhance their commercial opportunities justified by their public service obligations.

For example, it is common for an SOE to be granted exclusivity to commercially exploit rights to provide cross-border services secured by the government. Thai Airways is entitled to provide services on all international routes that Thailand had negotiated for under the bilateral air transport agreement with other countries. Similarly, as part of the 1993 agreement on transportation of goods in transit between Lao PDR and Thailand on, the Thai Government Authorized five carriers to undertake the transport of goods through Thailand to Lao PDR. Two of the five companies were the Express Transport Organization and State Railway of Thailand, the state road haulage and railway companies[8].

State-owned enterprises may also be exempted from certain laws and regulations or subject to a different set of rules and regulations governing their private competitors. For example, the competition law in Thailand provides a blanket exemption for state enterprises defines as all enterprises where the state holds a direct majority equity share. Fortunately, competition laws in Indonesia, Vietnam and Singapore do not provide such an exemption. In Vietnam, a state port operator is subject to the Law of State Enterprises, while private operators are subject to the Law of Enterprises.[9]

For example, all government cargoes must be transported by the state-owned shipping company, the Thai Maritime Navigation Company Ltd, unless the freight offered by an alternative shipping company is lower by more than 10%. Such privileges foreclose effective competition from the private sector. It should be noted that such privileges can hardly be justified if the enterprise were privately owned. For these reasons, the Singapore-US bilateral free trade agreement contains a provision that prohibits "devolved[10]" state enterprises from carrying special privileges that other private competitors do not enjoy.

3.4. State-owned enterprises' abuse of market dominance

The only recorded formal competition case involving an abuse of dominance in transport involving a state enterprise is the case of air transport in Indonesia. In 2003, the KPPU, the competition authority in Indonesia, found Garuda, the national airline, in breach of the national competition law by requiring travel agents to use only Abacus reservation system to reserve its tickets. The authority ordered Garuda to terminate exclusive agreement with Abacus and to withdraw the mandatory requirement for travel agents to use Abacus to reserve its tickets[11].

More recently, low cost airlines (LCCs) in Singapore has complained against alleged "predatory pricing" by the state incumbent, Singapore Airlines (SIA), as the latter slashed prices for tickets on route to Bangkok and Hong Kong. Elsewhere, LCCs have voiced their concerns about predatory pricing by the incumbent that threatened their survival. In the absence of an effective enforcement of a competition law, investigation into these alleged abuse of dominance cases will be unlikely and effective competition will be impeded.

3.5. State-owned enterprise regulatory authority

The sectoral regulatory regime in most ASEAN countries remain relatively undeveloped as will be discussed in the next section. Since regulatory failure in developing countries tend to be higher in developing countries due mainly to lack of information and skilled personnel on the side of the regulatory body, most governments choose to delegate regulatory authority to the state owned enterprises that - as an operator - possess both technical and commercial information and the skilled personnel required to form regulatory rules and policies.

Such a regulatory regime may be preferred when competition in the market is absent. But the lack of separation between regulatory and operational task may give rise to conflicts of interest that may impede effective competition in the market.

For example, the partially privatized Airport of Thailand (AoT) has recently been accused of favouring its affiliated companies, the Thai Airport Ground Service (TAGS) in which it holds a 28.5 per cent equity share, in granting a 10-year concession to manage the 40,000 square meter free zone logistics centre (FLC) at the New Bangkok International Airport. This case goes to show that a state-owned enterprise may abuse its regulatory power to further the interest of itself or of affiliated companies, and in effect, foreclose competition from other unaffiliated companies[12].

3.6. Conclusion

Competition concerns associated with state-enterprises that were raised in section 2 are most relevant to transport sector in the ASEAN region. This is because SOEs in most member countries operate simultaneously in both competitive and commercial market and reserved non-commercial service markets, without clear operational and accounting separation. As a result, it is possible that subsidies and privileges that were granted for the purpose of public service delivery were used to further the commercial interests and competitive edge of the state enterprises over private investors. It is thus imperative that ASEAN member countries overhaul their subsidy policy and rules as well as regulatory rules governing state owned enterprises. At the same time, competition rules will also be required to ensure a fair competition among different players, be they state or private, foreign or domestic. The following section will examine the state of ASEAN competition and regulatory regimes.

4. COMPETITION AND TRANSPORT REGULATORY REGIMES IN ASEAN

As mentioned earlier, markets that have traditionally been dominated by state enterprises are likely to have a relatively undeveloped regulatory regime. This is because the state is not accustomed to regulating private companies whose business information is protected by law. Longstanding reliance on state-owned enterprise non-proprietary business data and technical information for the purpose of regulation rendered state authorities particularly weak when it comes to dealing with private businesses.

In ASEAN, the authority to regulate often rests with a ministerial body that oversees both policy and regulation. Independent and specialized regulatory body is an exception rather than the norm in ASEAN. And, as mentioned earlier, in some case, state-owned enterprises are vested with the regulatory power, either *de jure* or *de facto*.

For example, regulation of air transport in ASEAN mostly rests within the purview of a ministerial authority such as the Department of Air Transport in case of Thailand, the Civil Aviation Authority of Singapore, the Department of Civil Aviation in Cambodia, Myanmar and Brunei, the Ministry of Transport in case of Malaysia and the Civil Aviation Administration of Vietnam. The Philippines is the only country that has a full-fledged regulatory authority known as the Civil Aeronautics Board as can be seen in Table 5 below.

Table 5. **Regulation of the Air Transport Industry in ASEAN**

Country	Air Transport Regulatory Body	Sea Transport Regulatory Body	Competition law and authority
Brunei	Department of Civil Aviation	Marine Department	No competition law
Cambodia	Department of Civil Aviation	Merchant Marine Department	No competition law
Indonesia	Directorate General of Air Transport	Directorate General of Sea Communication	Competition law available
Lao PDR	Lao Transport Authority	Lao Transport Authority	Decree on Competition (effective August 2004)
Malaysia	Ministry of Transport	Ministry of Transport	No competition law
Myanmar	Department of Civil Aviation	Department of Marine Administration	No competition law
Philippines	Civil Aeronautics Board (independent)	Maritime Industry Authority (MARINA), *independent regulatory body	Article 186 of the Revised Penal Code, Civil Code RA 386, RA 186 (Act to prohibit Monopolies and Combination in Restraint
Singapore	Civil Aviation Authority of Singapore	Maritime and Port Authority of Singapore	Competition law available
Thailand	Department of Air Transport	Department of Sea Transport	Competition law available (but a block exemption is provided for state-owned enterprises and major provisions are not yet enforceable)
Vietnam	Civil Aviation Administration	Vietnam National Maritime Bureau	Competition law available

Source: Data collected by author.

With respect to competition rules, only four ASEAN countries have a full-fledged competition law that contains all major substantive provisions regarding restrictive practices, namely abuse of dominance, collusive practices and mergers. These are by the order of when the law became effective, Thailand (1999), Indonesia (2000), Singapore (52005) and Vietnam (2006). Thailand has a law only on paper. Its implementation has been obstructed by persistent lobbying by big businesses and political intervention. Singapore's law was passed in late 2004 and became effective only at the beginning of 2005. Indonesia is the only country that has produced a few competition cases since 2000. The Philippines relies on the penal and civil codes to deal with anti-competitive practices. Work is under way to draft a competition law. Lao PDR has a Decree on Competition that came into effect on August 2004. While the Decree contains sections addressing issues of monopolies, collusive practices and mergers, the provisions are extremely brief such that it is unclear how the law will be implemented. The remaining ASEAN countries do not yet have a competition law.

It should be noted, however, that even when a competition law is present, one cannot be assured that fair competition will prevail in transport market. First, one should note that actual enforcement may deviate markedly from the letters of the law. In many ASEAN countries, different SOEs come under the purview of different line ministries. For example, the state electricity-generating enterprise may reside within the Ministry of Energy, while the national airline under the Ministry of Transport. The competition authority often comes under the purview of the Ministry of Commerce. Application of a competition law on SOEs may be a subject of inter-ministry turf war, in particular in a coalition government when ministerial portfolios are allocated to different parties. Thus, in practice, it would be difficult to apply competition law to state enterprises.

Second, the government may provide exemptions to protect the interests of state owned enterprises (as in the case of Thailand) or domestic industry. Recently, the Singapore National Shippers Council and Asian Shippers' Council have voiced their concerns about the proposed block exemption order for liner shipping by the Competition Commission of Singapore[13]. This is not surprising given that Singapore is a shipping hub with a large registry of international liner operators, including a state-owned operator, Neptune Orient Line. This is likely to be a sore point for future discussions on regional integration in maritime transport.

To conclude, regulatory and competition regimes in many ASEAN countries are ill-prepared to safeguard fair and effective competition in the market, both legally and institutionally. Dealing with competition issues, in particular those relating to pricing can be extremely complex, both conceptually and practically. Determining costs of a private company, in particular a multinational one, will be much more difficult than that of a state-owned enterprise where the government has free access to all cost figures.

5. CONCLUSION

With the predominance of state enterprises in the ASEAN's regional transport industry landscape, ASEAN countries need to be cautious about opening up their domestic transport markets to regional investors. Much preparatory work is required to ensure that liberalization will bring forth a fair and effective competition in the market that will benefit their economies as a whole. ASEAN governments need to undertake the following major tasks before launching an ambitious goal of establishing a regional transport market:

- Develop a regional Code of Conduct for State-owned Enterprise to ensure a more transparent operation of state enterprises. On this note, the OECD Guidelines on Corporate Governance of State-owned Enterprises can be helpful as a starting point.

- Establish a general subsidy rule for services trade and if need be, specific ones for transport service sectors.

- Establish rules regarding the devolution of state enterprises with respect to preferential treatment and regulatory power to ensure a level playing field between public and private enterprises operating in the same or related markets.

At the same time, each member country needs to undertake own internal reform to ensure compliance to the above regional commitments:

- Reform SOEs accounting system to ensure that costs are properly allocated for each service provided by the enterprise. Sappington and Sidak (2003) shows that an SOE that values revenue will have stronger incentives than a profit-maximizing firm to understate marginal cost of production in order to relax a binding prohibition against pricing below cost. The same study also demonstrates that to dodge pricing regulations, SOEs are also more readily to adopt excessively capital-intensive technology to lower marginal or variable costs, while raising fixed costs. Hence, regulatory burden is much more complex in the presence of state-owned enterprise.

- Overhaul existing subsidy schemes to detangle the complex web of *ad hoc* subsidies and to establish a transparent scheme that will guarantee efficient and fair allocation of state aid among different players in the market and; any cross-subsidization between monopoly and competitive markets must be eliminated. Once cross-subsidy schemes are eliminated, state-owned enterprises are then no longer necessary and should therefore, be eliminated as well.

- Undertake market restructuring before market opening in case where the SOE holds a dominant market share or maintain a vertically integrated structure that may foreclose competition in related markets. The more contestable a market is, the less regulatory burden will fall on the nascent regulatory or competition authority.

- Establish a comprehensive transport regulatory agency staffed with skilled personnel in the field. Price regulation of all modes of transport need to be revised. The agency will also need to develop clear rules before making market-opening commitments, particularly in bilateral free trade agreements that provide for private-state arbitration. Non-transparent and unclear regulatory rules can be easily accused of being discriminatory or inconsistent with the minimum standard of treatment required by customary law. Hence, a host country government may face endless series of expensive lawsuits if it is ill-prepared for the complexities of international competition.

- Develop a common competition rules to ensure against unfair competition undertaken by dominant state-owned enterprises and to ensure that individual member countries do not provide exemptions to protect the interest of own state enterprise or industry at the expense of other members' interests.

In the absence of these parallel agreements and reforms, it would unlikely that ASEAN states, especially smaller and less developed ones, to open up their domestic transport markets to other members' state enterprises.

While the overhauling of subsidy regimes and state enterprises' regulation and operation appears to be overwhelming, it should be noted that a bilateral trade agreement with the United States already imposed most of the mentioned conditionality on partner country's state enterprises. Given that Singapore already has a bilateral trade agreement with the US, and Thailand and Malaysia are negotiating one, it is likely that these agreements will help move ASEAN closer to a regional transport integration.

NOTES

1. CIA (2005), World Fact Book 2005.

2. The dates for new members are as follows: 2006 for Vietnam, 2008 for Laos and Myanmar, and 2010 for Cambodia.

3. Stephenson, Sherry and Deunden Nikomborirak (2002), Regional Liberalization in Services, in *Services Trade Liberalisation and Facilitation*, edited by Sherry Stephenson and Soonhwa Yi, Asia Pacific Press at Australian National University.

4. Although the administrative procedures for the releasing of transit goods can be cumbersome.

5. A proxy for employment and scale of service.

6. For example, the state-owned Bus Company Ltd. in Thailand derives its authority to set service and safety standards and regulate inter-provincial bus schedules from the terms and conditions stipulated in the concessions (or franchise) it hands out to private operators. Since private operators are not allowed to operate the reserved routes, given the SOEs exclusivity, they have no choice but to submit to the terms and conditions stipulated in the contracts.

7. Aldama (2005).

8. UNCTAD (2001).

9. Investconsult Group (2004), Studies on the Competitiveness and Impact of Services Trade Liberalization in Vietnam: Maritime Transport Services (draft), commissioned by the UNDP.

10. A state enterprise is considered to be "devolved" either when it becomes corporatised or when it competes in the market with another private service provider.

11. The Asia Pacific Anti-trust Review 2004. Available at www.globalcompetitionreview.com/apar/indo_overview.cfm

12. *The Nation*, Suvarnabhumi: Mystery Firm Gets Airport Windfall, 20/12/2005.

13. OEC News Bulletin, Singapore's Block Exemption Order Opposed by Asian Shipper Groups, 25/5/2006.

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Impact of cross-border road infrastructure on trade and investment in the Greater Mekong Sub-region

by

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SUMMARY

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ABSTRACT

This paper investigates the impact of cross-border road infrastructure on trade and foreign direct investments in the Greater Mekong Sub-region (GMS) using panel data obtained for the six economies involved. Available data suggests that the development of cross-border road infrastructure in the GMS has had a positive effect on intra-regional trade in major commodities, with the average elasticity of over 0.4, which is distinct from the effect of domestic road infrastructure. Cross-border road infrastructure is also found to have a complementary role to domestic road infrastructure in promoting aggregate intra-GMS trade. However, sample size constraints made it impossible to carry out comprehensive analyses on the precise nature of trade-FDI nexus in GMS.

1. INTRODUCTION

This paper investigates the impact of cross-border transport infrastructure on the economies of the Greater Mekong Sub-region (GMS).[1] Cross-border and domestic transport infrastructure together can reduce trade costs and lead directly to increased trade. Reduced trade costs can also raise indirectly foreign direct investment (FDI) mainly through intra-firm vertical integration across borders that exploits the comparative advantages of each location. Such increases in FDI in turn can further increase regional trade, adding to the direct effect of trade expansion. This defines a virtuous circle of cross-border infrastructure development, trade and investment, and eventually economic growth. This paper seeks to quantify trade creation and investment facilitation effects of cross-border infrastructure in the GMS. The motivation and more detailed background of this research are discussed in Fujimura (2004).

2. RELEVANT LITERATURE

Broadly two strands of literature motivated this paper. First, the economic geography literature that has flourished since 1990s makes increasingly clear the importance of geography in explaining patterns of trade and economic development. For example, access to sea and distance to major markets have been shown to have a strong impact on shipping costs, which in turn, strongly influence manufactured exports and ultimately economic growth (e.g. Limao and Venables, 2001). Countries suffering multiple geographical handicaps such as landlocked status, an absence of navigable rivers and lakes, or tropical or desert ecology, tend to be among the poorest in the world (e.g. Radelet and Sachs, 1998, and Redding and Venables, 2004). These papers have documented a strong negative empirical relationship between transport costs and economic growth controlling for the other variables that would be expected to influence growth. In the context of GMS, the relative poverty of Lao PDR has long been understood as at least a partial result of the country's landlocked status. Empirical evidence in this literature suggests there is much potential for cross-border road infrastructure and associated institutional arrangements to benefit economies that are not endowed with geographic characteristics favourable to economic development.

Second, the "new" trade literature that incorporates the presence of imperfect competition in standard trade theory derives interesting policy implications for prompting trade and growth that are not predicted in the standard neoclassical trade models. For example, Markusen and Venables (2000) find that the presence of transaction/trade costs and increasing returns to scale in production may create incentives for production agglomeration in particular markets. On the other hand, papers in this literature have also found that multinational firms can gain from intra-firm trade by integrating production processes located in different countries with varied comparative advantage, which reduces the tendencies towards production agglomeration. If the advantages of production integration across different countries outweigh those from agglomeration, then, reductions in transport costs would make FDI complementary to trade. The literature on this "trade-FDI nexus" shares an understanding that one of the common threads in the economic successes of the "East Asian Miracle" has been the trade openness of these economies, and a virtuous circle of increased trade, economic growth, and FDI in export-oriented manufacturing industries based on comparative advantage.[2] GMS economies have the potential to benefit from regional economic integration and the trade-FDI nexus induced by improved cross-border infrastructure.

3. RESEARCH QUESTIONS

Our interest extends to a number of empirical questions considered to be of importance in the context of ongoing road infrastructure development in the GMS. Most important among them are the following:

- What are the empirical relationships between measures of cross-border road infrastructure, trade, and FDI between GMS countries historically?
- Can additional reductions in trade costs and increases in trade flows associated with development in cross-border road infrastructure be found, and if found, how large are these effects?
- Do reductions in trade costs lead to increased FDI and to what extent can trade creation be attributed to increased FDI flows?

4. ANALYTICAL APPROACH AND ESTIMATION MODELS

Our analytical approach is adapted from that applied in Limao and Venables (2001) and applies a gravity model to predict bilateral trade and FDI flows by each pair of GMS members. However, departing from Limao and Venables (2001), we had to omit estimation of an explicit transport cost equation which could not be estimated for the case of overland transport of goods within the GMS due to data limitations. Therefore we estimate trade and FDI equations, as set out below, with road infrastructure being one of the key explanatory variables. Also, departing from the empirical literature on trade-FDI nexus, data limitations prevented us from estimating indirect impacts that come through trade and FDI.[3] Estimation parameters of our particular interest are the responses of trade and FDI to various transport cost factors including cross-border road infrastructure.[4] (See the Appendix for the detailed data explanation of key variables.) Accordingly, our empirical analysis centres on the following two functional relationships:

1. Trade equation: $X_{ij} = X(\boldsymbol{Y}_i, \boldsymbol{Y}_j, \boldsymbol{R}_i, \boldsymbol{R}_j, F_{ij}, \varphi_{ij})$

- X_{ij} : exports of country *i* to country *j* via land.
- $\boldsymbol{Y}_i$, $\boldsymbol{Y}_j$: vector of fixed or predetermined characteristics of country *i (j)* related to trade such as distance, economy size (GDP), population, land area, road infrastructure (country-wide), and similar variables routinely used in gravity model estimates.
- F_{ij} : country *i*'s foreign direct investment from country *j*.
- $\boldsymbol{R}_i$, $\boldsymbol{R}_j$: vector of variables measuring border area and non-border domestic infrastructure of country *i* (*j*).
- φ_{ij} : other factors not accounted for (model error).

The trade equation incorporates standard variables used in gravity models plus variables of our particular interest in this research (i.e., measure of cross-border and domestic road infrastructure, and FDI from the trading partners). Other factors seen as important in driving levels of bilateral trade, which are elements in vectors $\boldsymbol{Y}_i$ and $\boldsymbol{Y}_j$, are tariff rates, inflation rates, and a broad characterization of the export/import environment in the countries. Country GDP is considered a key variable in the base gravity model, and larger economies are expected to engage in greater trade. Trade is viewed as being positively affected by the economic mass of the trading partners and negatively affected by the distance between them. Other factors act against the 'gravity like' forces of economy size. Geographic area and population size are factors expected to reduce trade orientation by increasing the size of the domestic market and making economic activity more inwardly oriented. Additional variables, such as indicators of cultural affinity and sharing contiguous borders are usually added to empirical gravity models.

A principal aim in our analysis is to quantify "incremental effect" of cross-border (border-area) road infrastructure on trade relative to the effect of domestic (non-border area) road infrastructure. Trade is envisioned to be a function of both the quality of road infrastructure generally in each country and of road infrastructure in border areas in particular. Both road indicators are seen as being relevant to determining trade flows. In the next subsection of the paper we discuss our expectations regarding the signs of estimation coefficients, while further details concerning the definition, measurement, and sources of data used are left to the notes on Table 1 and the Appendix. While reliable information on overland transport costs is unavailable for GMS countries as mentioned above, examination of overland trade flows can provide some insight into changing overland transport costs in the GMS.

2. FDI equation: $F_{ij} = F(\boldsymbol{Y}_i, \boldsymbol{Y}_j, \boldsymbol{z}_i, \boldsymbol{R}_i, \boldsymbol{R}_j, X_{ij}, \epsilon_{ij})$

- F_{ij} : country i's foreign direct investment received from country j
- $\boldsymbol{Y_i}$, $\boldsymbol{Y_j}$: vector of characteristics of country i and j (same as in trade equation)
- $\boldsymbol{z_i}$: vector of characteristics related to country i's investment climate
- $\boldsymbol{R}_i$, $\boldsymbol{R}_j$: vector of variables measuring border area and non-border domestic road infrastructure of country i (j).
- X_{ij} : exports of country i to country j via land
- ϵ_{ij} : other factors not accounted for (model error).

The FDI equation specifies capital flows as being determined by several factors that also appear in the trade equation (e.g. economy size and resources, inflation rate, tariff rates). Of our particular interest is again the relative contribution of cross-border and domestic road infrastructure. In addition, FDI is viewed as being influenced by the volume of trade and the FDI and trade environment in the FDI-recipient country.

4.1. Dataset and estimation procedures

Our dataset is formed from a cross-sectional time-series data available for GMS member economies for the period of 1981-2003. Observations in the dataset are defined at the country-pair level over time. In all, 30 country pairs can be formed across the 6 GMS member countries (i.e., Cambodia-Lao PDR, Cambodia-Myanmar,…, Yunnan (China)-Thailand, Yunnan (China)-Viet Nam). Descriptive statistics from the dataset along with details on the data sources and definitions of variables are summarized in Table 1. Because the resulting dataset captures the value of variables for the country-pair over time, Table 1 presents the number of observations of each variable and country-pair over time (years). Nonetheless, due to the small number of GMS countries and relatively short time period for which most data are available, our analysis faced challenges in model estimates. Data at the start of our panel is available for only a few GMS countries due to long conflicts in the 1970s and the resulting poor statistical capacity in some countries.

The estimation procedure applied to estimate the coefficients is the random effects estimation approach that includes a generalized covariance matrix to characterize the distribution of residuals as in the Generalized Least Squares (GLS) regression model. Coefficient estimates reflect a weighted average of the cross-sectional and time-series association between the dependent and independent variables included, and the weighting is defined by the estimation parameter theta—which is reported in Tables 3 and 4. The overall statistical significance of the estimation models is tested using a Wald Chi-square test, which indicates the probability of a false rejection of the null hypotheses that the model has no explanatory power over the dependent variable. The need for the random effects estimator as opposed to treating the cross-sectional time-series data simply as a cross-section and applying regular GLS is tested through a Breusch-Pagan Lagrange Multiplier test.[5] The statistical significance of estimation parameters is tested using a test that is functionally equivalent to a standard t-test applied in Ordinary Least Squares (OLS) and GLS regressions. We took natural logarithm for all variables before running regressions so that estimation coefficients can be interpreted as elasticities of the dependent variable with respect to explanatory variables.

We also estimated our models for single years of data using standard GLS estimation. However, cross-sectional estimates using single years of our data offer a clearly inferior estimation approach as they do not take advantage of the panel data's capacity to trace the impact of changes in cross-border road infrastructure over time. In addition, cross-sectional estimates face severe sample size constraints. Nonetheless, they can provide insight into the evolution of the relationship between our dependent and explanatory variables over time.

4.2. Estimation results

The trade equation was estimated using two alternative definitions of trade: one based on major exports transported via land or river, and the other based on total bilateral trade as reported in the IMF *Direction of Trade Statistics* database. While our preferred estimation procedure is the random effects estimator for panel data, as mentioned above, we also estimated trade and FDI equations using single years of data on country pairs to gain additional insight in how the cross-sectional variation in our estimation models evolved over time.

Table 2 presents results of estimates of the value of major exports between GMS countries. Up to five commodities (defined at the 4 digit level in the UN Harmonized System of Product Categories) per country pair were selected and summed to generate this measure of trade. The selection of products relied on available (admittedly sketchy) information from customs data for these countries that details or suggests the commodities and goods that are most likely to be transported by road and ferry—where bridges are not available across rivers. Use of disaggregate commodity-specific trade data is preferred to aggregate trade data because a larger variety of factors besides cross-border road infrastructure are expected to influence aggregate trade. However, the downside of using the 'major exports' is data scarcity and unavoidable subjectivity in the selection of major commodities/goods due to unreliability of customs data at overland points of entry.

The five models presented in Table 2 report overall goodness of fit with estimated R^2 measures ranging between 35.6 percent (Model 1) and 76.2 percent (Model 5). They are also highly statistically significant as indicated by the results of the Wald Chi-square test. Models 1 and 2 were estimated from cross sectional time series data using the random effects approach, and yield coefficient estimates for the basic variables of the gravity model (i.e. GDP, population, and area) that accord with our expectations and with the results generally obtained in gravity model estimates.[6] A notable exception to the consistency of our results with previous estimates is the non-significant effect that distance is estimated to have on major export flows. This suggests that the distance between capitals may be a poor indicator of the relevant distance in determining overland trade flows between GMS countries, which is understandable since overland trade tends to focus on markets besides the capital city (e.g., regional markets closer to border areas). Unfortunately, limitations in the number of observations available in our dataset when additional variables of interest (e.g., measure of the state of cross-border and domestic road infrastructure, and FDI and tariff measures) are included in the model prevented us from applying the random effects approach to estimate the relationship between the level of major exports and an extended list of the right-hand-side variables.

Model 2 includes the cross-border infrastructure variables but only the GDP variable from the base variables of the gravity model. Although not detailed in the table, the variation in trade levels observed for pairs of GMS countries was explained largely by changes in the level of trade between countries over time (as opposed to cross-sectional variation across country-pairs).[7] A key finding from our estimation Model 2 is that intra-GMS trade via land in major commodities has an elasticity of between 0.42 and 0.46 with respect to cross-border road infrastructure on both sides of the border; which implies that a doubling of the density of roads in border provinces or regions would be expected to induce an average increase in trade in major exports of over 40 percent across the GMS countries. However, when we add a variable measuring domestic road infrastructure to our random effects panel estimates, the statistical significance of cross-border road infrastructure no longer holds, although both variables maintain their positive coefficients. The overall conclusion we reach from estimates for Models 1 and 2 is that trade in major commodities within the GMS is positively influenced by the level of cross-border infrastructure, and that such trade flows are largely driven by economic size of the countries involved and to a lesser but still significant extent by cross-border road infrastructure.

In order to overcome sample size limitations in using the GLS random effects approach for panel data, we reverted to a simpler Ordinary Least Squares (OLS) regression in Models 3, 4 and 5.[8] In these models we find that cross-border road infrastructure has an even larger positive and statistically significant association with trade in major exports than that found in our panel estimate (Model 2). Domestic road infrastructure is found to have a negative and statistically significant effect on trade in major exports. If we were to interpret this result, it would mean that domestic road infrastructure—when separated from roads in frontier areas—mainly promotes the integration of domestic markets within GMS countries and diverts economic activities away from trade in major commodities across GMS countries. Another interpretation is that domestic road infrastructure in GMS complements other infrastructure necessary for ocean-bound trade but not land-bound trade. However, additional information and study is required to assess the validity of this interpretation with confidence. Another coefficient estimate worth noting is the positive and statistically significant effect that importer tariff rates are found to have on major exports, which runs counter to expectations.

Table 3 presents estimation results on total exports between GMS countries. Because of the greater number of observations than in the models in Table 2, we were able to estimate all these models using the preferred random effects panel estimator. Use of this estimator is supported by the highly statistically significant results of the Wald Chi-square tests and the results of the Breusch-Pagan Lagrange Multiplier tests. The six variants (Models 6 through 11) reported in Table 3 have results that are largely consistent with our expectations and published gravity model results (e.g., negative association between distance and export levels, and the positive association between economic size and export levels). As in earlier studies, the association between population and total exports is generally negative, although in the majority of cases the association is not statistically significant. An unexpected result is the positive association between geographic size and export levels, which is opposite of the result in Table 2. This may have resulted due to the gross disparities in geographic sizes relative to our small sample size, in which China's exports to GMS partners via sea has grown fast and may have dominated the relation between geographic size and export levels.

The strong explanatory power of Model 6 estimates, which includes only the base variables of the gravity model, and the consistency of the coefficient estimates for the base variables across all six models reported in Table 3, together suggest that the gravity model approach provides a strong basis upon which we can judge the marginal effect of additional variables on the level of trade. Of our particular interest in Table 3 are the coefficient estimates for cross-border and domestic roads, indicators of trade policy and trade environment, and FDI inflows. Cross-border road infrastructure has a positive but not statistically significant effect on total exports in Model 8, and have a positive and statistically significant effect on total exports in Model 9—which also includes a measure of domestic road infrastructure that also has a positive and statistically significant association with total exports. This provides some limited evidence that cross-border roads favourably influence total exports, although the relationship is clearly weaker than was the case for selected major exports via land. Model 9 also indicates that cross-border and domestic road infrastructure play a complementary role to each other with respect to enhancing aggregate exports among GMS countries, which is contrary to the result we reported in Table 2 in terms of selected major exports via land. This may have resulted because aggregate exports among GMS which include those via sea would be promoted by the development of road infrastructure not only in land-border areas but also in coastal areas.

Models 7 and 10 in Table 3 show that the average tariff rate has a negative association with total exports, although the association is statistically significant only for the exporting country (while one would typically expect the importing economy's tariffs to have a greater effect on bilateral trade). This result may be obtained either because tariff barriers are the lesser obstacles to trade than quantitative restrictions and other non-tariff barriers, or because the weighted average tariff rates automatically include all kinds of exemptions as well as "missed" collections by customs authorities, and therefore, understate official tariff rates. FDI inflows has no statistically significant association with exports. However, we find a positive association between FDI inflows and imports (not reported), suggesting that FDI flows induce further exports from FDI-sending to FDI-receiving economies. This result is consistent with greater flows of raw materials and intermediate inputs needed to run foreign invested operation, anecdotally supported as one outcome of FDI, but may also reflect a loosening of budgets constraints in the face of increased FDI inflows that enable greater imports. Lastly, relative real prices across the trading economies—measured by the ratio of the purchasing power parity conversion factor and the official exchange rate—has strong effects on exports with the expected signs.

Table 4 presents estimation results on FDI inflows. Most of the coefficients show expected signs with statistical significance: e.g., positive association with economic size of the receiving (importer) country; negative association with population size of the exporter country (the larger the economy, the less impetus to invest abroad); and positive association with FDI environment. Both models are statistically significant overall and explained 60 and 81 percent of the variation in FDI, respectively. The finding that the larger the GDP (and land area) of FDI importer, the higher the level of FDI might reflect a China effect. In model 2, FDI inflow is associated positively with the cross-border road infrastructure of the receiving (importer) country as expected. But its negative association with cross-border road infrastructure of the sending (exporter) country seems counter-intuitive except attributing this irregularity to relatively poor quality of FDI data in GMS. Next, FDI inflow is positively and significantly associated with the domestic road infrastructure of the sending country but negatively with that of the receiving country. This might suggest that FDI tends to flow from richer to poorer countries within the GMS and that richer countries tend to have more developed road infrastructures. Overall it is difficult to draw very clear interpretations on the association between FDI inflow and cross-border road infrastructure.

Tables 5 and 6 summarize estimation results on total exports and FDI inflows, respectively, in individual years. Our main motive for these was to investigate stability and trend over time of the relationship between trade/FDI variables and standard RHS variables in a gravity model. In Table 5, the associations of exports with distance, economic size, and land area are fairly stable and consistent with the results in Table 3. However, the association with population size is unstable over time, which has been found in previous gravity model studies and in this instance may particularly reflect the massive changes in China's economic relationship with the other GMS countries over time. One interesting result in Table 6 is the positive and fairly stable association between distance and FDI inflows. This may suggest that market-seeking FDI motivated to close the distance is dominant between GMS members as opposed to production-integration-oriented FDI which would be associated negatively with distance. This interpretation is consistent with FDI's positive and stable association with economic size of the receiving (importer) economy.

5. CONCLUSIONS

This paper investigated the impact of cross-border road infrastructure on trade and FDI flows in the GMS. The theoretical underpinnings of the research drew from recent research in the new economic geography and new trade literatures, while the paper's estimation approach built on a basic gravity model framework. The paper examined two empirical relationships between cross-border road development and trade/FDI flows in the context of GMS economies during the past two decades. Our main interest was in the incremental effect of cross-border infrastructure on trade and FDI in addition to the general effect of domestic road infrastructure. The study used detailed data on trade flows across GMS countries and measures of road infrastructure and trade policy indicators that were collected for the study (discussed in Appendix). The following are some notable findings.

(i) The average elasticity of trade in major exports likely to be transported by road between GMS economies with respect to developments in cross-border road infrastructure is estimated to be over 0.4. This positive effect is identified for infrastructure development on both the exports and importer sides of the borders.

(ii) The association between total exports and the cross-border road infrastructure is positive but does not show statistical significance with coherence, but it does however show coherence in terms of complementary role of cross-border and domestic road infrastructure in promoting trade between GMS economies.

(iii) Formal trade barriers represented by weighted average tariff rates and trade environments do not appear to influence trade flows significantly. This may suggest a relatively greater impact of unmeasured non-tariff barriers or that the weighted average tariff rates derived understate official or actual tariff rates.

(iv) Economic size seems to be the dominant drivers of both trade and FDI, while cross-border road infrastructure has some identifiable influence on trade levels.

We conclude that available data suggests the development of cross-border road infrastructure in the GMS has had a positive effect on intra-regional trade that is distinct from and most likely complementary to the effect of domestic road infrastructure in general. This is understandable if one considers the role of domestic roads in linking domestic markets to major seaports, which in turn, connect regional economies to the global economy. In this light, cross-border road infrastructure becomes an important part of a broader effort to encourage regional integration to benefit GMS member economies that are relatively less endowed with natural seaports such as Lao PDR.

Nonetheless, sample size constraints associated both with the relatively small number of countries in the GMS and with missing data problems in several GMS countries represented serious challenges in carrying out otherwise more comprehensive regression exercises. In particular it was not possible for us to explore simultaneous estimation of trade and FDI equations due to sample size limitations. Therefore, we could not say much with confidence on trade-FDI nexus in the context of GMS.

The modelling framework and empirical estimates presented in this paper provide a useful beginning in efforts to estimate some of the key empirical relationships between road infrastructure development, trade, and FDI in the context of the economies of the GMS. With more reliable and coherent data that would hopefully become available as statistical capacities of GMS governments improve, more comprehensive and definitive evidence may be possible. Given the current data situation, however, extensions of this research could focus principally on considering applied simulation models to generate quantitative estimates of the aggregate economic impact of increases in trade attributable to cross-border road infrastructure development.

Potentially more interesting and policy-oriented extension from this paper would be a case-specific estimation or simulation of benefit-cost incidence of a certain cross-border road development. Notwithstanding the aggregate benefits expected from the development of cross-border infrastructure, the incidence of benefits and costs of such investments are unlikely to accrue equitably across involved countries. This is particularly likely in GMS where the countries involved are disparate in economic size and in their level of economic development. For example, the North-South Economic Corridor that links Kunming (Yunnan Province of China) and Chiang Rai (Thailand) through northern Lao PDR is on the one hand expected to bring greater economic benefits to Thailand and Yunnan Province through enhanced trade between these two large economies. On the other hand, many of the environmental and social externalities associated with the road's construction and operation (e.g., greater difficulty of travel while the road is under construction, encroachment on fragile forests and indigenous communities, risks of vehicle collisions to people and animals living along the road, and increased transmission of disease associated with anticipated increase in transit visitors), will likely be borne by stakeholders in Lao PDR. Detailed accounting of benefits and costs of cross-border infrastructure projects would help in the design and implementation of investments in this infrastructure so that a win-win outcome for all members involved can be obtained.[9]

NOTES

1. Members of GMS are Cambodia, Lao PDR, Myanmar, Thailand, Vietnam and two southern provinces of China: Yunnan and Guanxi. Guanxi Province joined GMS in 2005. Due to scarcity of detailed data documented (e.g., in Guanxi Statistical Yearbooks), particularly on transport infrastructure, empirical analyses in this paper excluded data for Guanxi Province.

2. Trade-FDI nexus in line with the argument here has been well researched in the context of East Asia's economic integration: e.g., Fukao, Ishido and Ito (2003) and Urata (2001).

3. Econometric estimation of a simultaneous system of equations (trade, FDI, cross-border infrastructure) was not feasible mainly due to the limited sample size available.

4. De (2005) applied a gravity model to Asian countries with transport infrastructure variables and transaction costs among the explanatory variables but did not attempt to distinguish cross-border and domestic transport infrastructure as such.

5. See Green (2003) for a technical treatment of the Random Effects estimator and the tests mentioned here.

6. For example, our estimation results are generally comparable to those reported in Frankel and Romer (1999), Soloaga and Winters (2001), Clarete *et al.* (2003), Rose (2004), and Yamarik and Ghosh (2005).

7. The time-series component of the estimate is assigned an 83.4 to 88.5 per cent weight in the final results reported.

8. However, use of the OLS estimator is not supported by our results from the Breusch-Pagan Lagrange Multiplier test as indicated by low numbers. General sensitivity tests of these models' coefficient estimates to changes in the right-hand-side variables also suggest that the results of models 3-5 are not robust. Therefore, caution is warranted in interpreting the results of Models 35.

9. A report by the authors in 2005 based on their field visit along the North-South Economic Corridor discusses possible distribution of the benefits and costs of the road project. A further research in this area by the authors is in progress as of this writing.

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APPENDIX: NOTES ON DATA FOR KEY VARIABLES

(1) Road infrastructure

Availability, level of details, and types of data on road infrastructure vary among GMS members, necessitating some procedure of making the data consistent and comparable across the GMS members. Therefore, our quantitative analysis used road density for GMS members where road inventory data are available and density of freight carriage for those where road inventory data are not available but administrative data on freights are available. For Cambodia, there are no geographically disaggregated data on road inventory. 1995 data provided by the Committee for Development of Cambodia (CDC) was the only disaggregated data by province made available to the authors. This information was extrapolated by the available aggregate road length figures for the subsequent years in calculating road density by province. For Lao PDR, data on road inventory and density by province were provided directly by the Department of Roads, Ministry of Communication, Transport, Post and Construction, upon the request of the authors. For Thailand, road inventory data from Department of Highways, Ministry of Transport are recorded by the route of national highways (NH1 through NH15) but does not provide the road length by province. Therefore, adjustment was made by the estimated provincial shares of road length of each highway based on the GIS-based "Road Inventory of ASEAN Highways" developed by UNESCAP in calculating road density by province. For Myanmar and Vietnam, there exist no official data on road length. Instead, various administrative data included in the transport section of the statistical yearbooks were combined to calculate the density of freight carriage by state/province. For Yunnan Province, road density by region was calculated from the road inventory data available in the transport section of the provincial statistical yearbooks.

Distinction between cross-border and domestic road infrastructure was made for each pair of GMS members based on the location of international crossing points as presented in Table A1. For example, Cambodia's cross-border and domestic road infrastructure with respect to Lao PDR is represented by road density of Stung Treng Province and that of all the other provinces (which do not share border with the other GMS members), respectively. Likewise, Lao PDR's cross-border and domestic road infrastructure with respect to Cambodia is represented by road density in Champassack Province and all the other provinces (which do not share border with the other GMS members), respectively. Where there is more than one province with shared borders with a neighbour country, the corresponding cross-border road infrastructure is represented by the average of the road density in such provinces. Likewise, domestic road infrastructure is represented by the average of the road density in the remaining provinces.

"Local border points" as opposed to "international cross-border points", as often referred to by public institutions in GMS, are the locations where there are border crossings with customs and immigration facilities that can be used only by local residents in the border area. While some of these borders might carry noticeable but unrecorded trade volumes, their traffic would mainly be limited to those immediate neighbouring provinces/states and therefore, limited economic impact on the sub-region as a whole. Because the focus of this paper is on the impact of road infrastructure on the entire GMS economies, it makes sense to focus on the international crossing points and leave out local border points. This treatment also seems to be a convenient way of making quantitative analysis consistent between the road infrastructure data and the officially recorded trade data that are the only available data in any reasonable time series.

Table A1: **International crossing points in GMS used in distinction between cross-border and domestic road infrastructure**

	GMS member A		**GMS member B**	
Borders between A/B	*Name of border city/town*	*Name of border province/state*	*Name of border city/town*	*Name of border province/state*
Cambodia/Lao PDR	Trapeangkreal	Stung Treng Province	Khinak	Champassack Province
Cambodia/Thai	Poipet	Bantreay Meanchey Province	Arayaprathet	Sa Kaeo Province
	Cham Yeam	Koh Kong Province	Hat Lek	Trat Province
Cambodia/Vietnam	Bavet	Xvay Rieng Province	Moc bai	Tay Ninh Province
Lao PDR/Thai	Huoayxay	Bokeo Province	Chiang Khong	Chiang Rai Province
	Thanaleng	Vientiane Municipality	Nong Khai	Nong Khai Province
	Thakhek	Khammouan Province	Nakhon Phanom	Nakhon Phanom Province
	Savannakhet	Savannakhet Province	Mukdahan	Mukdahan Province
Lao PDR/Vietnam	Nam Phao	Borikhamxay Province	Cau Treo	Ha Tinh Province
	Densavanh	Savannakhet Province	Lao Bao	Quang Tri Province
Lao PDR/Yunnan	Boten	Luangnamtha Province	Mengla	Xishuanbanna Region
Myanmar/Thai	Myawadi	Kayin State	Mae Sot	Tak Province
	Tachilek	Shan State	Mae Sai	Chiang Rai Province
Myanmar/Yunnan	Mongla	Shan State	Daluo	Xishuanbanna Region
	Muse	Shan State	Ruili	Baoshan Region
Vietnam/Yunnan	Lao Cai	Lao Cai Province	Hekou	Wenshan Region

Source: UNESCAP Asian Highway Database 2004; regional maps and atlas.

(2) Distance

Data on distance between each pair of GMS members were taken from Oldfield (2004) as summarized in Table A2.

Table A2: Distance between major markets in GMS

Distance between	*Major markets involved*	*km*
Cambodia - Lao PDR	Phnom Penh - Vientiane	753
Cambodia - Myanmar	Phonm Penh - Yangon	1101
Cambodia - Thailand	Phnom Penh - Bangkok	530
Cambodia - Vietnam	Phnom Penh - Ho Chi Minh City	217
Cambodia - Yunnan	Phnom Penh - Kunming	1519
Lao PDR - Myanmar	Vientiane - Yangon	695
Lao PDR - Thailand	Vientiane - Bangkok	521
Lao PDR - Vietnam	Vientiane - Hanoi	482
Lao PDR - Yunnan	Vientiane - Kunming	789
Myanmar - Thailand	Yangon - Bangkok	575
Myanmar - Vietnam	Yangon - Hanoi	1123
Myanmar - Yunnan	Yangon - Kunming	1142
Thailand - Vietnam	Bangkok - Ho Chi Minh City	754
Thailand - Yunnan	Bangkok - Kunming	1280
Vietnam - Yunnan	Hanoi - Kunming	555

(3) Export environment; import environment; and FDI environment

Table A3 summarizes the proxies selected for these variables and the value assigned to a dummy variable characterization of the business environment in each country (in parentheses).

Table A3: **Proxies for export, import and FDI environment**

	Export environment	Import environment	FDI environment
Selected Proxy	Average time spent on clearing export regulations (days)	Average time spent on clearing import regulations (days)	Overall ranking in "Doing Business
Cambodia	43 (1)	55 (1)	133 (0)
Lao PDR	66 (0)	78 (0)	147 (0)
Myanmar	n.a.(0)	n.a.(0)	n.a.(0)
Thailand	23 (1)	25 (1)	20 (1)
Vietnam	35 (1)	36 (1)	99 (1)
China	20 (1)	24 (1)	91 (1)

Source: World Bank, "Doing Business" database (2005).
Note: As the dataset does not include Myanmar, all three environments are assumed to be unfavorable and dummy value of 0 is assigned.

(4) Transport cost

Finding reliable and usable data on transport cost has proved difficult. Some attempt was made to look for directly observed transport costs by destination in GMS that may exist with shipping or logistics companies. However, the only available data relates mainly to sea transport and for a limited number of years and origin-destination. Part of the reason is that insurance is still difficult to obtain for long-distance land transport in the region due to various procedural and security uncertainties involved.

Use of proxy data for transport costs such as CIF/FOB ratios was considered but this also proved problematic. First, government authorities normally record export values in FOB and import values in CIF. The FOB value of imports recorded in balance of payment statistics is only available at the country-aggregate level, not by trading partners. The usual short-cut practice for recording FOB import in the balance of payment statistics seems to involve dividing CIF value by a certain assumed ratio such as 1.08 or 1.10. An alternative for finding FOB import value would be to use trade data of the exporting countries. But this does not appear to work for the GMS because there exist large discrepancies between the recorded values of exporter countries and those of corresponding importer countries. Even in international database such as IMF-DOTS (Direction of Trade Statistics), many missing or unreliable trade data for countries with weak statistical capacity such as Cambodia, Lao PDR, and Myanmar, data from the trading partners such as China and Thailand are substituted with adjustment of some assumed CIF/FOB factors.

A further attempt was made to collect CIF/FOB ratios for some representative goods being traded between each pair of GMS members using UNCOMTRADE database. However, very few time-series data by country pair are available other than Thailand-China pair. Even for Thailand-China series, the derived CIF/FOB ratios for major trade commodities do not look stable from year to year – presumably due to unreliable customs coverage – and proved unusable apparently.

Table 1: Descriptive statistics from the dataset used in estimates

Variable	Units	Number observations			Mean	Std. Dev.	Minimum	Maximum	Source(s) and notes
Country-pair identification code	n.a.	overall	N	690	353.5	170.6	102	605	
		between	n	30					
		within	T	23					
Year	n.a.	overall	N	690	1992	6.6	1981	2003	
		between	n	30					
		within	T	23					
Trade and tarde policies									
Country 1's exports to country 2	mil. current US$	overall	N	475	112.75	288.84	0.00	2853.60	1,2,3
		between	n	29					
		within	T-bar	16.4					
Major exports from country 1 to 2	mil. current US$	overall	N	171	74.71	125.43	0.04	845.01	4,5
		between	n	11					
		within	T	15.5					
Country 1's imports from country 2	mil. current US$	overall	N	442	116.59	261.21	0.00	2464.08	1,2,3
		between	n	27					
		within	T-bar	16.4					
Weighted average tariff rate	expressed in fraction	overall	N	525	0.158	0.174	0.023	1.050	6,7
		between	n	30					
		within	T-bar	17.5					
Export environment	dummy (0/1)	overall	N	690	0.6667	0.4717	0	1	8
		between	n	30					
		within	T	23					
Import environment	dummy (0/1)	overall	N	690	0.6667	0.4717	0	1	8
		between	n	30					
		within	T	23					
FDI and FDI policies									
Country 1's FDI inflow from country 2	mil. current US$	overall	N	231	7.0569	13.677	-9.020	97.39	9,10
		between	n	21					
		within	T-bar	11					
Outward FDI	mil. current US$	overall	N	375	6,550	13,300	0	47,200	11
		between	n	30					
		within	T-bar	12.5					
Net FDI inflow	mil current US$	overall	N	570	4,830	12,100	-1.6	53,500	11
		between	n	30					
		within	T	19					
FDI environment	dummy (0/1)	overall	N	690	0.5000	0.500	0	1	12
		between	n	30					
		within	T	23					
Gross FDI as % of GDP	%	overall	N	370	3.415	2.398	0.000	9.713	11
		between	n	25					
		within	T-bar	14.8					
Distance and roads									
Distance between country 1 and 2	kilometer	overall	N	690	802.4	344.4	217.0	1519.0	13,14,15
		between	n	30					
		within	T	23					
Country 1's road infrastructure in regions bordering country 2	km/km2 or ton-km/km2	overall	N	223	0.114	0.123	0.002	0.567	16,17
		between	n	19					
		within	T-bar	11.7					
Country 1's road infrastructure in interior regions	km/km2 or ton-km/km2	overall	N	370	0.813	1.247	0.007	4.047	16,17
		between	n	30					
		within	T-bar	12.3					
Country economic characteristics									
GDP	bil. current US$	overall	N	570	26.05	42.11	0.60	181.50	6,18
		between	n	30					
		within	T-bar	19					

Table 1: Descriptive statistics from the dataset used in estimates

Variable	Units	Number observations			Mean	Std. Dev.	Minimum	Maximum	Source(s) and notes
GDP deflator	%	overall	N	510	26.55	66.71	-4.04	411.04	11
		between	n	30					
		within	T-bar	17					
Current exchange rate	LCU per US$	overall	N	540	2505.39	4346.14	2.94	15509.58	11
	annual average	between	n	30					
		within	T-bar	18					
Consumer price index	%	overall	N	435	13.735	19.765	-1.710	128.419	11
		between	n	30					
		within	T-bar	14.5					
Total debt service	mil. current US$	overall	N	570	4,120	7,450	0	37,100	11
		between	n	30					
		within	T	19					
PPP conversion factor	ratio to	overall	N	415	0.273	0.117	0.099	0.795	11
	official exch.	between	n	25					
	exch. rate	within	T-bar	16.6					
Real interest rate	%	overall	N	440	2.641	11.589	-41.715	20.328	11
		between	n	30					
		within	T-bar	14.7					
Other country characteristics									
Total population	number (mil.)	overall	N	570	229.00	429.00	3.62	1290.00	11
		between	n	30					
		within	T	19					
Land area	square km (thou.)	overall	N	570	1,871	3,341	177	9,327	11
		between	n	30					
		within	T	19					
Arable land area	hectares (thou.)	overall	N	540	27,200	45,000	792	144,000	11
		between	n	30					
		within	T	18					

Notes: 1) IMF Direction of Trade Statistics (2005).

2) Yunnan statistical yearbooks (various years).

3) Approximate adjustments were made to exclude river- and sea-born trade and gas trade. Yunnan exports are specific to Yunnan Province.

4) UNCOMTRADE data from Statistics Canada's Trade Analayzer database (2005).

5) Up to 5 commodities (HS 4 digits) were selected relying on available information on border trades in the subregion.

6) ADB Key Indicators and statistical yearbooks of GMS members (various years).

7) WATR is calculated by dividing customs revenue by imports. Weighting of trade items by value is done automatically by this procedure.

8) World Bank Doing Business data (various years). See Appendix for the procedure of producing dummy variable.

9) Reports of the: Cambodian Investment Board for Cambodia, Department of Domestic and Foreign Investment for Laos, and Bank of Thailand (BOP basis) for Thailand.

10) Data for Cambodia, Laos, Myanmar, and Vietnam are approved amounts by investment approving authorities, adjusted by estimated average implementation ratios and smoothed by 5-year moving average. Data for Thailand are "net FDI inflows" recorded by the Bank of Thailand. Data for Yunnan Province are the "actually utilized" amount recorded in the provincial statistical yearbooks. Estimated investments in energy sector are excluded.

11) World Bank, World Development Indicators (2005).

12) World Bank Doing Business data (various years). See Appendix for the procedure of producing dummy variable.

13) Statistical yearbooks for Myanmar, Vietnam and Yunnan (various years).

14) Oldfield (2004).

15) Distance between capital cities was chosen, except for cases of Cambodia-Viet Nam and Thailand-Viet Nam where Ho Chi Minh City is used in preference to Hanoi since it represents largest Vietnamese city near the other two countries' capitals.

16) Separate sources were used for the countries. See Appendix for details.

17) Different measures of cross border road infrastructure are used depending upon data availability: and for Cambodia, Laos, Thailand and Yunnan--km/km2 (road density); for Myanmer and Vietnam--ton-km/km2 (freight carriage density).

18) Country 2's GDP is also defined but only for the purpose of pairing. This is true for all variables ending in "1".

Table 2. Estimates of Major Exports between GMS Countries

Estimated coefficient Standard Error of estimate	Panel estimates		Cross-sectional estimates		
Coefficients	Major Exports Model 1	Major Exports Model 2	Major Exports Model 3	Major Exports Model 4	Major Exports Model 5
Intercept	-8.186	8.802	8.875	1.985	-0.341
	9.397	10.400	7.135	9.009	7.705
Distance between countries	1.880	-0.743			
	2.979	1.451			
GDP exporter	0.786 ***	0.366 **	-0.155	0.078	0.586
	0.205	0.187	0.370	0.428	0.423
GDP importer	0.447 **	0.393 **	-0.054	-0.302	-0.299
	0.215	0.194	0.339	0.387	0.386
Population exporter	1.978 **		1.872 ***	1.732 **	0.966
	0.908		0.635	0.704	0.680
Population importer	4.557 ***		1.560	3.335 *	3.286 **
	1.005		1.554	1.989	1.656
Area (sq. km.) exporter	-2.677		-2.333 **	-2.089 **	-0.459
	1.633		0.927	1.031	1.025
Area (sq. km.) importer	-6.200 ***		-2.183	-4.031 *	-4.166 **
	1.458		1.782	2.212	1.895
Weighted average tariff rate exporter				-0.172	
				0.257	
Weighted average tariff rate importer				0.438 *	
				0.261	
Cross-boarder roads exporter		0.456 **	1.357 ***	1.465 ***	0.729
		0.202	0.443	0.476	0.466
Cross-boarder roads importer		0.423 *	1.577 ***	1.778 ***	2.152 ***
		0.242	0.537	0.553	0.541
Domestic Roads exporter (Road per km)			-0.644 **	-0.659 **	-0.320
			0.293	0.332	0.370
Domestic Roads importer (Road per km)			-0.805 **	-1.361 ***	-1.404 ***
			0.387	0.517	0.429
FDI net inflows exporter (BoP, current US$)					-0.274 *
					0.152
FDI net inflows importer (BoP, current US$)					-0.009
					0.159
Number Observations	169	88	88	83	76
Groups	11	9	9	9	9
Average years per group	15.4	9.8	9.8	9.2	8.4
R^2 /1	0.356	0.547	0.738	0.757	0.762
Breusch-Pagan Lagrangian Multiplier test	260.79 ***	102.26 ***	12.55 ***	5.63 **	3.34 *
Wald Chi-square	254.62 ***	54.04 ***	217.03 ***	218.05 ***	201.83 ***
degrees of freedom	[7]	[5]	[10]	[12]	[12]

Notes:
Statistical singificance of the parameter estimates: ***99%, **95%, and *90% confidence level, respectively.
Continuous variables in the models are estimated in natural logarithms
/1 The R^2 statistic here differs from the standard OLS R^2 and has slightly different properties, but its interpretation is equivalent (see Stata Corp. (2003), p.194-5 for details).

Table 3: Estimates of Total Exports between GMS Countries

Estimated coefficient Standard error of estimate	Panel (random effects) estimates					
	Total Exports	Total Exports	Total Exports	Total Exports	Total Exports	Total Exports
Coefficients	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Intercept	5.444	3.073	1.967	3.848	1.097	15.305 ***
	7.895	7.153	15.630	12.015	7.543	5.506
Distance between countries	-5.341 ***	-4.711 ***	-3.599 **	-1.839	-4.888 ***	-3.726 ***
	1.053	0.956	2.532	2.020	0.999	0.828
GDP exporter	1.794 ***	1.643 ***	1.046	0.580 *	1.620 ***	2.309 ***
	0.309	0.311	0.519	0.325	0.324	0.343
GDP importer	1.838 ***	1.611 ***	0.414	0.265	1.617 ***	0.510
	0.296	0.304	0.508	0.323	0.315	0.329
Population exporter	-1.117	-0.836	-0.430	-0.285	-0.361	-2.704 ***
	0.789	0.746	1.351	0.975	0.938	0.747
Population importer	-2.010 **	-1.957 **	-0.260	-0.396	-1.437	-0.762
	0.847	0.747	1.332	0.971	0.931	0.682
Area (sq. km.) exporter	2.299 **	1.712 *	1.376	-0.130	1.262	2.851 ***
	0.970	0.916	1.895	1.410	1.093	0.870
Area (sq. km.) importer	3.597 ***	3.401 ***	1.184	1.035	2.952 ***	1.785 **
	0.985	0.909	1.873	1.404	1.081	0.845
Weighted average tariff rate exporter		-0.663 **	-0.221		-0.666 **	
		0.299	0.456		0.318	
Weighted average tariff rate importer		-0.446	-0.092		-0.487	
		0.297	0.440		0.317	
Cross-boarder roads exporter			0.065	0.474 *		
			0.472	0.287		
Cross-boarder roads importer			0.452	-0.050		
			0.456	0.285		
Domestic Roads exporter (Road per km)				0.759 ***		
				0.296		
Domestic Roads importer (Road per km)				0.230		
				0.317		
Export environment dummy					-1.155	
					1.363	
Import environment dummy					-1.301	
					1.339	
FDI net inflows exporter (BoP, current US$)						0.186
						0.174
FDI net inflows importer (BoP, current US$)						0.041
						0.163
PPP exporter						-2.430 ***
						0.754
PPP importer						2.354 ***
						0.677
Sigma_u	2.990	1.826	2.275	1.850	1.907	1.243
Sigma_e	2.489	2.525	1.782	0.603	2.525	1.390
Rho	0.416	0.343	0.620	0.904	0.363	0.444
Theta (minimum)	0.564	0.376	0.669	0.690	0.393	0.512
Theta (median)	0.698	0.629	0.747	0.856	0.643	0.681
Theta (maximum)	0.738	0.690	0.770	0.878	0.702	0.745
Number Observations	392	326	156	89	326	227
Groups	29	29	18	18	29	20
Average years per group	13.5	11.2	8.7	4.9	11.2	11.4
R^2	0.491	0.480	0.474	0.423	0.493	0.574
Breusch-Pagan Lagrangian Multiplier test	77.62 ***	45.95 ***	41.16 ***	35.27 ***	43.87 ***	32.28 ***
Wald Chi-square	147.67 ***	153.17 ***	25.46 ***	33.35 ***	151.17 ***	140.44 ***
degrees of freedom	[7]	[9]	[11]	[11]	[11]	[11]

Notes: Same as in Table 2

Table 4. Estimates of FDI between GMS Countries

Estimated coefficient Standard Error of estimate Coefficients	Panel (random effects) estimates FDI Model 1	 FDI Model 2 /1
Intercept	-5.204	154.059 **
	4.700	63.017
Distance between countries	0.717	0.871
	0.846	1.087
Level of exports	0.020	0.062
	0.096	0.118
GDP exporter	0.447 *	0.735
	0.229	0.511
GDP importer	1.731 ***	1.163 ***
	0.198	0.405
Population exporter	0.391	-7.372 ***
	0.490	1.655
Population importer	-1.969 ***	2.003
	0.548	1.226
Area (sq. km.) exporter	-0.752	-3.851
	0.670	3.852
Area (sq. km.) importer	2.471 ***	-2.088
	0.695	1.610
Cross-border roads exporter		-2.535 ***
		0.706
Cross-border roads importer		2.771 ***
		1.018
Domestic roads exporter		4.649 ***
		1.242
Domestic roads importer		-2.538 ***
		0.692
CPI exporter		0.145
(annual rate of inflation)		0.135
CPI importer		0.080
(annual rate of inflation)		0.120
Weighted ave. tariff rate exporter		0.463
		0.408
Weighted ave. tariff rate importer		-0.583 *
		0.330
FDI environment dummy		18.477 ***
		4.938
Sigma_u	0.898	0.523
Sigma_e	0.972	0.857
Rho	0.460	0.272
Theta (minimum)	0.470	--
Theta (median)	0.661	--
Theta (maximum)	0.739	--
Number Observations	194	72
Groups	21	14
Average years per group	16	5.1
R^2	0.604	0.809 /2
Breusch-Pagan LM Test	23.70 ***	--
Wald Chi-square	131.12 ***	119.60 *** /3
degrees of freedom	[8]	[17]

Notes:

Statistical singificance of the parameter estimates: ***99%, **95%, *90% confidence level, respectively.

Continuous variables in the models are estimated in natural logarithms

/1 Model is estimated using the maximum likelihood random effects estimator

/2 Reports Maddela pseudo R^2

/3 Reports Log-likelihood ratio test

Table 5. Estimates of Exports between GMS Countries

Estimated coefficient
Standard Error of estimate

Single year cross-sectional estimates

Coefficients	1988	1989	1990	1991	1992	1993	1994	1995
Intercept	-46.065	-1.957	-12.412	3.601	5.480	6.954	11.425 *	11.499 *
	31.011	22.741	10.080	7.336	7.044	5.667	6.056	6.548
Distance between countries	1.220	-2.333	-3.039 ***	-2.513	-2.262	-2.655 **	-3.819 ***	-4.337 ***
	6.160	4.587	0.877	1.470	1.466	1.051	1.049	1.024
GDP exporter	2.247	1.658	0.356	0.812 **	0.805 **	0.746 **	1.093 ***	1.285 ***
	1.052	0.738	0.267	0.363	0.370	0.283	0.305	0.329
GDP importer	2.307	3.114 *	0.866 ***	0.745 *	0.673 *	0.370	0.685 **	0.748 **
	1.277	0.845	0.270	0.372	0.378	0.299	0.315	0.341
Population exporter	-6.443	-2.277	-1.075 *	-0.904	-0.830	-0.993	-1.264 *	-2.018 ***
	3.126	2.164	0.518	0.743	0.760	0.628	0.702	0.715
Population importer	-6.414	-7.782 *	-1.872 ***	-1.096	-1.308	-0.788	-1.161	-1.476 *
	3.411	2.306	0.554	0.820	0.774	0.647	0.698	0.757
Area (sq. km.) exporter	11.338	3.554	3.703 ***	1.520	1.460	1.619 *	1.948 **	3.046 ***
	4.419	2.986	1.053	1.018	1.023	0.806	0.906	0.877
Area (sq. km.) importer	7.990	10.387 *	2.689 ***	2.010 *	2.052 *	1.587 *	2.228 **	2.746 ***
	4.519	3.001	0.665	1.105	1.096	0.894	0.934	0.985
Number Observations	10	10	18	20	21	22	23	24
Adjusted R^2	0.457	0.565	0.557	-0.007	-0.001	0.165	0.428	0.507
F Statistic	2.08	2.67	4.06 **	0.98	1.00	1.59	3.35 **	4.38 ***
degrees of freedom [num./denom.]	[7,2]	[7,2]	[7,10]	[7,12]	[7,13]	[7,14]	[7,15]	[7,16]

Coefficients	1996	1997	1998	1999	2000	2001	2002	2003
Intercept	11.43578	6.813241	5.737296	6.1954	8.2403	2.3707	4.406884	35.77297
	6.680704	7.937215	7.20414	6.0852	5.1854	6.3384	6.462105	22.13246
Distance between countries	-3.311698 ***	-2.89998 ***	-3.65595 ***	-3.65 ***	-3.113 ***	-3.157 ***	-3.53273 ***	-3.95876 ***
	0.943987	1.01495	0.921693	0.751	0.656	0.8147	0.812905	1.081529
GDP exporter	1.247211 ***	1.173148 ***	1.469562 ***	1.5336 ***	1.3707 ***	1.5046 ***	1.598044 ***	1.837472 ***
	0.329725	0.379369	0.388505	0.3319	0.2797	0.3576	0.368358	0.509056
GDP importer	0.558644	0.541467	0.839302 **	0.857 **	0.4971 *	0.861 **	0.708422 *	1.469487 ***
	0.339036	0.380722	0.374567	0.3303	0.2855	0.3526	0.362831	0.491848
Population exporter	-1.540898 **	-0.768	-0.98225	-1.13	-1.341 **	-0.776	-0.92383	-1.26943
	0.730807	0.839869	0.784354	0.6712	0.5934	0.7097	0.72499	0.832283
Population importer	-1.035246	-0.53182	-0.8543	-1.285 *	-0.934	-0.957	-0.67411	-1.51591
	0.706031	0.838752	0.834757	0.6904	0.5706	0.7269	0.737175	0.874266
Area (sq. km.) exporter	2.182391 **	1.208428	1.613664 *	1.757 **	1.773 **	1.3963 *	1.496855 *	2.128659
	0.87208	0.984019	0.905238	0.7643	0.67	0.8124	0.825537	1.432537
Area (sq. km.) importer	1.910389 **	1.349452	1.998768 **	2.5708 ***	2.0925 ***	2.0876 **	1.832166 **	0.336779
	0.87259	0.973344	0.942338	0.7818	0.6541	0.8192	0.825509	1.295386
Number Observations	25	25	27	29	26	28	28	18
Adjusted R^2	0.4428	0.3784	0.6109	0.7233	0.7787	0.6891	0.6919	0.752
F Statistic	3.72 ***	3.09 **	6.83 ***	11.46 ***	9.05 ***	9.55 ***	9.66 ***	8.36 ***
degrees of freedom [num./denom.]	[7,17]	[7,17]	[7,19]	[7,21]	[7,18]	[7,20]	[7,20]	[7,10]

Notes:
Statistical singificance of the parameter estimates: ***99%, **95%, *90% confidence level, respectively.
Continuous variables in the models are estimated in natural logarithms

Table 6. Estimates of FDI between GMS Countries

Estimated coefficient — Single year cross-sectional estimates
Standard Error of estimate — Model 1

Coefficients	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Intercept	-11.61534	-5.357377	-11.52056	-12.94174	0.0421504	-9.840186	-2.235749	-11.138	-9.684299	-71.92233
	0.8934838	13.7214	9.739894	11.57176	4.721845	6.341298	4.563232	7.373805	5.923522	62.71343
Distance between countries	-3.712732 **	-0.2664514	1.248897	2.017416	1.831046 *	2.964075 **	2.372438 **	3.443651 **	2.07012 *	8.32592
	0.8934838	1.423874	0.8711083	1.104696	0.9148803	1.128943	0.9159433	1.377047	1.039748	5.636991
Export	-1.061837 ***	-0.3041599	-0.1670126	-0.1498265	0.3800976 **	0.8250634 ***	0.4691268	0.7695736 ***	0.6826491 **	1.54271
	0.1809247	0.3809002	0.2040078	0.2228613	0.1444143	0.2165874	0.2820102	0.2302953	0.2327857	0.8875368
GDP exporter	0.9322522 **	0.2602654	0.3214517	0.0829358	0.0196096	-0.9475828 *	-0.3072584	-1.544942 **	-0.6629415	-3.602159
	0.2167792	0.4707141	0.3174902	0.4117237	0.2921351	0.4564349	0.3583062	0.5566784	0.4028168	2.547942
GDP importer	1.113951 ***	1.586446 **	1.352823 ***	1.665071 ***	1.788246 ***	0.9929481 **	1.335301 ***	0.5690729	0.5624496 *	-1.270712
	0.1397522	0.3757472	0.2404968	0.3745471	0.2488585	0.3454423	0.2617124	0.4115005	0.2615096	1.824373
Population exporter	-1.125377 **	-0.4576682	-0.2285881	0.4913344	0.4252192	1.09873	0.1473055	1.397048	0.1626142	4.095312
	0.2713489	0.7088939	0.461915	0.6882396	0.5445677	0.7121905	0.5247382	0.9078314	0.6092409	3.399632
Population importer	-0.9445907 *	-2.88899 **	-2.436843 ***	-2.402005 **	-2.711892 ***	-0.6755905	-2.082016 ***	0.1387608	0.447565	2.869577
	0.3658215	0.9215893	0.614383	0.7086136	0.5859015	0.8024996	0.579858	0.9631653	0.7681485	2.2078
Area (sq. km.) exporter	3.812009 ***	1.006978	0.8149489	-0.4629194	-1.127914	-1.866667 *	-0.7394701	-2.23339 *	-0.5923692	-4.759298
	0.6104185	1.473309	0.8759692	1.038502	0.6863665	0.9012664	0.6985688	1.188085	0.8142666	4.216514
Area (sq. km.) importer	1.678287 **	3.71316 **	2.793878 **	2.737004 **	2.851453 ***	0.3562374	2.038889 **	-0.6962392	-0.6271143	-2.432437
	0.4517314	1.275152	0.8141852	0.9506952	0.7277547	1.044078	0.7884808	1.19994	0.887132	2.397745
Number Observations	12	14	14	14	20	20	19	19	18	12
Adjusted R2	0.8954	0.5985	0.8143	0.7607	0.855	0.7508	0.7818	0.6605	0.7091	0.3369
F Statistic	12.77 **	3.42 *	8.13 **	6.17 **	15.01 ***	8.16 ***	9.06 ***	5.38 ***	6.18 ***	1.7
degrees of freedom [num./denom.]	[8,3]	[8,5]	[8,5]	[8,5]	[8,11]	[8,11]	[8,10]	[8,10]	[8,9]	[8,3]

Estimated coefficient — Single year cross-sectional estimates
Standard Error of estimate — Model 2

Coefficients	1996	1997	1998	1999	2003
Intercept	-55.27963	24.60993 ***	26.99501	14.78637	-210.4685
	26.57857	4.29263	16.48798	23.22664	79.64823
Distance between countries	1.248041	1.874145 ***	0.6757284	4.052338	13.08924
	0.7519713	0.2017749	1.494767	1.797928	4.511594
Export	-0.0326232	0.0009284	0.2799011	0.8490905 *	2.468558
	0.1840667	0.0426275	0.1791647	0.3039432	0.7359051
GDP exporter	-0.730516	0.6649886 ***	1.194999	-1.068333	-6.123196
	0.6262683	0.0919908	0.9025003	1.161138	2.382805
GDP importer	2.59398 *	1.64034 ***	2.174477 *	1.271979	-4.664764
	0.9334313	0.0670294	0.7280626	0.9785904	1.938656
Population exporter	-0.7298791	1.290703 **	1.202168	1.058711	5.828177
	0.5316558	0.2737176	1.246823	0.9480897	2.51061
Population importer	0.7916973	-4.225325 ***	-3.361985 *	-1.079987	4.87052
	2.291836	0.2273005	1.066851	0.9880574	1.760459
Area (sq. km.) exporter	2.897721	-3.481648 **	-3.028505	-2.26712	-5.04623
	1.619715	0.6985153	2.618178	1.425446	3.445482
Area (sq. km.) importer	-1.137689	4.245979 ***	2.424218	-1.10788	2.785504
	2.792598	0.236753	2.357394	1.11958	2.86978
CPI exporter (annual rate of inflation)	-3.833865	1.387164 ***	1.852197	-0.1785942	-1.00918
	2.344018	0.2645012	1.72328	0.4630336	0.9872064
CPI importer (annual rate of inflation)	13.37884	-2.192683 ***	-0.4047697	-0.2076452	-2.654968
	9.611701	0.2074946	1.534483	0.4302675	1.15425
Number Observations	14	14	13	14	12
Adjusted R2	0.8699	0.9924	0.9474	0.88	0.6866
F Statistic	9.7 **	170.92 ***	22.55 **	10.53 **	3.41
degrees of freedom [num./denom.]	[10,3]	[10,3]	[10,2]	[10,3]	[10,1]

The Mediterranean Region

by

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SUMMARY

Madrid, June 2006

1. INTRODUCTION

As a promoter of the two Euro-Mediterranean conferences held in Barcelona in 1995 and 2005, Spain is a key player in Euro-Mediterranean cooperation. The result of the first conference was the Euro-Mediterranean Partnership and the Barcelona Declaration, which laid the groundwork for a new regional relationship and the creation of a free-trade area to promote the development of Mediterranean countries, among other measures.

The transport sector should play an important role as a facilitator of good operations and development in this free-trade area and, by extension, of good regional relations.

Starting in the early 1980s, the majority of Mediterranean countries decided to take action towards regional cooperation in the area of transport. At a conference of Transport Ministers in Thessalonica under the auspices of the United Nations, the first solid groundwork was laid for this cooperation in the area of transport in the Mediterranean. This conference led to the creation of transport study centres for the Western and Eastern Mediterranean with the support of the different countries in each sub-region. In the Western Mediterranean, Spain took up the proposal and got involved in the creation of the Centre for Transport Studies of the Western Mediterranean.

Based on the work done, and in conjunction with the push for Euro-Mediterranean cooperation, the countries in the sub-region created the Group of Transport Ministers of the Western Mediterranean (GTMO), which has been responsible for carrying out major studies to facilitate exchange. The Spanish Ministry of Public Works and Transport currently presides over this group.

The considerable progress made in terms of cooperation in Mediterranean transport since the Euro-Mediterranean Forum's drafting of the Blue Paper on Euro-Mediterranean Transport Policy, the conclusions reached by the High Level Group for extending the major European transport axes to neighbouring countries, the Euro-Mediterranean Ministerial Conference on Transport held in Marrakech in December 2005, and the proposal to draw up a Regional Transport Action Plan for the development of the transport sector in the Mediterranean all provide a solid basis through which this healthy cooperation can be promoted even further.

This paper is structured in three parts:

- The first part provides an overview of the progress of relations in the Mediterranean area, with the focus on the Euro-Mediterranean partnership and the transport sector.
- The second part addresses the current scenario of institutional cooperation in the transport sector and describes the four most noteworthy initiatives:
- The High Level Group sponsored by the European Commission with the aim of studying the extension of the major trans-European Transport axes to neighbouring countries.

- The result of the work done by the EuroMed Transport Project: the Blue Paper on Euro-Mediterranean Transport Policy.

- The first Conference between the Ministers of the EU and those of the Southern Mediterranean partner countries, which demonstrated the general interest in creating closer regional cooperation in the field of transport.

- On a different scale, it is worth highlighting the cooperation at the sub-regional level in the Western Mediterranean, with the contributions of the Group of Transport Ministers of the Western Mediterranean.

The third section of this document provides an overview of the measures and actions for regional rapprochement in the transport sector, as developed in the different Euro-Mediterranean cooperation frameworks mentioned above. This set of measures includes proposals for the extension of the network and measures designed to facilitate transport.

2. CO-OPERATION IN THE MEDITERRANEAN REGION

2.1. Introduction to the Mediterranean Region

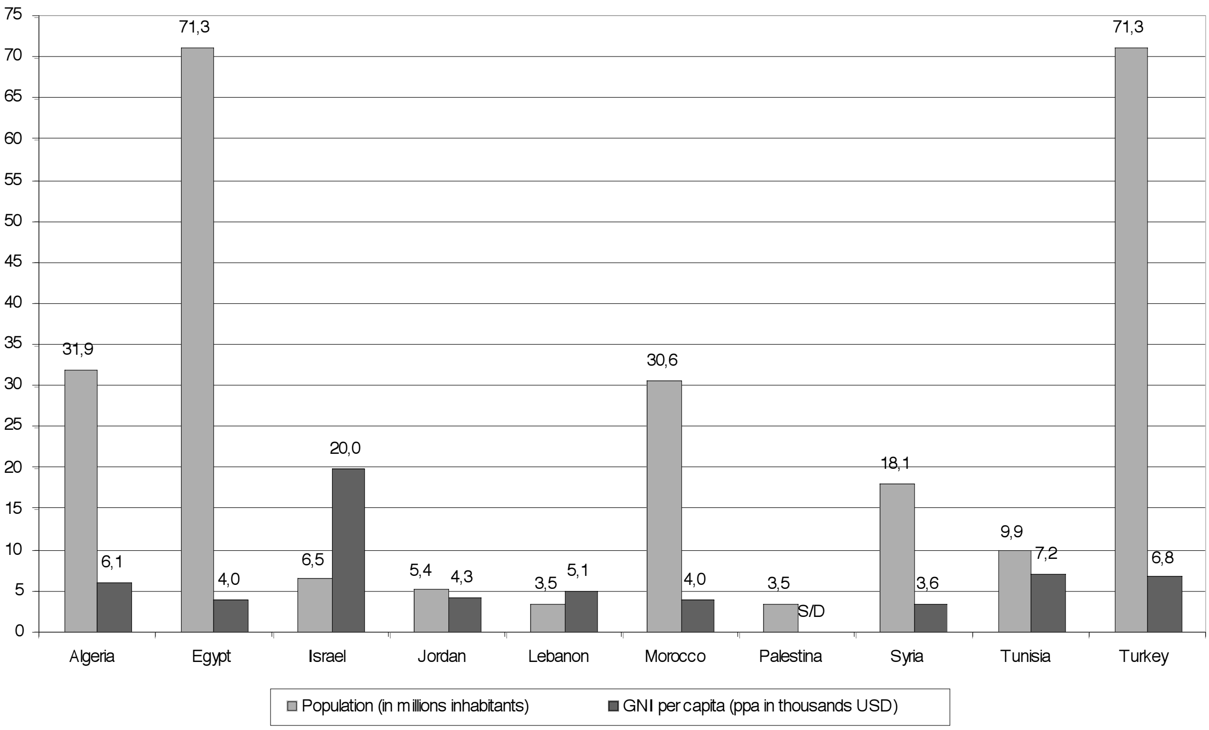
The countries involved in the integration of the Mediterranean area are those of the EU and Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, the Palestinian Authority, Syria, Tunisia and Turkey. In terms of socio-economic conditions, it is reasonable to differentiate Israel and Turkey from the other eight Southern Mediterranean countries.

These eight countries have a number of things in common: they are at a similar level of economic development, they share similar reform challenges, and none of them knows to what extent they will cooperate with the EU.

Moreover, Turkey already has a customs union with the EU and is recognised as an accession candidate and Israel is the only high-income country in the region.

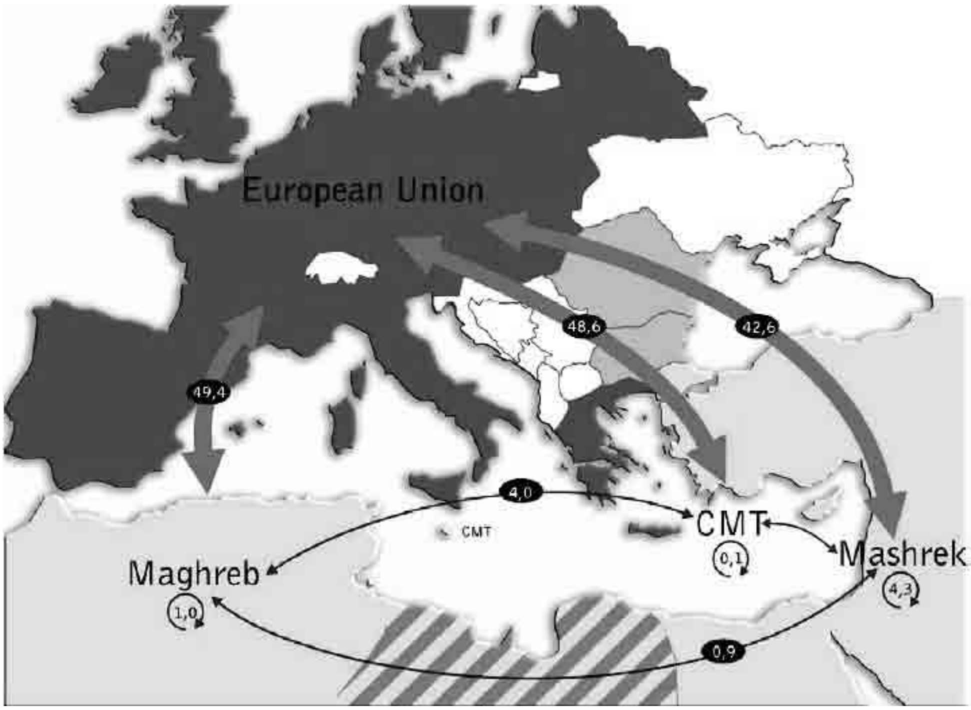
The European Union is the most important trading partner of the Southern Mediterranean countries, accounting for more than half of their trade. Trade integration of the Maghreb countries with the EU is more pronounced than that of the Mashrek. Despite the relatively high EU shares in trade of the Mediterranean Partners (MPs), however, the absolute size and composition of trade flows suggests that much of the trading potential between the EU and its Mediterranean neighbours remains unexploited. For example, Turkey and Israel (with a total of 78 million inhabitants) trade as much with the EU as the eight Arab MPs, with a total of 174 million inhabitants. Moreover, the vast majority of exports from the Arab MPs to the EU consist of raw materials (e.g. oil, gas, phosphate) and low value-added manufactures. Extreme cases are Algeria and Syria, where 96% and 86% of exports to Europe, respectively, are petrochemicals.

Figure .1. **Population and GNI per capita**



Source: UNDP.

Figure 2. **Sub-regional trade exchange (billion €, 2002)**



Source: EuroMed Transport Project.

In principle, geographic proximity to the world's second largest market and the emerging regional free trade area provide the opportunity to develop trade-driven growth strategies.

2.2. The Barcelona Process and Barcelona Declaration: Towards a Euro-Mediterranean Partnership

The Euro-Mediterranean Conference of Ministers of Foreign Affairs, held in Barcelona in November 1995, marked the starting point of the Euro-Mediterranean Partnership (Barcelona Process), a wide framework of political, economic and social relations between the Member States of the European Union and the Southern Mediterranean Partners.

The Euro-Mediterranean Partnership thus comprises 35 members: the 25 EU Member States and 10 Mediterranean Partners; Libya has had observer status since 1999.

In the Barcelona Declaration, the Euro-Mediterranean partners established the three main objectives of the Partnership:

1. The definition of a common area of peace and stability through the reinforcement of political and security dialogue (Political and Security Chapter).

2. The construction of a zone of shared prosperity through an economic and financial partnership and the gradual establishment of a free-trade area (Economic and Financial Chapter).

3. The rapprochement between peoples through a social, cultural and human partnership aimed at encouraging understanding between cultures and exchanges between civil societies (Social, Cultural and Human Chapter).

2.2.1 Euro-Mediterranean Free-Trade Area

In the Barcelona Declaration, the Euro-Mediterranean Partners agreed on the establishment of a Euro-Mediterranean Free-Trade Area (EMFTA) by the target date of 2010.

As well as bilateral "vertical" trade liberalization with Europe, the Mediterranean Partners are committed to implement free trade among themselves ("horizontal" or South-South integration). The Arab Maghreb Union (Morocco, Algeria, Tunisia, Mauritania and Libya), and more recently the Agadir Agreement signed in February 2004 by Morocco, Tunisia, Egypt and Jordan are examples of this committment.

2.2.2 Transport role

In accordance with the Declaration of Barcelona, where the Mediterranean is defined as a sea of union among peoples, the participants also agreed to cooperate in other areas and, to that effect: stress the importance of developing and improving infrastructure, including through the establishment of an efficient transport system, the development of information technologies and the modernization of telecommunications.

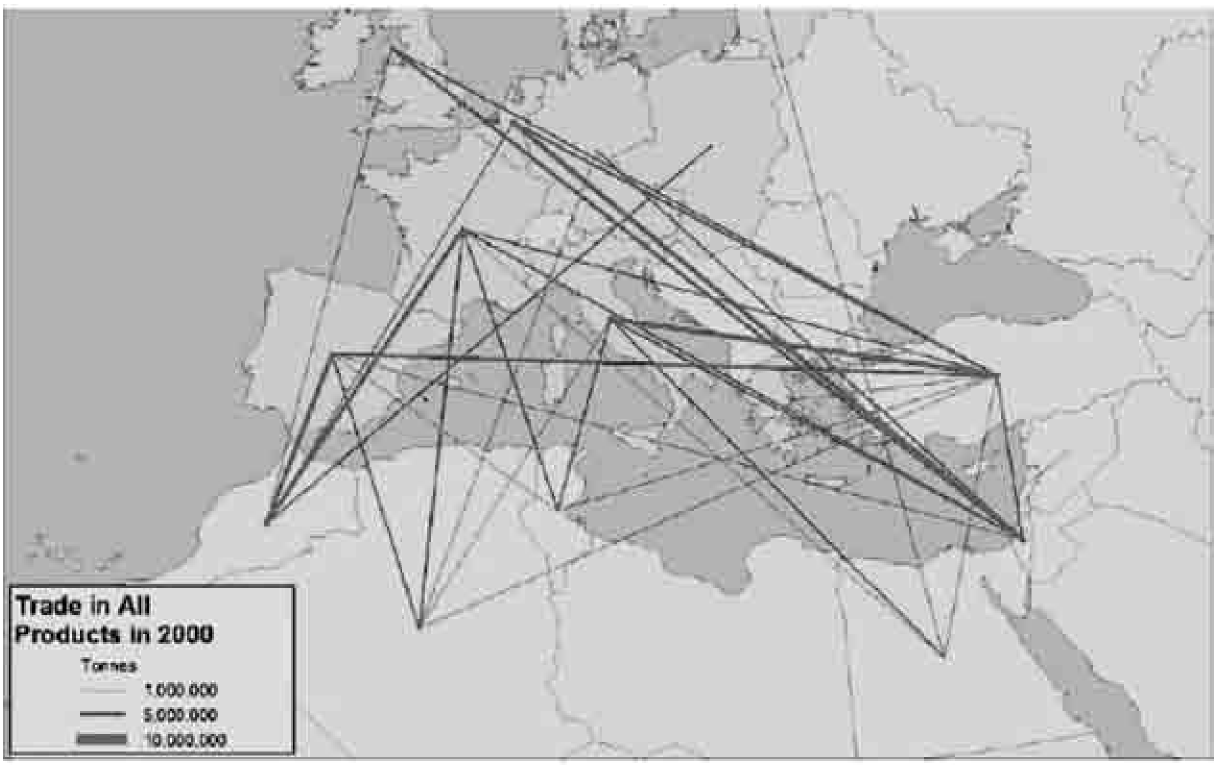
In the annex of Barcelona Declaration, work programme, it is specified that: "Efficient interoperable transport links between the EU and its Mediterranean partners, and among the partners themselves, as well as free access to the market for services in international maritime transport, are essential to the development of trade patterns and the smooth operation of the Euro-Mediterranean partnership".

Co-operation will focus on:

- development of an efficient trans-Mediterranean multimodal combined sea and air transport system, through the improvement and modernization of ports and airports, the suppression of unwarranted restrictions, the simplification of procedures, the improvement of maritime and air safety, the harmonization of environmental standards at a high level, including more efficient monitoring of maritime pollution, and the development of harmonized traffic management systems;

- development of east-west land links on the southern and eastern shores of the Mediterranean, and connection of Mediterranean transport networks to the Trans-European Network in order to ensure their interoperability.

Figure 3. **Base year trade flows (>750,000 tonnes) for all non-oil products between the MEDA- and EU25-countries**



Source: EuroMed Transport Project.

In 2005, a second meeting was held to mark the tenth anniversary of the Barcelona Conference (Barcelona II). Once again, the importance of transport was emphasized and the work programme adopted reflected the need to "develop a regional transport infrastructure network and adopt a set of recommendations at the Marrakech Euro-Mediterranean Ministerial Conference on Transport in December 2005 to boost transport co-operation."

2.3. From the Euro-Mediterranean Transport Forum to the Marrakech Conference: What has been done since 1995?

2.3.1 The Barcelona Declaration

When the Barcelona Declaration was approved in 1995, especially as a result of the introduction of a specific section on transport, all the parties involved in the initiative to any extent effusively congratulated each other, convinced that there was great potential for making progress in cooperation on Mediterranean transport.

The Barcelona Declaration encouraged countries in the region to redouble their efforts, and one of the results was the creation of the Group of Transport Ministers of the Western Mediterranean (GTMO), which was set up at the sub-regional level in conjunction with and as a complement to the Euro-Mediterranean Transport Partnership. The establishment of this group, along with the creation of MEDA Programme funding and the European Commission's participation as a major player, opened the door to exceptional perspectives for multilateral cooperation in the region.

However, some obstacles cropped up, that were either not foreseen or not evaluated sufficiently. These obstacles included the interpretative restrictions of the different texts and regulations drawn up to provide the Partnership with administrative support, and limited European awareness on the situation in the Mediterranean.

This meant that the logical and licit ambitions of Mediterranean countries to receive MEDA funding to analyse infrastructure priorities and study the possibilities of connecting their transport networks with trans-European networks were not fulfilled.

2.3.2 First Euro-Mediterranean Transport Forum

And yet the conclusions of the first Euro-Mediterranean Transport Forum, organized by the European Commission in Malta in 1999, included the two main priorities of the Partnership in this area: the definition of an infrastructure network and the proposal of measures to facilitate transport.

2.3.3 Third Euro-Mediterranean Transport Forum

After some changes in direction taken by the European Commission, it was not until the third Forum, held in Brussels in 2002, that two projects were started up for a total of €15 million: the EuroMed Transport Project to facilitate transport, and the Infrastructure Project to define an infrastructure network. These projects, which are being developed by teams of consultants from different countries, address the two major issues required for transport development in the region, as mentioned above.

The first issue involved the drawing up of an action plan and a set of initiatives to prepare and modernize the sector for the free-trade area, and addressing issues such as transport-market liberalization, training, new technologies, advanced logistics, and regulatory convergence, etc. The second issue involved defining infrastructure priorities and their financing.

2.3.4 The EC Communication on the Euro-Mediterranean transport network

Moreover, the publication in 2003 of the Communication (COM 376) from the European Commission to the Council of the European Union and the European Parliament "on the development of a Euro-Mediterranean transport network" made it possible to clarify the Commission's policy on the subject and to identify the path to be taken.

There were three points of interest in this Communication: the acceptance of the fact that there were two different sub-regions, namely, Western and Eastern Mediterranean, and the possibility of implementing different temporary initiatives and developments in each sub-region; the recognition of the contribution of existing cooperation structures such as the GTMO, and the possibility of addressing the situation and needs in terms of infrastructure in Southern countries.

2.3.5 The High Level Group

In 2004 the European Commission created the High Level Group for extending the major trans-European transport axes to neighbouring countries and regions. This High Level Group worked simultaneously with EuroMed projects. The work and results of this group are outlined below. The High Level Group was created in practice as a consensus group to work, particularly with regard to identify key infrastructure in the international relations of neighbouring countries. The High Level Group surpassed the work done by the EuroMed Transport Project on Infrastructure.

2.3.6 The Blue Paper

The EuroMed Transport Project drew up a Blue Paper on Transport in the Mediterranean Region, which includes the diagnosis of the transport system and recommendations for its improvement. This document, together with the report of the High Level Group, was endorsed by the Euro-Mediterranean Transport Forum and the first Conference of the Ministers of Transport of the region that was held in Marrakech in December 2005.

2.3.7 The Marrakech Conference

The Marrakech Conference therefore summarized ten years of cooperation by adopting both documents and urging the European Commission to submit a 5-year action plan for the region by the end of 2006.

2.3.8 10 years of Euro-Mediterranean transport cooperation

The result of ten years of Euro-Mediterranean cooperation in transport is certainly modest. It has been a long and difficult road, though in recent years the Euro-Mediterranean Transport Partnership seems to have designed its own roadmap.

3. ACTIONS TAKEN IN THE AREA OF TRANSPORT

This brings us to 2006 with a series of activities completed or in progress which, despite the eleven years that have passed since Barcelona 1995 and the delays that have arisen for the scheduled creation of the free-trade area by 2010, constitute a crucial set of tasks that will help define the strategic bases for future development of transport in the Mediterranean.

3.1. Actions taken throughout the Mediterranean Region

3.1.1 High Level Group for extension of major trans-European Transport axes to neighbouring countries and regions

The expansion of the European Union in May 2004 shifted the borders of the EU towards the east and south, thereby increasing the number of new neighbouring countries in the EU. The trans-European Transport Network (TEN-T) was revised to include the new EU Member States in the network.

Launched by the former European Commission Vice-President Loyola de Palacio and the Italian Presidency, a ministerial meeting took place in Santiago de Compostela on 8 June 2004 and concluded that "the development of technically and administratively interoperable transport connections between the European Union and neighbouring regions is an issue of utmost importance for economic growth, facilitation of trade and connecting people" and that "priority connections between major trans-European transport axes and the different neighbouring regions of the EU should be identified and developed".

Set up in October 2004, the Group was chaired by Loyola de Palacio and included representatives from 25 EU Member States, plus Romania and Bulgaria and 26 more, including all the Mediterranean countries. The European Investment Bank, the European Bank for Reconstruction and Development and the World Bank participated as observers.

Its main objectives were, among others:

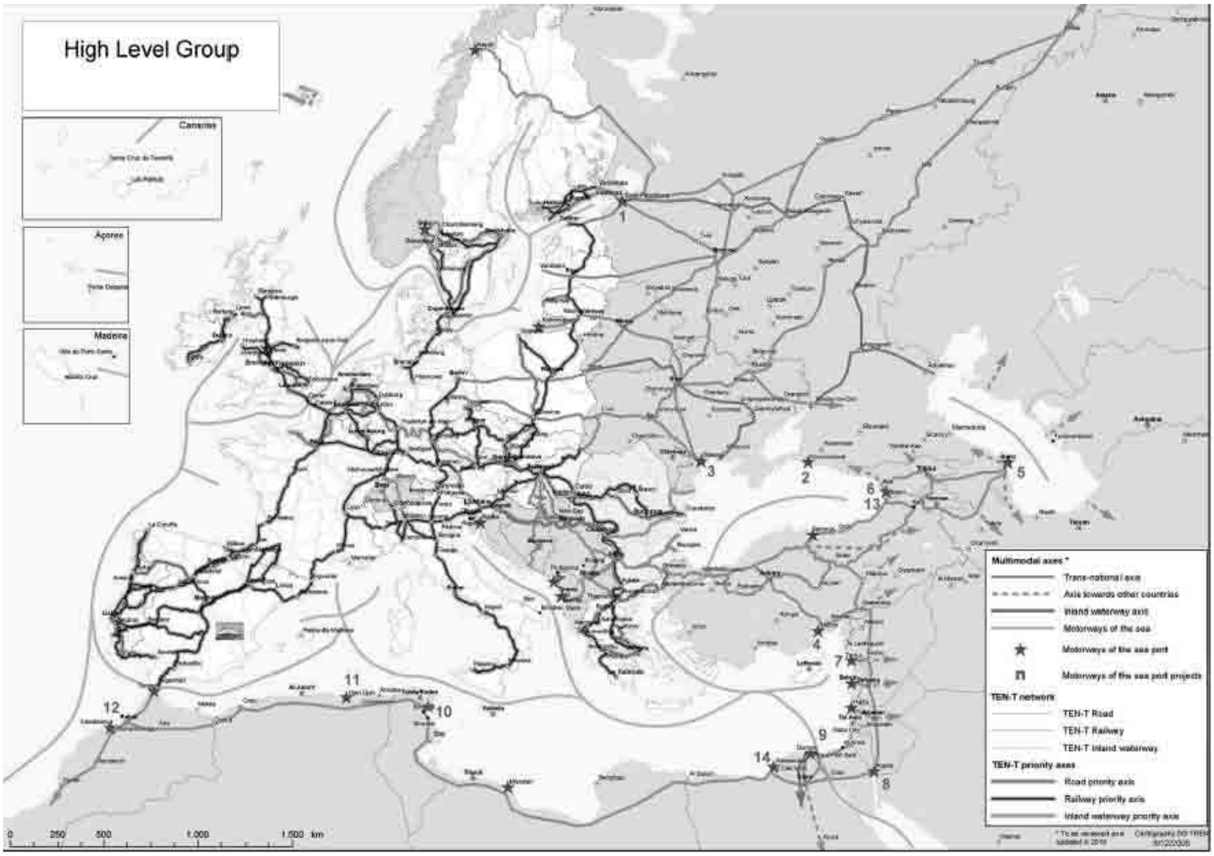
- to define the main axes to be developed in order to make trade easier and safer;
- to identify the measures to be taken to facilitate convergence and harmonization of the different management systems (customs, administrative procedures, visas, safety and security) as well as technologies;
- to try to find solutions to funding problems.

Finally the HLG submitted its final report in November 2005. The Group highlighted its main priorities in the operational conclusions, which included a number of infrastructure projects and several "soft" measures with the aim of removing physical and administrative bottlenecks along the main transport axes identified and to facilitate cooperation and communication between authorities in the different countries. These measures included maritime safety and environmental protection, rail interoperability, expansion of the European satellite radio navigation system (Galileo) as well as the expansion of the Single European Sky initiative to neighbouring countries.

As shown on the map, the five major transnational axes identified were:

- Motorways of the Seas.
- Northern axis.
- Central axis.
- South-eastern axis.
- South-western axis.

Figure 4. **High Level Group – Motorways of the Sea Axes**



The specific Mediterranean projects selected by this High Level Group will be discussed below.

3.1.2 The EuroMed Transport Project and the Blue Paper

At the second meeting of the Euro-Mediterranean Transport Forum (Brussels, November 2000), the submission to the EC's MEDA Programme of a regional project on the facilitation of transport in the Mediterranean was approved (Euro-Mediterranean Transport Policy and Training Project). Then, in November 2001, the European Commission approved the Euro-Mediterranean Transport Project with a financial allocation of €20 million[1].

The EuroMed Transport Project aims to:

- Contribute to overall economic and social development through increased and more sustainable transport flows, more competitive trade and better balanced exchanges.
- Improve the quality, safety and efficiency of the goods and passenger transport systems in the region, thus improving the functioning of the transport sector as a whole.
- Support the development of integrated multimodal transport networks and infrastructure, leading to improved transport flows, better connections and reduced bottlenecks.

During the 5th Euro-Mediterranean Transport Forum, which was held in Brussels in December 2004, the European Commission assigned the EuroMed Transport Project with preparing a strategic discussion paper on the Euro-Mediterranean transport policy, called the 'Blue Paper'.

The Blue Paper aims at identifying the main orientations and directions for achieving a sustainable, efficient and multimodal transport system in the region that can adequately link the Mediterranean countries together, as well as these countries and the European Union.

The Blue Paper is thus composed of two parts:

- Part I. Overview and Diagnosis of the MEDA transport System provides an analysis of transport systems in the MEDA region;
- Part II. Recommendations for a Regional Transport Strategy proposes a series of recommendations for a regional transport strategy.

The Blue Paper was presented at the First Euro-Mediterranean Ministerial Conference held in Marrakech, Morocco, in December 2005.

3.1.3 The Marrakech Conference: 2010 Action Plan

Euro-Mediterranean cooperation since the Barcelona Declaration has resulted in a number of initiatives in the field of transport, as mentioned above. In December 2005, ten years after the Barcelona Declaration, the Marrakech Conference was held, where the Transport Ministers of the EU-25 member states and the 12 Mediterranean partner countries stressed the need to intensify co-operation to contribute to better economic and social development in the region, in keeping with the Barcelona Declaration.

The discussions and conclusions of the Conference were based primarily on the Blue Paper on Euro-Mediterranean Transport Policy, drawn up within the framework of the Euro-Mediterranean Transport Forum and on the final report of the High Level Group on the extension of the major transEuropean transport axes to neighbouring countries.

The conclusions of the Marrakech Conference identified the priorities for future cooperation: institutional reform, infrastructure networks and financing, maritime transport, multimodal transport, air transport and the Galileo Project.

The Ministers also asked the Euro-Mediterranean Transport Forum to come up by the end of 2006 with a **Regional Transport Action Plan** for the next five years in order to implement recommendations included in the Blue Paper and the Final Report of the High Level Group.

3.2. Western Mediterranean initiatives

In the Western Mediterranean sub-region, the Transport Ministers' Group of the Western Mediterranean aims to promote co-operation on transport and contribute to the Euro-Mediterranean Partnership. The members of the GTMO are the Transport Ministers from the seven countries in the region (Algeria, France, Italy, Morocco, Portugal, Spain and Tunisia) and the EC Directorate General for Energy and Transport. The Transport Study Centre for the Western Mediterranean (CETMO) holds the position of secretariat and provides technical support.

After a proposal was made by the GTMO in 2001, the European Commission included a call for proposals on international cooperation in Mediterranean transport in the 5th Framework Programme on R&D. The Group presented two proposals that were evaluated positively and accepted.

The first initiative was the REG-MED Thematic Network, created for "Regulatory convergence to facilitate international transport in the Mediterranean"; and the second was the DESTIN Project on "Defining and Evaluating a Strategic Transport Infrastructure Network in the Western Mediterranean".

The specific objectives of REG-MED thematic network have been:

- To identify and analyse the obstacles inhibiting the facilitation of international transport in the Mediterranean;
- To seek and propose solutions to mitigate these obstacles and thereby improve goods flows between Mediterranean countries; and
- To evaluate how international agreements and convergence with respect to the EU regulatory framework can contribute towards reducing these obstacles.

The purpose of the DESTIN Project was to design and apply a decision-making support system for the identification and evaluation of a strategic transport network in the Western Mediterranean, as a way of expanding the trans-European network of transport of the European countries of the Western Mediterranean.

The specific objectives of DESTIN Project were:

- Developing and applying specific models to forecast international goods and passenger traffic in the Western Mediterranean, supported by a geographic information system and corresponding databases.
- Proposing and applying methods and criteria to identify a strategic transport network in the Western Mediterranean (based on previous results) and evaluating the priorities for development.

Both projects made it possible to complement most institutional aspects in determining the needs of the region and completing the two studies launched within the framework of the EuroMed Transport Forum.

A major step forward in terms of regional rapprochement was made because these initiatives allowed the participation of Maghreb experts for the first time in a European R&D programme.

4. CHALLENGES FACING MEDITERRANEAN INTEGRATION IN THE FIELD OF TRANSPORT

Previous points of this document have described the progress made in terms of cooperation in the Mediterranean, specifically in the field of transport. Despite completed and in-progress projects, the contributions of the High Level Group, and the Blue Paper on Euro-Mediterranean Transport Policy, among other things, we are fast approaching the year 2010, when the free-trade area is scheduled to be launched, and yet not enough real measures have been taken to make sufficient progress towards Mediterranean integration in the field of transport.

For the free-trade area to work as a catalyst for development in the area, to create closer ties between the Southern Mediterranean partner countries and the EU, and between individual Mediterranean countries, and to generate regional integration, acting more decisively in the transport system is a basic requirement.

This action should be focused in the transport sector on two main areas:

- Being able to define a Euro-Mediterranean transport network, which, like the TEN-T, expands into neighbouring Mediterranean countries.
- Facilitating exchange in terms of operations and eliminating bottlenecks that impede optimized operation of the transport system.

These two areas present major challenges that will be described below, along with the current situation.

4.1. Creating a Euro-Mediterranean Transport Network

In order to build a transport network for exchange in the Mediterranean (between the EU and Southern Mediterranean partner countries, and between the Southern Mediterranean partner countries) that facilitates and increases exchange and makes it possible to attract part of the traffic from Asia, it is first necessary to identify the network so that, at a later date, its opportunities and failings can be detected.

A great deal of energy has been put into this process, including the infrastructure contract of the EuroMed Transport Project, the High Level Group and the DESTIN and MEDA TEN-T research projects.

Following is a presentation of the results generated by all these initiatives, as outlined in the report from the High Level Group, which was endorsed at the end of 2005 by the Euro-Mediterranean Transport Conference, and as outlined in the DESTIN project, with a more technical and sub-regional approach.

4.1.1 Identification and development of the priority connections between the TEN-T and neighbouring regions of the EU: The High Level Group

This group (described above) identified five major transnational transport axes with neighbouring countries and presented a series of recommendations, including a mixture of infrastructure projects and basic measures designed to stimulate and facilitate transport flows.

The Group identified the following five major transnational axes:

- *Motorways of the Seas:* linking the Baltic, Barents, Atlantic, Mediterranean, Black and the Caspian Sea areas, as well as the littoral countries within the sea areas and with an extension through the Suez Canal towards the Red Sea.
- *Northern axis:* to connect the northern EU with Norway to the North and with Belarus and Russia and beyond to the East. A connection to the Barents region linking Norway through Sweden and Finland with Russia is also foreseen.
- *Central axis:* to link the centre of the EU to Ukraine and the Black Sea and through an inland waterway connection to the Caspian Sea. Connections towards Central Asia and the Caucasus are also foreseen, as well as a direct connection to the Trans-Siberian railway and a link from the Don/Volga inland waterway to the Baltic Sea.
- *South-Eastern axis:* to link the EU through the Balkans and Turkey to the Caucasus and the Caspian Sea, as well as to Egypt and the Red Sea. Access links to the Balkan countries as well as connections towards Russia, Iran and Iraq and the Persian Gulf are also foreseen.
- *South-Western axis:* to connect the south-western EU with Switzerland and Morocco and beyond, including the trans-Maghrebin link connecting Morocco, Algeria and Tunisia. An extension of the trans-Maghrebin link to Egypt as well as a connection from Egypt to the south towards other African countries are also foreseen.

The members of the Group submitted almost 100 project proposals to be considered as priority investments on the major transnational axes. The proposals were classified into two categories, depending on their maturity and the potential role they could have in alleviating bottlenecks that affect international and long-distance traffic, i.e.:

- Projects ready to start before 2010 (completion by 2020)
- These projects are expected to bring about time and operating-cost savings for users and operators in comparison to today's situation.

Projects of longer-term interest (works to start by 2020)

This category typically includes the second stage of a project that gradually increases infrastructure capacity, the first phase being among projects ready to start prior to 2010.

In addition, the Group members proposed a number of other major projects that were considered of more regional or national importance. These projects are on a transnational axis but they seem today relevant mainly for regional traffic between just two countries or aim at improving the functioning of an urban transport system.

The High Level Group did not have the mandate and therefore did not analyse the ability of the current TEN-T to handle not only intra-European traffic, but also traffic between the EU and non-EU countries. Thus, the definition exercise of an integrated Euro-Mediterranean network has not been fully completed.

4.1.2 List of projects concerning Euro-Mediterranean Transport Forum countries

Motorways of the Seas:

- Extension of the motorway of the sea of Western Europe towards Norway in the north and towards Morocco in the south;
- Extension of the motorways of the Mediterranean Sea towards North Africa and the Middle East, including the Red Sea and beyond;
- Extension of the motorways of the Mediterranean Sea to the Black Sea.

Projects of short- to medium-term interest:

- Port of Mersin (capacity increase, phase 1)
- Port of Tartus
- Port of Aqaba (master plan, capacity increase, phase 1)
- Multipurpose platform East Port Said Port
- Deep-water port in Enfidha
- Port of Djen-Djen
- Container terminal of Mohamedia port.

Projects of longer-term interest:

- Port of Mersin (capacity increase, phase 2)
- Port of Aqaba (capacity increase, phase 2)
- Extension of existing breakwater and new platform of El Dekhela Port.

South-eastern Axis

Multimodal connection Ankara–Mersin–Syria–Jordan–Suez–Alexandria/East Port Said, including the following connections:

- Sivas–Malatya–Mersin
- Turkey towards Iran and Iraq
- Tartus–Homs towards Iraq
- Beirut–Damascus towards Iraq and Saudi Arabia
- Haifa–Israel border
- Jordan border–Amman towards Iraq and Saudi Arabia.

Multimodal connections Damietta–Cairo and beyond, including the River Nile.

Projects of short- to medium-term interest:

- Railway line Istanbul-Cerkezköy-Bulgaria border
- Railway line Ankara-Sivas
- Ha'emek railway (from Haifa up to Jordanian border)
- Road upgrading Gerede-Merzifon
- Road upgrading Turkey border-Jordan border, including the branch Tartus-Homs
- Irdib ring road

- Road upgrading Alexandria-Cairo-Suez-Taba (Israeli border)
- Road upgrading Ismailia-East Port Said.

Projects of longer-term interest:

- Upgrading transportation through the River Nile (up to Cairo)
- Construction of railway line Syrian border
- Railway signalling system and station infrastructure Beni Suef
- Road connection Sanhurfa
- Road connection Homs
- Road construction Amman.

Other major projects on multimodal axes, projects of regional or national interest:

- Electrification of Shebin El Qanater-Damietta railway line
- Railway line Bir El Abd-Rafah
- Upgrading of coastal road Rafah-Damietta-Alexandria-El Saloum
- Road tunnel under Suez Canal
- Burg Al Arab-Aswan western desert road
- Airport – supporting air cargo
- Airport – expansions, rehabilitation and modernisation.

South-western Axis

Multimodal connection Algeciras–Rabat towards Agadir and beyond;

Multimodal connection Rabat–Fes–Oudja–Constantine–Al Jazair–Tunis–Libyan border (the "trans-Maghrebin"), including the connection Tunisia–Egypt.

Projects of short- to medium-term interest:

- High-speed railway line Casablanca-Marrakech (phase 1 of Casablanca-Marrakech-Agadir)
- Upgrading of road Casablanca-Rabat
- Upgrading of road Fes-Oujda.

Projects of longer-term interest:

- Fixed Gibraltar connection
- High-speed railway line Marrakech-Agadir (phase 2 of Casablanca-Marrakech-Agadir)
- Doubling and electrification of the railway line Fes-Oujda.

Other major projects on multimodal axes, projects of regional or national interest:

- Development of logistics zones (along the trans-Maghrebin).

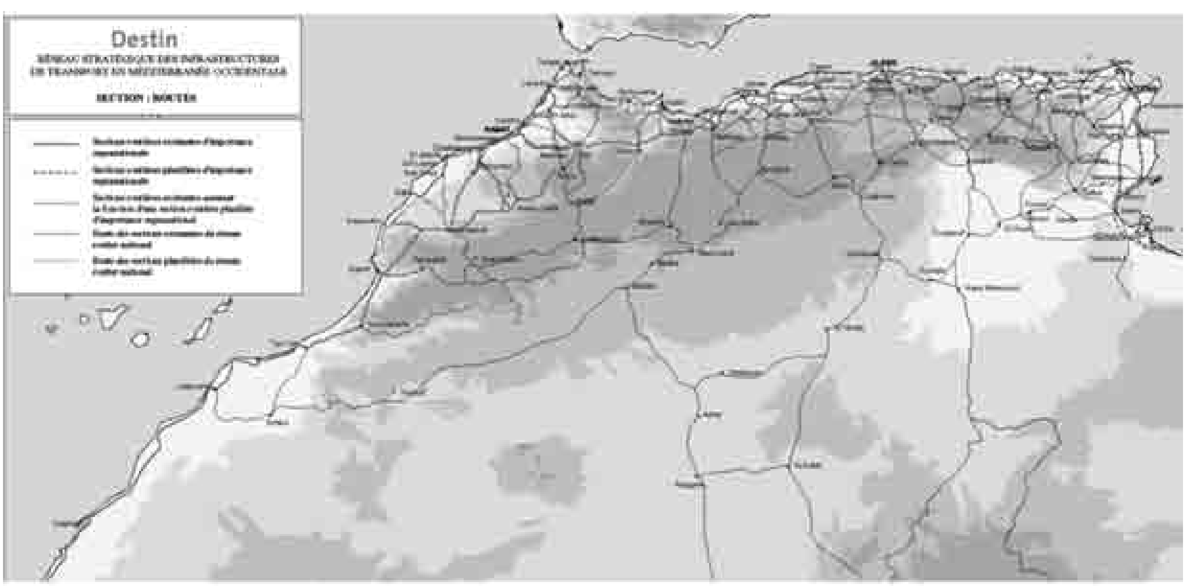
4.1.3 *Identification of the Strategic Transport Network for the Western Mediterranean: the DESTIN project*

We also feel it is worth drawing attention to the process, especially the methodology generated in the DESTIN Project, to define a strategic transport infrastructure network in the Maghreb, conceived as an expansion of the Trans-European Transport Network (TEN-T) of European countries into the Western Mediterranean. Work was done in a slightly different way. First, the existing network planned by the states was identified. Then a study was carried out on the exchanges (involving people and goods) between the two sides of the Mediterranean, and between the Southern Mediterranean partner countries so a network could be chosen that supported these exchanges and would therefore become strategic. Once this network was identified, a study was carried out on the needs of the network so the actions required to ensure its efficient running could be determined.

The strategic transport network in the Maghreb has been designed to facilitate international flows of goods and people between the Maghreb and the European Union, and to link major urban areas in the Maghreb. This network includes land, maritime and air infrastructure networks, in accordance with the notion that the network should, as far as possible, be interoperable within each mode of transport, and should also favour inter-modality between the different modes of transport and with the trans-European Transport Network. It also includes existing and planned gas and oil pipelines of supranational importance.

The strategic road network is shown in Figure4.1 as an example of work results. It consists of motorways and roads referred to as being of supranational importance. They either already exist (though some sections require upgrading to ensure sufficient quality levels) or are planned.

Figure 5. **Strategic Transport Network – Routes defined by the DESTIN project**



Source: DESTIN – CETMO.

4.2. Towards transport facilitation through regulatory harmonization

Besides the transport network's requirements in terms of infrastructure, a number of factors still exist that make the transport system far from optimal and which can be resolved through operational and regulatory measures in order to facilitate transport and exchange in the Mediterranean.

The High Level Group, the EuroMed Transport Project, the Blue Paper on Euro-Mediterranean Transport Policy and the REG-MED Project have all attempted to diagnose the existing transport system in the Mediterranean with a view to proposing a series of operational and regulatory improvements, such improvements being clearly necessary, given that increased infrastructure has so far been incapable of solving all bottlenecks.

4.2.1 The High Level Group

It should be borne in mind that the horizontal measures put forward by the High Level Group are applicable to the five major transnational transport axes mentioned above. Given its broad, differentiated spectrum of application, it is not possible to go into such minute detail of actions as with other projects.

The area of horizontal measures can be summarized mainly as follows:

Border-crossing procedures:

- Implementation in full of the international conventions and agreements on harmonization of the format and content of trade and transport- related documents.
- Modernization of frontier customs posts, following the rules and recommendations set out in international conventions and regulations.
- Simplification of customs procedures, with electronic data interchange systems and one-stop offices, especially in ports.

Satellite radio-navigation systems:
- Bilateral negotiation.

Security measures:
- Application of international agreements and standards.
- Security audits with neighbouring countries.

Maritime transport and Motorways of the Sea:
- Ratification and implementation of international standards and conventions (IMO).
- Harmonization of the practices and procedures of the Paris and Mediterranean memorandums of understanding (MoUs) at the highest level of performance.
- Recognition of ships blacklisted by the different MoUs.
- Concentration of cargo flows, improvements of port infrastructure and services and implementation of regular frequency of shipping services operating on future Motorways of the Sea.

Rail transport and interoperability:
- Measures to render rail transport regulations more convergent.
- Introduction of rail-traffic management systems and standardized telematic applications.

Road transport:

Measures to improve road safety that address:

- Driver behaviour.
- Vehicle safety.
- Road-infrastructure safety audits.
- Traffic-management systems.

Air transport:
- Convergence towards a single sky, following the European initiative.

4.2.2 The Blue Paper

The Blue Paper on Euro-Mediterranean Transport Policy also proposes implementing a broad set of measures to facilitate transport in the Mediterranean. They focus on the institutional framework, goods and passenger transport and transport safety, security and sustainability.

The following horizontal measures are of note:

Strengthening and modernizing the institutional dimensions of transport:

- Distinguishing between the administrations that set the policies and regulations and the parties that manage and operate the transport industry.
- Increasing institutions' financial and administrative freedom/capacity.
- Enhancing coordination between all players, at both the national and regional levels.
- Reinforcing human resources through training programmes to strengthen the skills of existing staff, in line with the current and future requirements.

Freight transport:
- Port reform, involving increased decentralization of management and enhanced commercialization of services/private management.
- Prioritizing Motorways of the Sea projects by improving port efficiency, restructuring public shipping companies and supporting private-sector participation in the shipping business.
- Modernizing the road freight-transport industry by improving the licensing mechanisms of the industry, promoting the transformation of individual owners-operators into companies and harmonizing international road-transport regulations.
- Improving the competitiveness of the rail system by implementing fundamental structural reforms (separating rail infrastructure from operations) and making carefully planned investments (e.g. commercial and physical interoperability of the networks).
- Simplifying and harmonizing customs procedures, signing and implementing relevant international agreements and developing the freight-forwarding industry.
- Optimizing and coordinating transport planning.
- Implementing advanced transport logistics.
- Introducing IT systems, particularly EDI technology.

Passenger travel (medium and long distance):

- Ensuring a fair and open aviation market.
- Establishing a Euro-Mediterranean common aviation area.
- Harmonizing air-traffic management and progressing towards achieving a single Euro-Mediterranean sky.
- Optimizing the exploitation of airports (separating airport regulation from airport management, promoting the decentralization of airport management and enhancing the commercialization of airport services).

Transport safety and sustainability:

- Using safer ships; approximating maritime-transport legislation.
- Approximating national air-transport legislation with the regulations of the EU.
- Approximating the legislation governing international rail and road transport with the regulations of the EU.
- Incorporating the sustainability culture into transport-infrastructure development, ensuring that all measures are duly complied with.
- Harnessing the full potentials of Galileo.

4.2.3 The REG-MED thematic network

With broad, multidisciplinary participation and the involvement, among others, of public administrations (Ministries of Transport and Customs), semi-public bodies (port and railway authorities), academics and private operators (ship-owners, shipping agents, freight forwarders, transport companies, stevedores, the banking and insurance industries, etc.), the REG-MED network has focused its attention primarily on the three Maghreb countries, although people from other Mediterranean countries have also participated in it, and many of the recommendations are applicable to the entire Mediterranean.

The convergence with international agreements and the EU regulatory framework

- Having a good knowledge of the main existing conventions and agreements.
- Involvement during the revision processes.
- Maghreb countries should be aware of the regulatory framework of the EU, not only once the texts are in force, but also during the discussion phase.

The liberalization of international maritime transport services

- It is recommended that the EU accompanies the Maghreb countries throughout this liberalization process.

The facilitation of the passage through ports in the Maghreb

- The upgrade of the institutional level
  - The processes of port reform and of liberalization and privatization of port services within the Maghreb countries should continue.
- Promotion of PPP/SOFT[2] (Partenariat Public Privé en matière de Simplification, Organisation, Formation et Technologie)
  - Port communities must develop tools and methods for the identification and evaluation of existing bottlenecks in the passage of ships and goods through ports.
  - The results of this evaluation will allow for the implementation of processes for continuous improvement and to benchmark with other port communities.

- The modernization of customs and its involvement in the port community
  - Application of risk-management techniques and *a posteriori* controls.
  - Implementation of the electronic concept of the one-stop office.
- To take advantage of the customs-transit regimes
  - Bringing closer together the national and Community transit regimes and the feasibility of implementing a common transit procedure between the EU and the Maghreb, which would minimize the impact of the border controls.
- The application of information and communication technologies
  - It is necessary to assure the legal support that allows for the dematerialization of documents and information and to encourage the need and use of port-community information systems.

Recommendations concerning inland transport

- Road transport
  - Increase dialogue between the national administration and the private sector.
  - Restructuring and professionalism of the sector, supported by a programme of accompanying measures agreed upon with the administration.
  - To advance in the formalization of a single bilateral agreement between each of the Mediterranean Partner countries and the EU, instead of each Maghreb country signing different agreements with each Member State.
- Railway transport
  - To improve the conditions of intermodality between the rail and maritime modes of transport.
  - Consideration of the Maghreb as a single market for the transport of goods with an integrated and interoperable railway network.

The improvement of the efficiency of door-to-door transport

- Evaluation of logistic platforms in the Maghreb.
- To develop a strong local professional sector (freight forwarders, freight integrators, etc.) in the Maghreb.

5. CONCLUSIONS

The result of eleven years of Euro-Mediterranean Partnership, specifically in the transport sector, has been irregular progress in cooperation over time and in different geographic areas, with more development in the Western than in the Eastern Mediterranean.

After the Barcelona Declaration, cooperation received an exceptional boost from all the players involved, but this enthusiasm has dwindled over the years.

The result of eleven years of Euro-Mediterranean cooperation in transport is certainly modest. It has been a long and difficult road, though in recent years the Euro-Mediterranean Transport Partnership seems to have designed its own roadmap.

Specifically, the initiatives promoted within the Partnership, such as the Blue Paper, the High Level Group and the proposal by the Transport Ministers at the Marrakech Conference to draft a Regional Transport Action Plan have been the source of renewed hope and clarification for the future.

In this regard:

- With our sights set on 2010, which is getting so close, and the lessons learned during this stage of the Partnership, we feel this is the time to give a strong impetus to cooperation in the transport sector through a feasible, realistic and well-planned Regional Transport Action Plan that is specific in terms of funding and time, and that leads the way to addressing the failings detected in the transport system and taking full advantage of the potential offered by the transport sector for closer regional integration in the Mediterranean.

- Although we feel the problems identified in the transport system are similar throughout the Mediterranean and that the recommendations will not widely differ from one country to another, we are convinced that these measures should focus on immediate realities that provide for harmonizing the level of progress and the introduction of measures and recommendations. The Action Plan should be drawn up for the whole of the Mediterranean, but the recent progress achieved in terms of cooperation shows us that its application should be different for the Western and Eastern Mediterranean.

- The Regional Action Plan should be implemented as soon as possible to begin giving the Euro-Mediterranean Transport Partnership the physical visibility it needs and to fulfil the expectations created by the 1995 Barcelona Declaration.

The future of Euro-Mediterranean cooperation in the transport sector calls for a shift from thinking to facts and to taking specific action. Europe should be capable of making a financial effort that matches its political discourse. And by that we do not merely mean development help, but technical and institutional cooperation in the mutual interest.

NOTES

1. €10 M for main EuroMed Transport Project; €5 M for the Infrastructure Project; and €5 M for other projects.

2. The PPP/SOFT defines a work domain in which it is possible to set action strategies in order to facilitate the fluidity of passage through ports by employing the method of cooperation at different levels. The PPP/SOFT is a concept that encompasses the spirit of the port community and integrates aspects concerning the simplification of the regulations, the organization of passage through the port, professionalism at all levels and the implementation of information and communication technologies. Even though the main agents concerned with the PPP/SOFT are those of the port community, the PPP/SOFT also lays on cooperation at national and international levels.

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Topic IV:

Trade and Infrastructure

Globalisation and Infrastructure Needs

by

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SUMMARY

Leicester, June 2006

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1. INTRODUCTION

Growth in the volume of world trade, which is at the heart of the process of globalisation, has, with few exceptions, continued unabated for more than half a century. Trade is widely considered the engine of economic growth: trade volume – measured usually as a ratio of exports plus imports to GDP - has been found to be robustly correlated with economic growth in numerous academic studies[1]. Transport infrastructure remains, however, the unsung hero of the globalisation-growth nexus. Without ports, airports, roads and telecommunications there can be no world trade: economies will revert to autarkic solutions. Yet, in spite of their obvious contribution to economic growth, investments in transport infrastructure are rarely portrayed in a positive light by anyone outside transport ministries, not least by the media. The same is to a large degree true of the academic literature on economic growth: there are still very few analytical studies of the contribution of transport infrastructure, though there are some recent and not so recent exceptions[2].

Transport infrastructure – both its volume and quality – is arguably one of the main determinants of trade costs, which are, in turn, a major determinant of the volume of world trade. In a recent survey of trade costs, James Anderson and Eric van Wincoop (2004) provide a headline figure of 170% as an estimate of the tax equivalent of “representative” trade costs for industrialised countries. This figure, which includes all the costs of getting a product from the foreign producer to the domestic consumer, comprises 21% transport costs, 44% trade-related barriers and 55% retail and wholesale distribution costs. Anderson and van Wincoop also find that trade costs vary widely across product categories and that for developing countries they are even larger, by a factor of two or more in some important categories. The impact of trade costs on bilateral trade flows may, therefore, be much more important than the actual cost of production[3].

This paper examines the following three aspects of the relationship between globalisation and infrastructure:

- The contribution that infrastructure makes to increasing international trade, through its influence on transport costs, using analytical and empirical perspectives;

- The implications for domestic infrastructure policies emanating from empirical studies of the rate of return to public infrastructure capital in various countries[4];

- The international dimension of public infrastructure investments, emanating from international spillovers.

- These three aspects are addressed in sections 2, 3 and 4 respectively. Section 5 provides some concluding remarks.

2. INFRASTRUCTURE, TRANSPORT COSTS AND TRADE

Bougheas *et al.* (2000) put forward a model in which transport infrastructure promotes the growth and sub-division of industry, capturing Adam Smith's idea of the importance of waterways for industrial development[5]. The key to understanding the full economic benefits of infrastructure is capturing its influence on both the location of and the organisation of industry, both of which are dynamic processes. A common mistake frequently made by cost-benefit approaches or transport economists when analysing the benefits of an infrastructure investment project is to focus primarily on the static effects on existing industries and to ignore or under-play the future dynamic benefits on the macroeconomy. These effects include attracting new firms or new industries to the area and positive spillover effects emanating from these industries, as well as increased specialisation within an industry, all of which are difficult to assess. Bougheas *et al.* model the production of a final consumption good as a function of intermediate inputs à la Romer (1987). The fixed costs of producing intermediate goods are assumed to depend inversely on the resources devoted to infrastructure accumulation. Infrastructure is provided by the government and is financed by a tax on final output; there is, therefore, a trade-off between final consumption and infrastructure investment. Given, however, the positive effects of infrastructure on specialisation – the engine of growth in Romer's model – the relationship between long run economic growth and the tax rate (or infrastructure investment) has an inverse U-shape, positive one, and a positive tax rate exists that maximises final consumption.

It is also plausible to conjecture that transport infrastructure may also promote (intra-industry and inter-industry) trade. Bougheas, Demetriades and Morgenroth (1999) – henceforth Bougheas *et al.* (1999) – remains one of very few papers that provides a theoretical, as well as an empirical, analysis of this relationship. Specifically, the paper examines the role of infrastructure in a simple Ricardian trade model with transport costs. The transport technology – which is of the Samuelson 'iceberg' variety[6] - is extended to embed an inverse relationship between the level of infrastructure and transport costs. The idea modelled here is that infrastructure improves transportation conditions and it is, therefore, treated like a cost-reducing technology. The accumulation of infrastructure is, however, costly. Infrastructure investment takes away a resource that may be put into the production of final goods. The specification of the infrastructure technology includes both fixed and variable components, and takes into account geographical factors ('distance'). To fix ideas, let L denote the total amount of input that the two countries devote to infrastructure investment. Let D denote the 'distance' variable, which is a summary measure of geographical disadvantage; countries with a high D need to devote a higher proportion of their input endowment in order to reduce transport costs by a given amount relative to pairs of countries with a low D. Let g be the fraction of the quantity shipped that arrives at its destination. Bougheas *et al.* (1999) specify the following functional form for g.

$$G(\Lambda / D) = \begin{cases} \bar{g} & \text{for} \quad \Lambda / D \leq k \\ g(\Lambda / D) & \text{for} \quad \Lambda / D \geq k \end{cases}$$

where k is a parameter designed to capture the lumpiness of infrastructure investment projects and g is increasing in L/D at a decreasing rate. For example, connecting two coastal economies, like France and the UK, by a channel tunnel or a bridge, would involve a large initial outlay – transport costs do not begin to diminish until the tunnel or bridge is completed; hence the discontinuity captured by values of

L/D below k. Once the tunnel or bridge has been constructed, i.e. for values of L/D above k, there can be marginal improvements that result in a continuous reduction of transport cost, but this reduction is, however, subject to diminishing returns.

The authors show that, depending on geography and initial endowments, equilibria with or without infrastructure can be obtained. Equilibria without infrastructure occur when considering either two geographically distant countries or two poor countries. In both cases the opportunity cost of infrastructure investment, as measured by the loss of final output, is too high compared to the welfare benefit, so the countries will choose not to invest in infrastructure. These findings reflect the lumpiness of infrastructure investments. Thus, geographically disadvantaged and/or poor countries may find it sub-optimal to develop their infrastructure altogether and, as a result, get stuck in a low-trade equilibrium.

The relationship between welfare and the level of infrastructure for poor or geographically disadvantaged countries, predicted by Bougheas *et al.* (1999), is depicted in Figure 1. Because of the large fixed costs, and the lumpiness of infrastructure investment, welfare is initially decreasing in infrastructure investment. Only once a certain minimum level of infrastructure investment (kD) has been exceeded, welfare begins to increase with the level of additional investment. Because of diminishing returns in the cost-reducing technology and the trade-off between infrastructure investment and the production of final goods, the relationship between welfare and infrastructure reaches a local maximum above kD. However, at that local maximum welfare is below the level that accrues at a zero level of investment – the latter corresponds to the global maximum. This case could reflect low initial endowments (‘poor’ countries), which intuitively means that the trade off between final consumption and infrastructure investment is a very steep one. These countries simply cannot afford to invest in infrastructure because the lumpiness of the cost technology means that for them to be able to put in the minimum investment required in order to obtain transport cost reductions, they would have to give up too large a chunk of their final consumption. Alternatively, the situation depicted in Figure 1 could be representative of a geographical disadvantage, i.e. very high value of D, which, in order to overcome too large a chunk of the initial endowment has to be diverted into infrastructure formation.

On the other hand, for pairs of countries with large initial endowments (‘rich’ countries) or with favourable geography (low values of D), positive investment in infrastructure is optimal. This is depicted in Figure 2, which shows that the relationship between welfare and infrastructure investment attains a global maximum at a level of investment that is above kD. For these pairs of countries, the model also predicts a positive relationship between infrastructure investment and the volume of trade.

Bougheas *et al.* (1999) offer empirical evidence using an augmented gravity model and data from European countries, which strongly supports this prediction of the theory. In their estimations, they use two infrastructure variables, namely public capital and the length of the motorway network. The estimated elasticities on the infrastructure indicators are not only positive and significant, they are also quite large. For example, a 10% increase in the transport infrastructure indicator (in one of the two trading countries) is found to increase bilateral trade by 1.8% - 4.6%, depending on the exact specification.

Figure 1. **Infrastructure and welfare in poor or geographically disadvantaged countries**

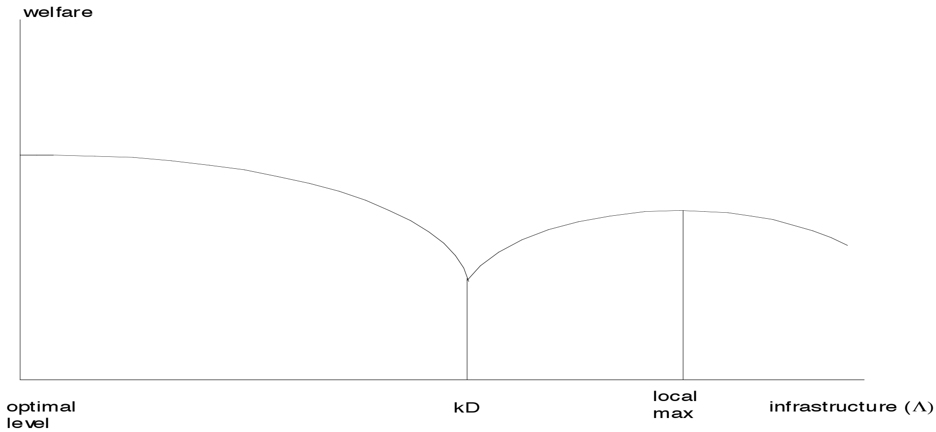
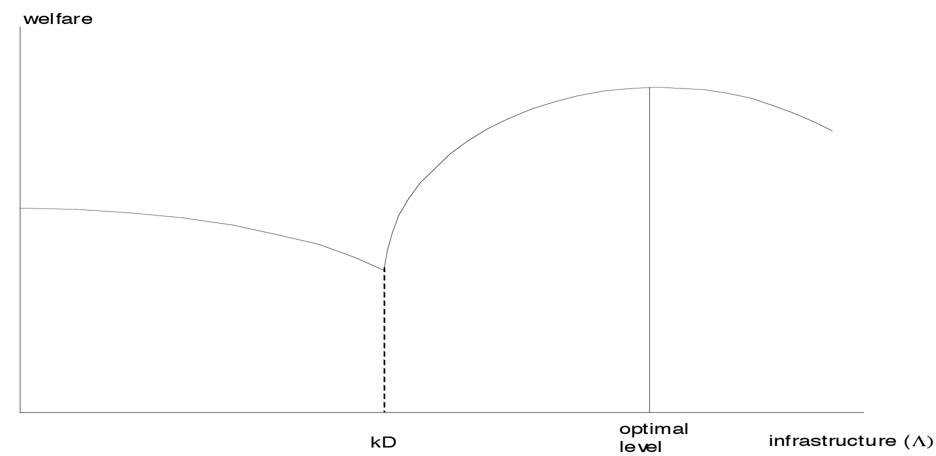


Figure 2. **Infrastructure and welfare in rich or geographically advantaged countries**



Nuno Limao and Anthony Venables (2001) examine the empirical relationship between infrastructure, transport costs and trade, taking into account geographical factors. Their first set of results is based on the costs of shipping a standard 40 foot container from Baltimore to 64 different destinations in the world. The find that being landlocked raises costs by \$4620, compared with a mean of \$3450 for non-landlocked countries. They also find that an extra 1000km by sea adds \$190 to transport costs while a similar increase in land distance adds \$1380. Furthermore, they find that the increased transport costs of landlocked countries are not solely attributable to the extra overland distance that must be travelled; they suggest that landlocked countries may also face greater border delays and transport coordination problems, as well as higher insurance costs and direct charges by the transit country. They also find that own infrastructure explains 40% of the predicted transport cost of coastal economies, and 36% of the transport cost of landlocked countries; for landlocked countries transit infrastructure explains 24% of the cost.

Limao and Venables (2001) also estimate a gravity model in order to assess the effects of infrastructure on trade flows, using a data set for 1990 that includes 103 countries. Their results are striking. They find that the infrastructure variables are significant at the 1% level and have very sizeable effects on trade volumes. Moving from the median to the top 25th percentile in the distribution of infrastructure raises trade volumes by 68%, which is equivalent to being 2005 km closer to trading partners. Moving from the median to the bottom 25th percentile in the distribution of infrastructure reduces trade volumes by 28%, which is equivalent to being 1627 km further away from other countries. Further analysis of Sub-Saharan African (SSA) trade reveals that (poor) infrastructure accounts for nearly half the transport cost penalty borne by intra-SSA trade. Additional empirical findings suggest that the under-performance of SSA countries in terms of international trade (both within and outside the SSA region), is explained by poor infrastructure and by a penalty on cross-continental trade in Africa.

3. DOMESTIC INFRASTRUCTURE POLICIES

There is a significant body of academic literature which either directly or indirectly suggests that countries systematically under-invest in infrastructure[7]. Recently, for example, Demetriades and Mamuneas (2000) find that the long-run net rates of return to public capital in twelve OECD economies exceed those of private capital. One plausible answer to this puzzle - that is consistent with the findings of Demetriades and Mamuneas, 2000 - is the asymmetry between political horizons and the timing of costs and benefits of large infrastructure projects. To put it differently, politicians may have too short horizons to invest in projects that will only result in costs during their period of office, while most of the benefits will occur after that period. To illustrate this point, some of the key findings in Demetriades and Mamuneas are reproduced in Table 1.

Table 1. **Estimated net rates of return to public and private capital**

Country	Intermediate-run		Long-run	
	Public	Private	Public	Private
Australia	0.112	0.153	0.165	0.134
Belgium	0.183	0.130	0.237	0.125
Norway	0.121	0.136	0.172	0.134
Sweden	0.137	0.144	0.181	0.123
Finland	0.160	0.121	0.204	0.114
United States	0.106	0.315	0.265	0.113
Canada	0.146	0.156	0.204	0.130
Japan	0.240	0.215	0.357	0.095
Germany	0.168	0.183	0.260	0.100
France	0.192	0.206	0.277	0.129
Italy	0.255	0.257	0.354	0.153
United Kingdom	0.204	0.210	0.284	0.143

Source: Demetriades and Mamuneas (2000).

It is important to note that these estimates are derived using an optimising framework in which the private sector makes optimising (profit-maximising) decisions in relation to the stock of private capital and employment, taking the stock of public capital as exogenous. Increases in the stock of public capital are empirically found to increase both employment and private output and, subsequently, the private capital stock, which takes time to adjust. Once the private capital stock adjusts in the second period (the intermediate run), there will be subsequent adjustments in output and employment, which may trigger subsequent adjustments in private capital. This process aims at capturing empirically the full dynamic effects of public capital and explains why in the table above the net rate of return of public capital is much higher in the long-run than in the intermediate run. The findings also suggest that if one were to empirically assess whether there is under-investment in public capital just by looking at the comparison between the net rates of return of public and private capital in the intermediate run, one would come to the conclusion that this is the exception rather than the norm. Only Belgium and, to a lesser extent, Finland exhibit rates of return to public capital that are visibly higher than that of private capital in the intermediate run. When looking at the long-run rates of return, however, a very different picture emerges: public capital has a much higher net rate of return than public capital, suggesting under-investment in public capital. In several cases the public rate of return exceeds the private one by a factor of two (e.g. Belgium, Germany, US and UK), or even three (Japan).

Looking at the same results from the point of view of politicians, it is clear that the economic benefits from investments in public capital may be felt well after the end of their term of office, while their costs may be upfront. Even in those cases where such investments are financed through bond issues or loans, the concomitant squeeze in public finances may crowd out other expenditure with more immediate political benefits[8]. Financing large infrastructure projects through borrowing may also have undesirable implications for interest rates in the short-to-medium run, which influence the re-election prospects of incumbent governments. Thus, it is not difficult to explain why politicians may shy away from large public investment projects, particularly from those with long gestation periods. It is also easy to see how government mandarins can justify such preferences by focussing on the short-run or medium-run rates of return, which, are much closer to those obtained by cost-benefit analyses which typically fail to take into account the dynamic benefits that accrue from large public investment projects in the long-run.

4. INTERNATIONAL POLICY ASPECTS

The work presented in Section 2 highlights an alternative mechanism that may explain why countries may choose to under-invest in public capital. Specifically, transport costs for landlocked countries include a component that depends on the infrastructure of transit countries. In international trade this is quite common – the trading countries frequently have to rely on the infrastructure of a third country in order to trade. Thus, investments in infrastructure by one country will benefit not only itself but also other countries, which may not even be trading partners of the country that invests. This section illustrates the analytical and empirical importance of these international infrastructure spillovers, utilisng relevant academic literature. Specifically, it follows the work of Bougheas, Demetriades and Morgenroth (2003) which analyses a bilateral trade setting in which it is assumed that each country's social planner behaves strategically[9].

4.1. Theoretical analysis

Following Bougheas *et al.* (2003), let us assume that the "home" country is denoted by *H* and the "foreign" country (*F*). Each country produces only one good: *H* produces good *h* and *F* produces *f*. The agents of each country derive utility from consumption of both goods, hence there is trade. Each country is endowed with a capital good. Let z_H and z_F denote the endowment of *H* and *F*, respectively. Each unit of the capital good can produce one unit of the domestic good. The endowments can also be used for the development of infrastructure which reduces transport costs which, in turn, influence domestic and international trade. Following Samuelson's "iceberg" model, it is assumed that only a fraction of the goods shipped arrive at their final destination. Let *g* denote the fraction of exports consumed. It is further assumed that the consumption of domestically produced goods is also subject to transport costs. Let g_H and g_F denote the corresponding fractions. Notice that while domestic transport costs are country specific, international transport costs are common. Transport costs are assumed to depend on the quality of public infrastructure. Without continuous improvement through additional investment, the existing stock of public infrastructure, i.e. road networks, telecommunications etc. will deteriorate and consequently transport costs will be high. Let z_{HG} and z_{FG} denote the investment in infrastructure of *H* and *F*, respectively. Then, the transport cost technologies are given by:

$$(1) \quad g_H = g_H(z_{HG})$$

$$(2) \quad g_F = g_F(z_{FG})$$

$$(3) \quad g = g(z_{HG} + z_{FG})$$

where $0 < g_H, g_F, g < 1$, $z_{HG} \leq z_H, z_{FG} \leq z_F$ and all the functions are strictly increasing and concave. Note that any investment in infrastructure will affect both domestic and international transport costs. Furthermore, the two investments are perfect substitutes in the international technology.

Bougheas *et al.* (2003) analyse a two-level decision making process in each country. The allocation of the capital good between production and infrastructure investment is decided by a social planner. Afterwards, a competitive market decides the allocation of consumption between the two goods. The trading process is captured with a price taking, utility maximising, representative agent who takes the social planner's decision as given. Market clearing determines the equilibrium prices that depend on the decisions of both social planners. While agents behave competitively, the two social planners behave strategically. Each planner makes a decision, taking into account the equilibrium price mechanism, given the other social planner's decision (Cournot competition).

Let c_{ij} ($i = H, F; j = h, f$) denote the consumption of the representative agent in country *i* of good *j*. Preferences in each country are described by a logarithmic utility function as follows:

$$(4)\,, \quad U_i(c_{ih}, c_{if}) \equiv \theta_{ih} \log c_{ih} + \theta_{if} \log c_{if}\,, \qquad i = H, F$$

With the above functional form closed form solutions can be obtained without imposing any further restrictions on the infrastructure technologies[10]. The following program describes the utility maximisation problem of the representative agent of country *H*:

$$Max\,, \quad \theta_{Hh} \log c_{Hh} + \theta_{Hf} \log c_{Hf}$$

subject to: $p_h \dfrac{c_{Hh}}{g_H} + p_f \dfrac{c_{Hf}}{g} = p_h y_H$

The solution is given by:

(5) $c_{Hh} = \dfrac{\theta_{Hh}}{\theta_{Hh} + \theta_{Hf}} g_H y_H$ and $c_{Hf} = \dfrac{\theta_{Hf}}{\theta_{Hh} + \theta_{Hf}} pgy_H$

Because of the logarithmic specification the demand for each good is proportional to income. The proportionality factor depends on how strong preferences are for the home good relative to the foreign good and indirectly on relative prices which depend on transport costs. The equilibrium allocations must also satisfy the corresponding solution for country F and the following feasibility constraints:

(6) $z_H - z_{HG} \geq \dfrac{c_{Hh}}{g_H} + \dfrac{c_{Fh}}{g}$

(7) $z_F - z_{FG} \geq \dfrac{c_{Ff}}{g_F} + \dfrac{c_{Hf}}{g}$

The left-hand side of each expression is equal to the production of the domestic good which is also equal to income. The right hand side shows the allocation of production between domestic consumption and exports. The equilibrium relative price (terms of trade) is given by:

(8) $p = \dfrac{c_{Hf}/g}{c_{Fh}/g} = \dfrac{\theta_{Fh}\left(\theta_{Hh} + \theta_{Hf}\right)}{\theta_{Hf}\left(\theta_{Ff} + \theta_{Fh}\right)} \dfrac{(z_F - z_{FG})}{(z_H - z_{HG})}$

Because of the logarithmic preferences the amount that each country spends on each good is proportional to its income. In addition, because international transport costs are common, they do not enter directly into the equilibrium condition. However, transport costs, both domestic and international, affect indirectly the equilibrium price because they affect the allocations of the two social planners which determine the levels of income.

Using (5), (8), and the preferences of the representative agent of *H*, the authors derive the corresponding indirect utility function. The social planner of *H* maximises this utility by choosing investment in infrastructure, z_{HG}, taking as given the investment of country *F*, z_{FG}:

$$V\left(z_{HG}; z_H, z_F, z_{FG}\right) \equiv Max\ \theta_{Hh} \log g_H\left(z_{HG}\right) + \theta_{Hh} \log\left(z_H - z_{HG}\right)$$
$$+ \theta_{Hf} \log g\left(z_{HG} + z_{FG}\right) + \theta_{Hf} \log\left(z_F - z_{FG}\right) + \text{constant}$$

The solution of the above problem yields the following reaction function:

(9) $\theta_{Hh} \dfrac{1}{z_H - z_{HG}} = \theta_{Hh} \dfrac{g'_H\left(z_{HG}\right)}{g_H\left(z_{HG}\right)} + \theta_{Hf} \dfrac{g'\left(z_{HG} + z_{FG}\right)}{g\left(z_{HG} + z_{FG}\right)}$

where primes denote the first derivatives. By multiplying both sides of the above equality by z_{HG}, so that on the right-hand side parameters represent elasticities of the transport cost functions, they find that the optimal policy requires that the ratio of infrastructure investment to production should be higher the more responsive the transport cost functions are with respect to investment. Bougheas *et al.* (2003) show that the reaction function has a negative slope with an absolute value that is less than one.

The social planner of *F* faces a similar optimisation problem which yields a corresponding reaction function. The following conditions hold at the unique Cournot-Nash equilibrium, found by the intersection of the two reaction functions[11].

$$(10)\quad \frac{dz_{iG}}{dz_i} > 0 \qquad \frac{dz_{iG}}{dz_j} < 0 \text{ and ; } i, j = H, F \;\; i \neq j\,.$$

Investment in infrastructure in both countries is increasing in their own endowment but decreasing in the other country's endowment.

Bougheas *et al.* (2003) compare this aspect of the non-co-operative solution with the co-operative outcome obtained when international transfers are not allowed. Assuming that preferences are symmetric and identical, and that domestic transport cost functions are also identical, they show that at the global constrained efficient equilibrium investment in infrastructure in both countries is increasing in their own endowment but decreasing in the other country's endowment. They also show (Proposition 2), that (a) the country with the higher endowment invests more in infrastructure (b) total investment in infrastructure under voluntary contributions is higher relative to the global constrained optimum (overinvestment) and (c) the country with the lower endowment definitely overinvests at the voluntary contribution equilibrium. The country with the higher endowment invests more in infrastructure and has a higher net income.

An earlier (unpublished) version of the same paper[12] examines the case when international transfers are allowed, the investment levels in the two countries, (z_{HG}, z_{FG}), and the levels of consumption, (c_{Hh}, c_{Hf}, c_{Ff}, c_{Fh}), are chosen to maximise the sum of utilities subject to the global feasibility constraint. The solution is (unconstrained) Pareto optimal. Formally the optimization problem is the following:

$$\mathit{Max} \quad \theta_{Hh} \log c_{Hh} + \theta_{Hf} \log c_{Hf} + \theta_{Ff} \log c_{Ff} + \theta_{Fh} \log c_{Fh}$$

$$\textit{subject to} \quad z_H + z_F - z_{HG} - z_{FG} \geq \frac{c_{Hh}}{g_H} + \frac{c_{Fh}}{g} + \frac{c_{Ff}}{g_F} + \frac{c_{Hf}}{g}$$

The solution of the co-operative case yields the following two conditions:

$$(14)\quad \frac{1}{z_H + z_F - z_{HG} - z_{FG}} = \theta_{Hh} \frac{g'_H(z_{HG})}{g_H(z_{HG})} + (\theta_{Hf} + \theta_{Fh}) \frac{g'(z_{HG} + z_{FG})}{g(z_{HG} + z_{FG})}$$

$$(15)\quad \frac{1}{z_H + z_F - z_{HG} - z_{FG}} = \theta_{Ff} \frac{g'_F(z_{FG})}{g_F(z_{FG})} + (\theta_{Hf} + \theta_{Fh}) \frac{g'(z_{HG} + z_{FG})}{g(z_{HG} + z_{FG})}$$

Let us compare (14) and (15) with those corresponding to the voluntary contributions equilibrium. Given the logarithmic specification, θ_{ij} represents the fraction of its net income (z_i, z_{iG}) that country spends on the good produced by country *j*. Since the solutions for the two countries are symmetric, let us concentrate on (14) and (9), the solutions for the home country. The left-hand side of (9) captures the home marginal cost while the corresponding term in (14) represents the global marginal cost of infrastructure investment. An increase in infrastructure investment by one unit reduces the amount available for consumption by one unit. The social planner of *H* takes into account that home consumption is only reduced by a fraction θ_{Hh} of home income, while the global planner takes into account the corresponding reduction in the utility of the foreign country's representative agent caused by one unit reduction in global income. The second term of the right-hand side captures the marginal benefits of infrastructure investment from the reduction in the international transport cost function. While the social planner of *H* takes into account only the benefits for country *H*, the global social planner also considers the benefits for country *F*.

Equations (14) and (15) jointly determine the co-operative solution for investment in infrastructure by the two countries. Notice that the only difference between the above conditions is the first term on the right-hand sides. Also the left-hand sides imply that what matters, from a global efficiency point of view, for the allocation of infrastructure investments in the two countries is their total income. The following two conditions hold at the global efficient equilibrium:

$$(16)\ \frac{dz_{iG}}{dz_i} > 0 \ \text{ and } \ \frac{dz_{iG}}{dz_j} > 0 \ ; \quad i, g = H, F\ i \neq j\,.$$

Comparing (16) and (10) it can be deduced that while in the non-co-operative case an increase in one country's income results in a decrease in the other country's investment in infrastructure (because investments are strategic substitutes), a global social planner would increase investment in both countries (because international transfers are allowed). Under the assumptions of the model a global social planner who is allowed to use international transfers will equalise the levels of infrastructure investment in the two countries. This result crucially depends on the assumption that the two domestic transport functions are identical. Nevertheless, as long as spillovers are important, a global social planner would tend to bring the two investments closer together. Comparing the constrained with the unconstrained global optimum it can be shown that if there is complete symmetry (the endowments are equal), then the unconstrained and the constrained global optima are identical. This result is not surprising since the only difference between the two global optima is whether or not international transfers are allowed. It is only when countries are not identical that the social planner can use international transfers to increase welfare. Thus, relative to the unconstrained (first-best) optimum low-income countries will tend to under-invest under voluntary contributions.

These findings have important policy implications, particularly for trading blocks such as the European Union. They suggest that such blocks are likely to be better off by addressing the co-ordination problem associated with the provision of trade-promoting public infrastructure[13].

4.2. Empirical evidence

In their empirical contribution, Bougheas *et al.* (2003) examine how infrastructure investment responds to changes in the levels of domestic and foreign income. Their theoretical prediction is that an increase in one country's income leads to an increase in that country's infrastructure investment and a decrease in the other country's in both the voluntary contribution equilibrium and the constrained global optimum. In contrast, in the unconstrained global optimum an increase in one country's income leads to an increase in both countries' infrastructure investment. As a first basic check of the model, the prediction that an increase in domestic income leads to an increase in domestic infrastructure investment is tested. Additionally, evidence is provided on the effect of foreign income on domestic infrastructure investment. They predict that this effect should be negative, as long as the unconstrained global optimum does not obtain. Thus, evidence of a negative effect would imply that infrastructure levels are not optimal.

The realities of a multi-country setting are captured by the convention that the 'foreign country' represents all trading partners of the domestic economy. The model of infrastructure investment is specified in log-linear form and relates the logarithm of per capita infrastructure investment of a country *i*, denoted i_i, to per capita income in that country, y_i, and per capita income in other countries, fy_j, and a number of variables that capture the characteristics of the country in question, α_i. Since the model is estimated using panel data all variables are further subscripted to indicate a specific time period. The estimation equation therefore takes the following form:

$$i_{it} = \alpha_{it} + \beta_1 y_{it} + \beta_2 fy_{jt} + \beta x_{it} + u_{it}$$

where *i* indexes countries and $i = 1......n$, and indexes time periods where $t = 1......T$.

The specification of the foreign income variable is particularly important. In particular, countries can observe more than one neighbour at a time, which suggests that the coefficients on the income of every foreign country should be estimated separately. However, this would imply a significant loss of degrees of freedom that renders this approach impossible in cross-section estimation. Furthermore, the estimation of n - 1 foreign income coefficients is likely to introduce multicollinearity. In order to overcome these problems it is customary to impose some structure on the specification of the foreign variable that results in the estimation of only one parameter (see Anselin and Bera, 1998). This is achieved through the use of a spatial weights or connectivity matrix, *W*, which has to be specified by the researcher. This weights matrix consists of individual elements w_{ij} such that the foreign income variable is specified as a weighted sum:

$$(18)\quad fy_{jt} = \sum_{j=1}^{n} w_{ij} y_{jt}$$

or in vector form for each cross-section, with $w_i = 0$, $FY_t = WY_t$.

This specification allows the authors to relate the infrastructure investment at one point in space to the income in other points in space, and they refer to the foreign income as the spatially weighted income[14]. An important issue is the choice of the weights, w_{ij}. One of the most widely used specifications of these spatial weights is based on the concept of connectivity which is measured as a binary variable which is equal to one if countries *i* and *j* have a common border and zero if they do not have a common border[15]. This implies that such a specification assumes that only neighbouring countries have an effect on the investment decision of the home country. Another widely used specification utilises the distance or inverse distance between two countries, which implies a distance decay of the effect of foreign countries (see Ord, 1975, Cliff and Ord, 1981, Bell and Bockstael, 2000). Of course the theoretical model also suggests a specification of the spatial weights, namely trade weights implying that foreign countries with which the home country trades more have a larger impact. Scaling the weights so that they sum to one renders the spatial weights matrix non-symmetric but facilitates the interpretation of the results since this imposes the restriction that the sum of the neighbours of each country are treated equally.

The data set consists of annual observations for the period 1987 to 1995 covering 16 European countries, namely Austria, Belgium/Luxembourg, Denmark, Finland, France, Germany, Greece, Ireland Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.[16] Separate investment equations for investment in roads, rail infrastructure, maritime ports and airports are estimated. Infrastructure investment depends on the per capita income in the home country, y_{it}, as well as the foreign per capita income, fy_{it}, the construction of which was discussed in the previous section. In order to account for the specific characteristics of each country Bougheas et al (2003) include a set of additional variables,

x_{it}, which are further outlined in this section. In order to take account of scale effects they include size of the population, p_{it} and the population density, pd_{it}. Since countries with a high population density can achieve a given service level with a lower density of infrastructure stock than countries that have a scattered low-density population population density, pd_{it}, is also included on the RHS. Another important variable is the existing stock of infrastructure since countries that have already completed a network will need less additional investment than countries that are still building up a network. The existing per capita road stock, $rden_{it}$ (kilometres of road per inhabitant) in the road investment equation and the per capita stock of rail lines in the rail investment equation are therefore also included on the RHS. For the other two investment equations, namely maritime ports and airports no stock variables are available, and indeed capital stocks are not available for most countries for any of the infrastructure types.

Financing issues may also be important determinants of investment. Countries with a high level of debt are likely to reduce their investment in order to improve their fiscal position. To capture this effect the authors include government debt expressed as a percentage of GDP, de_{it} and the long-run interest rate, ir_{it}. As the sample consists of European countries, some of which have been receiving large transfers from the EU Commission as part of the Structural Funds in order to improve their infrastructure a dummy variable is also included which equals unity from 1988 onwards, for those countries that received the bulk of these funds. Thus, the infrastructure investment equation is as follows:

$$(19)\quad i_{it} = \alpha_z + \beta_1 y_{it} + \beta_2 fy_{it} + \beta_3 p_{it} + \beta_4 pd_{it} + \beta_5 de_{it} + \beta_6 ir_{it} + \beta_7 rden + \beta_8 coh_{it} + u_{it}$$

This is estimated using three different specifications of the foreign income variable, namely (i) using binary contiguity weights (ii) using trade weights and (iii) using inverse distance weights. Overall particular importance is attached on b_1 and b_2 in equation (19), which are expected to be positive and negative, respectively.

The data were drawn from the following sources. Gross Investment in Roads, Railways, Maritime Ports and Airports in constant 1995 ECU was obtained form the report of the European Conference of Ministers of Transport (1999) entitled "Investment in Transport Infrastructure 1985-1995: Country Studies"[17]. This was converted to US Dollars using the ECU/$ exchange rate from the OECD Economic Outlook. Population, the long-run interest rate and GDP in constant 1995 US Dollars, PPP adjusted, were also obtained from the OECD Economic Outlook. The long-run interest rate refers to the 10-year government bond yield. In the case of Greece the long run interest rate could not be obtained from the OECD, IMF or Eurostat, and hence the short-run interest rate was used instead.

The spatial weights used are the binary contiguity weights, distance weights and trade weights. The road length was obtained from the International Road Federation World Road Statistics Year Books. The data for rail network length were obtained from the World Bank Railways Database[18]. The distance weights refer to great circle distance between the centre of each country, and this was calculated using the SpaceStat programme (see Anselin, 1995) in conjunction with the ArcView GIS package. The trade weights are derived using total trade, that is imports plus exports between country pairs, where the trade data was obtained from UN International Trade Statistics. In order to obtain a reasonable sample size for estimation all the observations are pooled, yielding a potential sample of 144 observations. However, as there are missing observations for some countries at least one country had to be eliminated from the estimation, and thus the maximum number of observations is 135 in the case of roads and rail investment and the minimum of 117 for airport investment[19].

In order to obtain benchmark results against which the results of the full models can be judged, they estimate the infrastructure investment equations excluding the sum of the foreign incomes using ordinary least squares estimation (OLS)[20]. The results from this estimation of the two base specifications shown in Tables 2 to 5 confirm that the income of the home country has a significant positive effect on domestic infrastructure. Countries with a larger population invest more in roads, rail and airports, while such countries invest less in maritime ports. Countries with a higher population density invest less in roads and airports but more in rail and maritime port infrastructure. A high debt to GDP ratio decreases investment in all cases except for airport investment. A higher long-run interest rate depresses investment in roads and airports. The Cohesion Countries, Greece, Ireland, Portugal and Spain which receive high levels of Structural Funds assistance invest more in road and port infrastructure. In order to account for differences between countries which are located on island (Ireland and the UK) and the other countries with respect to maritime port infrastructure a dummy was added. The coefficient for this dummy turns out to be negative indicating that these island countries invest less in maritime port infrastructure, perhaps because they are already well served by port infrastructure. A higher per capita road stock reduces road investment but a higher per capita rail stock increases rail investment. The latter may be explained by the preferences of policy makers in some countries to focus on rail investment and keeping the stock of rail lines high while in many countries the length of the rail stock has fallen and other forms of transport have been given higher priority.

Turning to the estimation of the fully specified equations, the results are presented in the remaining columns of the same tables. The inclusion of the weighted foreign incomes does not change the signs of the coefficient, and the inclusion of these adds to the explanatory power of the model. In nine of the twelve columns, the sign of the foreign income is negative and only one of the positive coefficients is statistically different from zero. Thus, the results confirm that domestic infrastructure investment is increasing in domestic real GDP and decreasing in foreign income, irrespective of the definition of the latter.

The OLS estimates presented in Tables 2 to 5 assume that domestic income is exogenous. However, this assumption may not be valid since, as has been shown in some studies, a higher stock in infrastructure, which will of course only be achieved through investment in infrastructure, will lead to higher output and therefore income. To examine the robustness of our results to this assumption, Bougheas *et al.* also estimate the infrastructure equations using instrumental variable (IV) estimation, where domestic income is instrumented by the lag of domestic income. The results from the IV estimation which are not reported here are very similar to those found using OLS and it can therefore be concluded that endogeneity is not a problem. Thus, the result that infrastructure investment is negatively related to the sum of all trading partners' incomes is found to be robust. The fact that the parameter on the foreign income variables is negative in almost all cases despite the differences in the weights matrices further highlights the robustness of their results.

Given that the spatially weighted foreign income was measured by a weighted sum, some further comments about the interpretation of the results are in order. Firstly, it should be noted that a one percent increase in all 15 foreign countries' per capita GDP will result in a one percent increase in the foreign variables, for both the trade and the distance weighted foreign incomes. For the contiguity weighted sum this depends on the number of contiguous countries. For example, Austria has just three neighbours so a one-percent increase in one of these countries' income would result in an increase in the contiguity weighted foreign income of one third of a percent. For the other two spatially lagged foreign income variables the impact of an increase of the per capita GDP of one country on the investment decision in another, depends on the weight it is given in the spatial weights matrix. This in turn depends on either the distance between the two countries or the trade share.

Table 2. **Investment in Roads Infrastructure (OLS)**

	1	2	3	4
Per capita GDP	1.38 (0.18)	1.62 (0.18)	1.46 (0.17)	1.36 (0.15)
Foreign per capita GDP				
First Order Contiguity Weights		-1.18 (0.25)		
Trade Weights			-3.49 (0.86)	
Distance Weights				-4.33 (1.26)
Population	0.15 (0.01)	0.12 (0.01)	0.11 (0.01)	0.14 (0.01)
Population density	-0.23 (0.02)	-0.22 (0.02)	-0.21 (0.02)	-0.20 (0.02)
Long-run interest rate	-0.79 (0.10)	-0.74 (0.11)	-0.72 (0.11)	-0.71 (0.10)
Debt to GDP ratio	-0.30 (0.03)	-0.28 (0.03)	-0.31 (0.03)	-0.28 (0.03)
Per capita roads (km)	-0.24 (0.06)	-0.25 (0.05)	-0.30 (0.06)	-0.15 (0.05)
Cohesion country dummy (88)	0.36 (0.09)	0.25 (0.07)	0.29 (0.07)	0.20 (0.10)
N	135	135	135	135
$\bar{R}^2$	0.72	0.73	0.73	0.73

Source: Bougheas *et al.* (2003).

Table 3. **Investment in Rail Infrastructure (OLS)**

	1	2	3	4
Per capita GDP	2.34 (0.41)	2.58 (0.44)	2.00 (0.37)	2.50 (0.80)
Foreign per capita GDP				
First Order Contiguity Weights		-0.83 (0.40)		
Trade Weights			11.21 (1.71)	
Distance Weights				-13.67 (2.32)
Population	0.13 (0.03)	0.14 (0.03)	0.14 (0.04)	0.14 (0.04)
Population density	0.46 (0.03)	0.44 (0.04)	0.34 (0.03)	0.44 (0.02)
Long-run interest rate	0.56 (0.11)	0.46 (0.15)	0.53 (0.09)	0.26 (0.15)
Debt to GDP ratio	-0.42 (0.05)	-0.37 (0.07)	-0.43 (0.05)	-0.16 (0.07)
Per capita rail lines (km)	0.76 (0.06)	-0.79 (0.04)	0.56 (0.03)	0.98 (0.05)
Cohesion country dummy (88)	-0.06 (0.04)	-0.14 (0.17)	0.21 (0.15)	-0.48 (0.33)
N	135	135	135	135
$\bar{R}^2$	0.66	0.66	0.74	0.72

Source: Bougheas *et al.* (2003).

Table 4. **Investment in Maritime Port Infrastructure (OLS)**

	9	10	11	12
Per capita GDP	3.15 (0.77)	4.58 (0.60)	3.11 (0.80)	4.75 (0.52)
Foreign per capita GDP				
First Order Contiguity Weights		-3.39 (0.67)		
Trade Weights			0.78 (2.58)	
Distance Weights				-19.66 (2.41)
Population	-0.25 (0.03)	-0.26 (0.04)	-0.25 (0.03)	-0.38 (0.04)
Population density	0.18 (0.03)	0.16 (0.03)	0.18 (0.04)	0.24 (0.03)
Long-run interest rate	-0.13 (0.30)	-0.01 (0.24)	-0.16 (0.30)	0.19 (0.25)
Debt to GDP ratio	-0.39 (0.07)	-0.31 (0.06)	-0.39 (0.07)	-0.38 (0.07)
Cohesion country dummy (88)	0.61 (0.23)	0.46 (0.14)	0.63 (0.22)	0.32 (0.10)
Island dummy	-0.62 (0.07)	-0.64 (0.07)	-0.61 (0.07)	-0.40 (0.06)
N	117	117	117	117
$\bar{R}^2$	0.52	0.61	0.52	0.69

Source: Bougheas *et al*. (2003).

Table 5. **Investment in Airport Infrastructure (OLS)**

	13	14	15	16
Per capita GDP	1.51 (0.41)	1.89 (0.59)	1.99 (0.44)	1.50 (0.47)
Foreign per capita GDP				
First Order Contiguity Weights		-0.86 (0.51)		
Trade Weights			-10.47 (1.60)	
Distance Weights				0.21 (2.19)
Population	0.11 (0.03)	0.11 (0.02)	0.08 (0.02)	0.11 (0.03)
Population density	-0.19 (0.06)	-0.21 (0.07)	-0.16 (0.06)	-0.20 (0.06)
Long-run interest rate	-0.58 (0.25)	-0.53 (0.26)	-0.41 (0.24)	-0.59 (0.27)
Debt to GDP ratio	0.10 (0.06)	0.13 (0.08)	0.13 (0.07)	0.10 (0.07)
Cohesion country dummy (88)	-0.09 (0.13)	-0.14 (0.11)	-0.22 (0.11)	-0.08 (0.12)
N	126	126	126	126
$\bar{R}^2$	0.47	0.47	0.50	0.46

Source: Bougheas *et al*. (2003).

To see how the spatial weights matrix determines the effect of the income in one country on the investment decision in another it is instructive to take an example. Take the investment decision of Belgium and the income of France and Finland. Since Finland is not a neighbour of Belgium it has a zero weight in the contiguity matrix, while France is one of the four neighbours of Belgium and thus has a weight of one quarter. However, since the per capita GDP of France is slightly higher than the average for the four neighbouring countries of Belgium, a one percent increase in French per capita GDP will result in an increase of just over one quarter of a percent in the contiguity weighted foreign GDP of Belgium. Turning to the trade and distance weighted foreign GDP's the weights for France are 0.2242 and 0.155341 respectively, while those for Finland are 0.0082 and 0.024261 respectively. These imply that a one percent increase in the per capita GDP of France results in a 0.23% increase in the trade weighted foreign income and 0.16% increase in the inverse distance weighted sum of foreign income of Belgium. A similar increase in the per capita GDP of Finland gives rise to an increase of 0.01% and 0.02% of the spatially weighted foreign income measures respectively. This example highlights that the three spatial weights give substantially different importance to individual countries.

These differences in the weighting schemes also explain the differences in the size of the parameter. This is easily demonstrated by a simple example that results in a one percent increase in the weighted foreign income variable. Again, taking the case of Belgium for 1995, a one percent increase in the GDP of all other countries would result in a one percent increase of the trade and distance weighted sums of foreign income. However, a one percent increase in the per capita GDP of just four countries, namely France, Germany, the Netherlands and the UK would yield a one percent increase of sum of the contiguity weighted foreign income. In the former case this would amount to a total increase of $2936.15 while the latter would be achieved through an increase of just $818.99. Thus, apart from attributing contrasting importance to individual countries the particular weighting scheme also implies differences regarding the absolute size of a change in foreign income needed to achieve a certain change in the weighted sums. If the income of Belgium's four neighbouring countries were to increase by $2936.15, which is equivalent to a one percent increase in the income of all countries, the impact of such a change would be 3.6 times larger than the impact of a one percent increase of the income of these four countries alone. Given the parameter estimates the impact from this would be similar to the impact of a one percent increase in all foreign countries using the trade and distance weighted foreign income.

5. CONCLUDING REMARKS

This paper provides an overview of academic literature which suggests that investment in transport infrastructure may have important positive influence in promoting international trade and economic growth. It also provides some relatively new ideas as to why levels of infrastructure investment may be sub-optimal, not only in developing but also in developed economies.

While the academic literature on the effects of infrastructure on productivity and growth has grown quite considerably in recent years, there is, thus far, very little work that has been done on the relationship between infrastructure and trade facilitation. Further work in this area is needed not only in order to advance the academic literature but also to inform policy makers around the world. An important policy dimension in the context of international trade relates to the externalities and spillover effects of infrastructure across countries – which remains an under-researched question, especially in a multilateral context. One possible finding that could emerge from such research is that, given its international public good aspects, both the provision and financing of infrastructure should involve much more regional and international co-operation among policy makers than has hitherto been the case, even within trading blocks like the EU.

The literature reviewed in this paper suggests that infrastructure investment in any economy has an important international dimension. Infrastructure investment appears to be a strategic decision that can not be examined in isolation of the investment decisions of a country's trading partners. Empirical findings also suggest that this strategic behaviour arises from the spillovers across national boundaries created by infrastructure investments, which are an important determinant of international transport costs. These findings have important policy implications, particularly for trading blocks such as the European Union. Such blocks are likely to be better off by addressing the co-ordination problem associated with the provision of trade-promoting public infrastructure.

NOTES

1. E.g. Dollar and Kraay (2004).

2. E.g. Perera-Tallo (2003), Bougheas, Demetriades and Mamuneas (2000).

3. Feenstra (1998) provides the example of Mattel's Barbie doll, the production costs of which are $1 yet it sells in the US for $10. Thus, trade costs are equivalent to a 900% ad-valorem tax.

4. The seminal work of David Aschauer (1989a, 1989b, 1989c) estimated the rate of return of public capital in the US to be around 60% per annum. Even though Aschauer's findings have been questioned by subsequent literature, on balance the literature suggests that there may well be under-investment in infrastructure, not only in developing countries but also in developed ones. See, for example, Nadiri and Mamuneas (1994), Lynde and Richmond (1992), Gramlich (1994), Morrison and Schwartz (1996), Demetriades and Mamuneas (2000).

5. "As by means of water-carriage a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon the sea coast, and along the banks of navigable rivers, that industry of every kind naturally begins to subdivide and improve itself…" A. Smith, Wealth of Nations, 1937, p. 18.

6. This means that only a fraction of the quantity shipped arrives at its destination – the rest evaporates like an iceberg.

7. The seminal work of David Aschauer (1989a, 1989b, 1989c) placed the rate of return of public capital in the US at around 60% per annum, much higher than the rate of return to private capital, suggesting substantial shortfalls in public investment. Even though Aschauer's findings have been questioned by subsequent literature, on balance the literature suggests that there is likely under-investment in infrastructure, not only in developing countries but also in developed ones. See, for example, Nadiri and Mamuneas (1994), Lynde and Richmond (1992), Gramlich (1994), Morrison and Schwartz (1996) or Demetriades and Mamuneas (2000). These findings contrast sharply with the results of cost-benefit analyses of specific infrastructure projects. Policy makers in developed countries may well argue that they undertake all infrastructure projects with positive net present value. This paradox may well reflect the inability of cost-benefit studies to capture the full dynamic externalities of large infrastructure projects.

8. The millennium dome in the UK, which cost £800 million, is a very telling example in this respect.

9. Analysing the same problem in a multilateral setting should produce further insights but at this stage this remains a question for further research.

10. The assumptions on preferences and the transportation costs functions ensure that the second order conditions for a maximum are satisfied in both stages.

11. It can be shown that the equilibrium is both unique and stable.

12. Available from the authors on request.

13. While the European Union (EU) Structural Funds are aimed at economic growth and the recovery of regions that are underdeveloped by comparison with the European Community average, they have not been specifically designed to address co-ordination failures of this type. Yet the Structural Funds are particularly well suited for this purpose since optimal provision of public capital is also likely to raise the rate of return of public capital, thereby increasing economic growth.

14. The term spatial lag is also often used in the literature. Both refer to the fact that the observations are neighbours in space rather than in time as would be the case in time series analysis where the lag would refer to the value of a variable in the previous time period.

15. Moran (1948) and Geary (1954) first proposed binary contiguity between spatial units in their pioneering papers on measures of spatial dependence.

16. The choice of countries was determined by the availability of the infrastructure investment data.

17. It would be preferable to use net road investment rather than gross investment, thereby taking account of differences in depreciation rates, but since such data is not available the analysis has to rely on gross investment data.

18. Available from: http://www.worldbank.org/transport/rail/rdb.htm

19. The countries that had to be left out due to missing observations were: Roads (Portugal), Rail (Greece), Maritime Ports (Denmark, Austria and Switzerland) and Airports (Austria and Ireland). Of course for Austria and Switzerland maritime port investment is unavailable since these are landlocked countries.

20. All estimations were carried out using TSP version 4.4, and the standard errors are derived using the TSP code available from John Driscoll's web site at http://econ.pstc.brown.edu/~jd/.

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Road infrastructure in Europe and Central Asia: Does network quality affect trade?

by

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SUMMARY

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ABSTRACT

We examine the impact of road network quality on intra-regional trade in Europe and Central Asia. Computerized mapping techniques are used to compile a new database of minimum-distance routes connecting 138 cities in 27 countries. Inter-country road quality indices reflecting both average and minimum quality on each route are then calculated. Gravity model results show that upgrading roads to the current regional average could increase trade substantially: up to about 60% of baseline trade or up to approximately \$65 billion. This total includes an estimate of the costs of upgrading road quality networks in the region. Moreover, results indicate modernizing road infrastructure in the region could produce greater benefits than comparable programs of tariff reduction or streamlining customs regulations. Infrastructure spillovers are found to be significant: 60% of the overall trade gains could be captured by upgrading road infrastructure in three countries—Albania, Hungary and Romania.

Keywords: International Trade; Europe and Central Asia; Road Transport; Trade Facilitation; Gravity Model.

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1. INTRODUCTION

Provision of good-quality, well-maintained and efficient transport infrastructure is one important way in which governments can help firms engage more actively in international trade. Indeed, at a time when tariff barriers are in general at historically low levels in many countries, it is likely that transport and transaction costs often represent more serious impediments to exports than do traditional trade policy measures (see e.g., Hummels, 2001; Anderson & Van Wincoop, 2004). In Eastern Europe and Central Asia (ECA), this argument has particular importance given the trade dependence of many countries in the region. From Table 1, which shows the ratio of merchandise exports to GDP for the 27 regional economies analyzed in this paper, we can see that ECA countries are generally more trade-dependent than the world and income group averages. In most cases, they have become increasingly so over the last decade.

Notwithstanding this, the transport sector in a number of ECA countries remains subject to high costs. According to Molnar and Ojala (2003), for example, transport costs in Central Asia and the Caucasus are at least three times higher than those prevailing in developed countries. This is due, in part, to a combination of corruption, inefficient customs procedures and regulations, small and fragmented transport sectors, underdeveloped multi-modal interfaces and physical infrastructure impediments. Moreover, a high proportion of ECA countries (11 out of 27) suffer from being landlocked. This is known to imply particular difficulties in terms of integration into the trading system (Raballand, 2003; Cadot *et al.*, 2006). Most notably, the ability of landlocked countries to access world markets depends not only on the quality of their own infrastructure, but also on that of countries through which their goods must transit. This phenomenon is all the more serious when, as in Central Asia, political instability often leads exporters to favor overland routes into Europe to sea-based routes passing through the Persian Gulf (Cadot *et al.*, 2006).

Data from recent editions of the Doing Business Report (World Bank, 2006 & 2007) can be used to provide a simple but compelling overview of the difficulties ECA countries face when it comes to trade. These reports—which are based on surveys of the private sector—show that delays at export in the ECA region are more than twice as long as in the OECD. At import they are more than three times as long (see Table 2). Taking the US dollar price of exporting and importing a container of goods in 2006 as a baseline, the same source shows that the cost of trading in the ECA region is approximately double the average rate among OECD countries. In sum, the cost of exporting from ECA countries appears little different from that in Sub-Saharan Africa (SSA), while the cost of importing is similar to that in South Asia.

The contrast with traditional trade policy measures in the ECA region is striking. Protection is higher than the OECD average, but can nonetheless be characterized as generally moderate. Table 3 reproduces extracts from the Overall Trade Restrictiveness Index (OTRI) of Kee *et al.* (2006), which represents the uniform tariff required in each country to achieve an equivalent level of total imports as under current policy settings. When only tariffs are considered, the ECA countries' average OTRI comes out at approximately 7%, compared with 5.5% for the OECD. Even with the inclusion of non-tariff barriers, the comparison is 12% (ECA) versus 11% (OECD). Table 3 shows that although these averages conceal considerable cross-country heterogeneity, the overall picture that emerges is one of moderate trade protection in the region—in contrast to the very high trade and transport costs referred to above.

It is also important to examine the trade policy barriers faced by regional exporters in trading with the rest of the world. To do this, we use the Market Access OTRI (MAOTRI) of Kee *et al.* (2006), which represents the uniform tariff required in the rest of the world in order to achieve an equivalent level of total exports from a given country as under current policy settings. It is therefore an appropriate summary measure of the average degree of restrictiveness faced by exporters in any given country vis-à-vis the rest of the world. Table 4 shows that ECA countries do not in general face inordinately high barriers in the world market when compared with those faced by exporters in OECD countries. The average MA-OTRI for the ECA region is 9.4% (tariffs only) or 16.4% (tariffs and NTBs), which compares quite favorably with the corresponding rates of 7% and 13% for the OECD.

Summarizing the above, it is clear that ECA exporters face significant hurdles. However, a comparison with those faced by exporters in OECD countries is instructive. In terms of "traditional" trade policy (i.e., tariffs and the like), ECA countries do not fare too much worse than their OECD counterparts, regardless of whether the metric used is their own trade restrictiveness or that of their trading partners. On the other hand, transport costs are very high relative to the OECD, and the cost of moving goods across borders is correspondingly greater. The region therefore has considerable progress left to be made in terms of the broad trade facilitation agenda, which we take to include a wide range of policy measures designed to reduce trade costs. The breadth of this definition means that the range of policies to be considered under the heading of trade facilitation runs from streamlining of customs regulations procedures (i.e., the sense in which the term is used at the WTO) to improvement of the domestic regulatory environment, or upgrades of trade related infrastructure. Given that the ECA region is starting from a relatively low baseline in terms of tariffs but a relatively high one in terms of trade and transport costs, it seems plausible that the impact of policy interventions in the latter domain might be greater than in the former. In other words, there would seem to be real scope for the ECA region to reap significant gains from additional investments in infrastructure and trade facilitation.

As the above discussion makes clear, the question of policy reform in this area is a complex and multifaceted one. In order to make the best use both of available financial resources and political capital, it is important for policymakers to target reforms at points where the expected net payoff is high relative to other possibilities. To do that, they need assessments of the relative costs and benefits of different reform possibilities. Our paper seeks to inform that process in the ECA region by providing a quantitative assessment of the potential intra-regional trade gains from upgrading road transport infrastructure—a particularly important part of national trade infrastructure for many ECA countries, for the reasons set out above. We then compare the gains from a hypothetical infrastructure upgrade with the possible outcomes from alternative reforms, such as reducing tariffs or streamlining customs procedures.

A number of previous papers have investigated the trade impacts of infrastructure quality, including roads[1] Bougheas *et al.* (1999) construct a theoretical model of infrastructure and trade, then test it using a gravity model augmented to include data on the stock of public capital and the length of the road network in importing and exporting countries. Limao & Venables (2001) use data on road, rail and telephone network density to estimate the importance of infrastructure in explaining global transport costs. They also use a gravity model to investigate the direct trade impacts of infrastructure quality in exporting, importing and transit countries.

Cadot *et al.* (2006) adapt their approach to the Central Asian context and use alternative estimation methodologies for the gravity model. Nordas & Piermartini (2004), on the other hand, use the Limao & Venables (2001) approach with a broader range of infrastructure indicators, and attempt to identify the effects of individual components (road, rail, etc.). They focus on three broad product sectors, in order to examine possible heterogeneity that could be obscured by using total trade flows. They also account for the impact of tariffs. Whereas the preceding papers use simple averages in calculating an overall infrastructure index, Francois & Manchin (2006) use a principal components weighting scheme. They then estimate a gravity model that emphasizes threshold export propensity in addition to the intensity of observed flows, while also controlling for the effect of applied tariffs.

Two very recent papers consider the issue of road quality in isolation from other aspects of national infrastructure. The first of them, Coulibaly & Fontagne (2006), focuses on countries in West Africa. The authors find that a composite measure of road quality in the importing and exporting countries has a statistically significant (and negative) effect on trade, in the context of a gravity model. Transit effects are also found to be important, with the authors using a count of the number of borders crossed as a proxy. By contrast, Buys *et al.* (2006) examine road network quality across the whole of Sub-Saharan Africa (SSA). They use detailed road transport data to construct measures of international distance on an overland basis. They then build up a multi-dimensional measure of road quality, which is aggregated in such a way as to take proper account of transit effects. Results from their gravity model show that network quality has a significant impact on intra-regional trade, while simulations suggest that the net benefits of a road upgrade are very substantial.

In sum, there is considerable evidence to the effect that infrastructure matters for transport costs, and thus for trade flows. However, the relative trade benefits of upgrading infrastructure versus reducing tariffs or implementing trade facilitation measures, is less well understood[2]. Moreover, there is relatively little work focusing on road transport infrastructure in particular, notably outside the SSA region. In the ECA regional context, overland transport is particularly important in light of the significant number of landlocked countries in the region (11 out of the 27 included in our sample). This paper is intended to move forward in these directions, by focusing on road transport infrastructure in the ECA region and taking a comparative approach to the estimation of the benefits expected from an upgrade.

While our paper builds on the recent work by Buys *et al.* (2006), there are also some important differences. In particular:

- The focus of this paper is on an assessment of the relative benefits of different policy options, including a road network upgrade. We therefore include data on applied tariffs and trade facilitation in our model of intraregional trade, and conduct simulations of policy changes in each of the three areas;

- We pay particular attention to the identification of infrastructure bottlenecks, which in turn highlights important areas to target as part of a reform program;

- We establish the robustness of our results to different proxies for road network quality;

- Our model disaggregates trade data into broad product categories (BEC single digit);

- We rely on a theoretically-grounded version of the gravity model, due to Anderson & Van Wincoop (2003, 2004); and

- We ensure that our results are robust to the presence of zero trade flows by using Poisson and negative binomial quasi-maximum likelihood estimators.

Our paper proceeds as follows. We first use computer mapping software to construct a new database of road distances connecting 138 cities across 27 ECA countries. We aggregate inter-city distances to the country level, producing international distance measures that we show to be quite different from the standard measures used in applied international trade work (Section 2). We then construct two indices of road quality. The first proxies network quality by the percentage of national roads that are paved. The second includes in addition a measure of national capacity to maintain road infrastructure, as well as capability to limit unofficial payments. We then use national indices and the roads dataset to produce distance-weighted and minimum quality measures on a bilateral (country-pair) basis, taking account of actual overland transit routes (Section 3).

In Section 4, we use a gravity model of international trade to assess the impact of our new distance and quality measures on intra-regional trade, and to make comparisons with the impacts of traditional trade policy measures (tariffs) and inefficient customs clearance regulations (as measured by the number of documents required at export and import). After estimating a number of different specifications using various econometric methodologies, we conclude that an improvement in average or minimum road network quality is robustly associated with increased intra-regional trade. According to our preferred specification, the relevant elasticities are 0.8 (average quality) and 0.6 (minimum quality). Section 5 presents the results of simulation exercises in which we consider a hypothetical road network upgrade, and show that a large part of the gains can be appropriated to the region by focusing the intervention on a small number of countries. It is also demonstrated that the gross trade gains from comparable programs of tariff cuts and reductions in customs formalities are likely to be of lesser magnitude. Section 6 then provides a ballpark assessment of the likely costs involved in road network upgrading in the ECA region, using data compiled by the World Bank. We show that even once the direct costs are netted out, the benefits are still likely to be large compared with other scenarios. The paper concludes with some policy implications of our findings, as well as a number of suggestions for further research.

2. MAPPING ROAD NETWORKS IN EUROPE AND CENTRAL ASIA

The ECA road network is notable for its wide geographic extent. It extends from the Czech Republic in the West to Russia (Siberia) in the East, and from Turkmenistan in the South to the Baltic States and Russia in the North (see Table 1 for a full list of the countries included in our sample). Inter-city distances are often long. They span up to about 11 500 kilometers for the most distant city pair considered here (Tirana in Albania and Vladivostok in Russia). While the road network is extensive, it is also known to exhibit variable quality. This is particularly true in areas where the post-Communist transition has been long and difficult. The Communist legacy can also be seen particularly in Central Asia, where road links between those Republics and Moscow are often vastly superior to links among the Republics themselves (see Molnar and Ojala, 2003; ADB, 2006; and Cadot *et al.*, 2006 for further details).

Given these considerations, mapping the ECA network requires a considerable quantity of information which must then be summarized in ways useful in the context of modeling international trade flows within the region. As in Buys *et al.* (2006), we use a computerized map and spatial network analysis software to produce a minimum-distance network of roads in the ECA region. Our analysis covers 27 countries and connects 138 cities within those countries, i.e. all regional cities with a year 2000 population of over 300 000 people. This produces 9 453 inter-city routes along 2 411 individual arcs, represented graphically in Figure 1. For each route, we are able to identify the exact road distance travelled in each of the sample countries. For instance, the minimum distance route from Prague to Moscow includes 128.6 km of road travel in the Czech Republic, 723.6 km in Poland, 547.2 km in Belarus and finally 454.4 km in Russia. These transit distances will be of vital importance below, when we come to designing an appropriate weighting scheme for our road network quality indicators.

It can immediately be seen both from Figure 1 and Table 3, which provides a breakdown of the number of cities per country in our database, that a few countries play a very significant role in driving our picture of the ECA road network. Given the minimum population threshold we have chosen, Russia, Ukraine and Poland alone account for 65% of the cities in our database (45% just in Russia). The flipside of this observation is that the comprehensiveness of our measure of the road network varies considerably across countries. While this means that our database abstracts considerably from reality by excluding many smaller cities—and by implication, a considerable part of the overall road network—we are confident nonetheless that our measure captures that part of the network that is of greatest relevance for the analysis we are interested in, namely, the international trade dimension. Moreover, such abstraction is necessary even in alternative measurement schemes, such as using the great circle distance between largest or capital cities.

The gravity model that will be estimated in Section 4 uses trade data aggregated to the national level. Our road distance data will therefore need to be aggregated to the same level. To do that, we adopt the convention that the distance between two countries will be treated as the unweighted mean of the minimum road distances between all relevant cities in those two countries, as in Buys *et al.* (2006)[3].

It is useful at this point to consider the relationship between the distance measures constructed as set out above, and the great circle distances more commonly used in the international trade literature. As a point of comparison, we use the great circle distance measures from the dataset assembled by the CEPII research center in Paris (Mayer & Zignago, 2006)[4]. Over the full sample, our measure correlates very strongly with CEPII's (0.93). However, the scatter plot in Figure 2 shows that it is important to look beyond the full sample correlation. It is clear that great circle distances are systematically lower than the road distances calculated as set out above[5]. The difference in sometimes large: over 500% in one case. Moreover, as inter-country distance increases, the difference between the two measures appears to increase correspondingly. In other words, our results would appear to suggest that great circle distances tend to systematically underestimate inter-country distances, at least in a context where road transport is important. While great circle distance might be an acceptable proxy for relatively short inter-country distances, there are real risks of downwards bias when those distances are long[6].

3. NETWORK QUALITY

Since we are interested in examining the extent to which upgrades of existing infrastructure have the potential to increase bilateral trade, it is important to establish an appropriate measure of road network quality in each country. To do that, we adopt two approaches. The first one simply uses the percentage of paved roads in each country as a proxy for network quality in that country (cf. Coulibaly & Fontagne, 2006). The second one follows Buys *et al.* (2006) in constructing a road quality index that takes account of three different dimensions: (1) percentage of paved roads, (2) maintenance capacity, and (3) control of unofficial payments.

We define a country's road quality index score Qj as a function of the percentage of paved roads in that country (Pj), its per capita GDP (Gj) and the World Bank's Country Policy and Institutional Capacity Index (Cj):

$$Q_j = P_j^{\alpha_1} G_j^{\alpha_2} C_j^{\alpha_3}$$

As in Buys *et al.* (2006), we set the alpha coefficients such that the quality index displays slightly increasing returns. Specifically, we impose $\alpha 1=0.8$, $\alpha 2=0.2$ and $\alpha 3=0.2$. Table 7 shows the results of these calculations, along with the raw data used. Our final quality index is produced by re-scaling country scores in such a way that the leading country (Slovenia in this case) is placed at 100.

The above measure is intuitively appealing, in that it captures the multi-dimensional nature of an infrastructure upgrade. In the ECA case in particular, there is extensive qualitative evidence to suggest that maintenance capacity and corruption are serious issues (Molnar and Ojala, 2003; Cadot *et al.*, 2006). However, the regression results obtained using such an index are not simple to interpret. It can always be argued that the relevant coefficient is in fact capturing the independent effects of the variables used to construct the index, rather than a genuine composite effect of road network quality. Similar difficulties apply to the interpretation of simulation results, since it is problematic to identify a change in the Buys *et al.* (2006) index with use of a single policy instrument. It is for that reason that we use both the percentage of paved roads and the Buys *et al.* (2006) index in what follows, in the hope that consistent results obtained using the two approaches will help buttress our conclusions and simplify interpretation.

In constructing the road quality dataset, we have drawn on a number of different sources. This is because information on the percentage of paved roads sometimes varies considerably both in the cross-sectional and temporal dimensions, for reasons that are not substantive. For instance, redefinition of the national road footprint can significantly alter the apparent percentage of paved roads, even though the physical state of a country's road system is unchanged. Table 6 provides a summary of paved road data for 2003 from three common sources, along with our consolidation. We have been guided in that exercise by expert opinion from within the World Bank, and as a result we believe that our measures represent a reasonable approximation to the reality on the ground. In light of the possibility for spurious variation in the paved roads indicator through time, in addition to the difficulty of obtaining continuous series, we have opted to compile our dataset for a single year only, namely 2003.

As in Buys *et al.* (2006), we use our regional mapping to construct indicators of paved roads and road quality on a bilateral basis, taking full account of transit. We calculate weighted average measures based on paved roads and our quality index in the exporting and importing countries, as well as in all transit countries between the two. Weights are attributed according to the road distance travelled in each country along the route, as a proportion of the total distance. In addition, we calculate minimum measures using the same information but taking the minimum of paved roads and the quality index respectively over the exporting and importing countries, as well as in all transit countries between the two. While Buys *et al.* (2006) used only the minimum measure in their regressions, we will use both. This choice represents an effort to capture the basic role of network quality as a trade facilitation mechanism. It also takes into consideration the fact that in extreme cases network performance can be determined by the quality of the weakest link in the chain running from exporter to importer. We have chosen to let the data decide the issue of the extent to which variations along these two dimensions are associated with larger or smaller trade flows.

Calculation of the minimum measures provides a useful basis for outlining some simple descriptive results. Table 8 shows, for example, that across 702 country-pair routes, around 65% of minimum paved roads percentages are attributable to just three countries: Albania, Hungary and Romania. When the Buys *et al.* (2006) index is used, around 60% of minimum quality routes are found to be related to Georgia, Romania and Uzbekistan. Therefore, if it is shown below that bottleneck effects (as measured by either the minimum quality index or the minimum paved roads percentage) have a significant impact on trade, then it could be expected that infrastructure upgrades in a small group of countries would have important spill-over effects for a large number of intra-regional trade relations. This is an issue to which we return in more detail below.

4. MODEL DESCRIPTION, ESTIMATION AND RESULTS

Our goal is to produce a set of policy-relevant results indicating the potential benefits from upgrading road infrastructure in the ECA region. We also want to compare those benefits with the likely results of tariff reductions and improvements in trade facilitation. To do this, we will use a commonly accepted modelling framework that is well grounded in terms of micro-foundations, namely the gravity model formulation due to Anderson & Van Wincoop (2003, 2004). While the basic gravity intuition remains unchanged—i.e., trade flows should vary proportionally with trading partners' GDPs and inversely with distance between them—this recent work has nonetheless prompted changes to standard practice in regard to estimation (see Baldwin, 2006 for a review). These changes are necessary to reflect the fact that trade flows between two countries depend not only on prices (and trade barriers) in those countries, but also on prices (and trade barriers) in all other countries.

The basic form of our model comes directly from Anderson & Van Wincoop (2003, 2004) and can be expressed as follows:

$$(1)\ \log\left(X_{ij}^{k}\right)=\log\left(E_{j}^{k}\right)+\log\left(Y_{i}^{k}\right)-\log\left(Y^{k}\right)+\left(1-\sigma_{k}\right)\log\left(t_{ij}^{k}\right)-\left(1-\sigma_{k}\right)\log\left(P_{j}^{k}\right)-\left(1-\sigma_{k}\right)\log\left(\Pi_{i}^{k}\right)+\varepsilon_{ij}^{k}$$

Where:

X_{ij}^{k} = Exports from country i to country j in sector k

Y_i^k = Output of country i in sector k

E_j^k = Expenditure of country j in sector k

Y^k = Aggregate (world) output in sector k

σ_k = Elasticity of substitution in sector k

t_{ij}^{k} = Trade costs facing exports from country i to country j in sector k

$$\left(P_j^k\right)^{1-\sigma_k} = \sum_{i=1}^{N} \Pi_i^{\sigma_k - 1} \omega_i^k \left(t_{ij}^k\right)^{1-\sigma_k}$$

$$\left(\Pi_i^k\right)^{1-\sigma_k} = \sum_{j=1}^{N} P_j^{\sigma_k - 1} \omega_j^k \left(t_{ij}^k\right)^{1-\sigma_k}$$

ω_i^k = Country i's output share in sector k

ω_j^k = Country j's expenditure share in sector k

ε_{ij}^{k} = Random error term, satisfying the usual assumptions

It is common in applied work to specify the trade cost function in the following way (dropping the sector superscripts for simplicity):

$$
(2) \quad \begin{aligned} t_{ij}^{k} &= d_{ij}^{\rho} \tau_{ji}^{\theta} \prod_{m=1}^{M} \left(b_{m}^{z_{ij}^{k,m}} \right) \\ \Leftrightarrow \log\left(t_{ij}^{k}\right) &= \rho \log\left(d_{ij}\right) + \sum_{m=1}^{M} \log\left(b_{m}\right) z_{ij}^{k,m} \end{aligned}
$$

Where:

ρ = elasticity of exports with respect to distance

d_{ij} = distance between countries i and j.

b_m = set of m constants

z_{ij} = set of observable bilateral determinants of trade costs

Combining (1) and (2) gives the baseline "theoretical" gravity model:

$$
(3) \quad \begin{aligned} \log\left(X_{ij}^{k}\right) &= \log\left(E_{j}^{k}\right) + \log\left(Y_{i}^{k}\right) - \log\left(Y^{k}\right) + \left(1-\sigma_{k}\right)\left[\rho \log\left(d_{ij}\right) + \sum_{m=1}^{M} \log\left(b_{m}\right) z_{ij}^{k,m}\right] - \ldots \\ &\ldots - \left(1-\sigma_{k}\right)\log\left(P_{j}^{k}\right) - \left(1-\sigma_{k}\right)\log\left(\Pi_{i}^{k}\right) + \varepsilon_{ij}^{k} \end{aligned}
$$

As is commonplace in the gravity literature, we use fixed effects to take account of the combined impact of output and expenditure in both countries across the various sectors under consideration. This gives a final estimating equation of much simpler form, in which we specify reduced-form coefficients and substitute the trade cost observables we intend to use in this case[7]:

$$
(4) \quad \begin{aligned} \log\left(X_{ij}^{k}\right) &= c + \delta_{i} + \delta_{j} + \delta_{k} + \beta_{1} \log\left(dist_{ij}\right) + \beta_{2} \log\left(paved\_ave\right) + \beta_{3} \log\left(paved\_\min\right) + \ldots \\ &\ldots + \beta_{4} \log\left(1 + tariff\right) + \beta_{5} \log\left(docs\right) + \beta_{6} border + \beta_{7} colony + \beta_{8} language + \varepsilon_{ij}^{k} \end{aligned}
$$

Our data and sources are set out in detail in Table 10. For bilateral trade, we use the value of 2003 imports by BEC sector, taken from the WITS database[8]. Whenever import data are missing, we use export (mirror) data. Trade cost dummies based on geographical and historical factors (contiguity, colonization and common language) are drawn from the CEPII distance database (Mayer and Zignago, 2006). Distance is measured using average intercity road distances obtained by computer mapping, as set out above. Paved_ave and Paved_min refer to our average and minimum paved road percentages respectively (see above). They will be used interchangeably with q_ave and q_min, which refer to our average and minimum network quality indices, calculated in the way set out above, following Buys *et al.* (2006). Our tariff variable is drawn from effective applied tariffs as recorded in the WITS-TRAINS database. As a robustness check, we use both simple (tariff) and trade-weighted (tariffw) averages. For an indicator of trade facilitation, we use data from the 2006 Doing Business Report (World Bank, 2006) on the number of documents required to export and import (docs)[9]. We prefer that measure to the more commonly used indicator of time to export and import (Djankov *et al.*, 2006; Nordas *et al.*, 2006) because it does not suffer from endogeneity to trade flows in the same way. It also represents a very intuitive measure of the impact of trade facilitation in the sense of streamlining customs procedures and formalities.

4.1. Standard OLS results

As a starting point, we perform OLS regressions of (4), using a variety of different specifications[10]. For the moment, missing and zero trade flows are simply dropped from the sample; this is an issue to which we will return below. Results are reported in Tables 11 (percentage paved roads) and 12 (Buys *et al.*, 2006 quality index). All estimated coefficients carry the signs expected from theory, and have economically reasonable magnitudes in light of previous work in this area. In particular, the tariff and trade facilitation variables are uniformly negative. Even though only the former is statistically significant, the magnitude of the latter is still highly significant in economic terms. We also note that the distance coefficient is considerably larger in absolute value than the central tendency of the literature, which is around -0.9 (see the meta-analysis of Disdier & Head, 2005, which covers 1 467 estimates from 103 published papers). This is perhaps an indication that measuring distances using detailed overland transport data can make a difference to the perceived impact of distance on trade flows.

In Table 11, the percentage of paved roads variables have a uniformly positive impact on intraregional trade flows. While the magnitudes of both the minimum and weighted average measures are relatively stable across specifications, only the minimum indicator is statistically significant (at the 5% or 1% level depending on the specification). By contrast, the Buys *et al.* (2006) quality index used for the regressions in Table 12 is not statistically significant in either minimum or weighted average form. Nonetheless, the magnitudes involved could be argued to be economically significant, equating to elasticities of 0.5 to 1 in the case of average quality, and 0.08 to 0.22 for minimum quality.

On the whole, we take the results in Tables 11-12 as providing some preliminary evidence in favor of the proposition that road quality (in addition to tariffs and trade facilitation) has a significant impact on trade flows. However, in common with many gravity estimates, the models presented in Tables 11 and 12 have simply dropped zero trade flows or missing values from the dataset. In this case, our dataset contains approximately 1 500 zeros or missing flows—around one-third of the potential data, in other words[11]. Dropping such a large amount of information from the estimation sample clearly has the potential to influence results, and it would be desirable to perform some robustness checks in this regard.

4.2. Poisson PML results

Our preferred approach to the "zero trade" problem draws on recent work by Santos Silva & Tenreyro (forthcoming)[12]. First, note that prior to taking logarithms of both sides, (4) can be expressed in the following non-linear form:

$$(5) \qquad trade0_{ij}^{k} = \exp\left(x_{ij}^{k}\beta\right) + \omega_{ij}^{k}$$

We use the notation *trade*0 to indicate that the trade flow variable in (5) includes both non-zero and zero flows. By $x_{ij}^{k}\beta$, we mean the set of explanatory variables in (4) and their coefficients, appropriately rearranged. The error term is indicated as ω_{ij}^{k} in order to distinguish it from the additive error term in the log-linearized model, ε_{ij}^{k}. Santos Silva & Tenreyro (forthcoming) show that only under very restrictive assumptions on the error term ω_{ij}^{k} will OLS estimation of a log-linearized version of (5) give consistent parameter estimates. However, non-linear estimation of (5) is numerically equivalent to pseudo-maximum likelihood (PML) estimation of the Poisson model for count data (e.g. Davison & MacKinnon, 2004, p. 476), under the assumption that the conditional mean is proportional to the conditional variance (i.e. $E[trade0_{ij}^{t}|x_{ij}^{t}] \propto V[trade0_{ij}^{t}|x_{ij}^{t}]$).

Santos Silva & Tenreryo (forthcoming) therefore argue that use of such an estimator with trade data in levels (including zeros) should produce superior estimates to those obtained with OLS under log-linearization. Their Monte Carlo simulation evidence supports that proposition under a variety of empirically relevant parameterizations.

We therefore re-estimate equation (4) replacing log(*trade*) with *trade*0 as the dependent variable. All independent variables remain the same (i.e. in logarithms). Table 13 reports results using the percentage of paved roads as a proxy for network quality, while Table 14 uses the Buys *et al.* (2006) quality index. In both cases, we find a number of significant differences in the parameter estimates compared with OLS (as was the case in Santos Silva & Tenreyro, forthcoming). In particular, the distance coefficient—while still negative and statistically significant at the 1% level—is considerably smaller in absolute value under Poisson PML estimation than under OLS. On the other hand, the applied tariffs variable is considerably larger in absolute value in the former case than in the latter. With the exception of colonization (which is not statistically significant), the set of geographical controls enter the regression with similar coefficients to the OLS case. More surprising is the coefficient on our trade facilitation variable, which now carries an unexpected positive sign (but is still statistically insignificant).

In both tables, our proxies for average road network quality are consistently significant at conventional levels, and have considerably larger magnitudes than with OLS estimation. However, our minimum road quality proxies are now generally insignificant at the 10% level. When the percentage of paved roads is used, the Poisson PML coefficient tends to be smaller than its OLS counterpart, whereas the reverse is true for the Buys *et al.* (2006) quality index. Given that these two measures can be viewed as alternative ways of attempting to measure the same underlying quantity, it is difficult to be entirely comfortable with such a qualitative difference in terms of the estimation results. Combined with the unexpected positive coefficient on the number of documents at export and import, these results suggest that it may be important to reconsider our specification.

4.3. Negative binomial PML results

One common problem with Poisson models is that real-world data often tend to be over-dispersed (i.e. have variance greater than their mean). In such circumstances, the Poisson PML estimator will often still be consistent, but may suffer from bias (e.g. Cameron & Trivedi, 2001). One way of dealing with this problem is to use the alternative negative binomial PML estimator[13]. Poisson is a special case of the negative binomial, with over-dispersion parameter equal to zero. By testing the significance of that parameter—which is estimated by the negative binomial PML model—it is possible to have an idea of the extent to which Poisson results might be impacted by over-dispersion.

We therefore re-estimate the gravity model using the negative binomial PML estimator. Results are presented in Tables 15-16. A likelihood ratio test of the hypothesis that the data are not over-dispersed (based on Table 15, column 1) is strongly rejected (prob=0.00). This suggests that there may be good reasons for preferring the negative binomial estimates to Poisson in this case.

On a substantive level, results in Tables 15-16 are more internally consistent, and accord more closely with our priors, than do the Poisson PML estimates in Tables 13-14. In particular, the coefficient on documents at export and import is now negative and statistically significant, in line with results from previous work (Djankov *et al.*, 2006; Nordas *et al.*, 2006). Of the geographical controls, contiguity is still insignificant though much smaller in magnitude than under OLS, while colonization carries an unexpected negative sign (but is statistically insignificant). Our common language dummy remains statistically significant, and of comparable magnitude to the OLS case.

The parameters of primary interest, namely, those relating to trade policy and road network quality, paint a relatively clear and consistent picture across Tables 15 and 16. In all cases, tariffs are negative and statistically significant. Customs related regulatory procedures are also negative in all cases, but are only statistically significant under certain specifications using the percentage of paved roads rather than the Buys *et al.* (2006) quality index. Both average and minimum network quality variables are positive in all cases. However, only the percentage of paved roads variables are statistically significant in all cases. For the Buys *et al.* (2006) index, only the weighted average is statistically significant.

4.4. Summary

In this section, we have presented estimates of 12 different models, containing various combinations of the variables of interest, in order to gauge the effect of the exclusion of certain variables (and, by implication, expansion of the effective sample) on our core parameter estimates. We have also applied three different estimation methodologies, in particular to deal with the problems of zero bilateral trade flows and over-dispersion in trade data[14].

Using the percentage of paved roads as a proxy for network quality, we find parameter estimates in the range 0.18 to 1.84 for the weighted average, and 0.2 to 0.89 for the minimum. In the former case, 10 out of 15 estimates are significant at the 10% level, while in the latter it is 13 out of 15. If the Buys *et al.* (2006) multidimensional network quality indicator is used in place of the paved roads variables, we find parameter estimates ranging from 0.53 to 2.74 (average) and 0.04 to 0.77 (minimum), with 11 and 2 out of 15 respectively being statistically significant at the 10% level.

We interpret the general thrust of these results as providing strong evidence for two propositions. Firstly, that the average quality of the road network between the importer and the exporter is positively related to trade flows between those countries. And secondly, the minimum quality of the road network between the importer and the exporter is also positively related to trade flows between those countries. Both propositions hold regardless of whether network quality is measured using the percentage of paved roads, or the composite quality index due to Buys *et al.* (2006), although they are noticeably stronger in the former case. Moreover, our results are robust to changes in effective sample and estimation methodology, and take account of the independent trade impacts of geographical features, trade policy and customs procedures.

While these propositions represent interesting results in as far as they go, they need to be backed up by relevant policy simulations using the models we have estimated. This will give an idea of the relative dollar amounts that could be associated with policy actions in the area of road network quality, trade policy and trade facilitation. It is to that task that the next Section turns.

5. POLICY SIMULATIONS

In this Section, we use counterfactuals to present indications of the trade benefits that could result from upgrading road infrastructure in the ECA region. We then compare them with the benefits from alternative policy reforms in the areas of tariffs and import/export procedures. It is important to highlight that while similar approaches have been taken in the previous literature (e.g., Wilson *et al.*, 2005), the issue of producing such indications from a reduced-form econometric model is not without its difficulties. In particular, policy simulations are required to assume that all estimated parameters remain constant following the policy change (Lucas, 1976)[15]. Moreover, our simulations will be undertaken on the basis that all other factors except the one under simulation remain constant. Finally, our econometric model is effectively a reduced form version of a considerably more complex structural system and as such does not incorporate all of the restrictions that flow from that structure. As a result, the simulation results that we produce should be taken as indicative of the orders of magnitude involved only. Given the scope of this work, our simulation results do not measure economic welfare, but focus exclusively on projected trade impacts. Nonetheless, comparison of results across simulations is likely to prove a useful tool in assessing different policy options, in particular for rank-ordering interventions according to a given criterion.

Before embarking on the simulation exercise, it is necessary to make some choices in terms of the parameter set that will be used. Given the importance of being able to compare the impacts of different policy options, we limit consideration to those models including variables on tariffs, customs procedures and road network quality. Since the main thrust of our estimation results suggests that both minimum and average quality effects are important, we also exclude from consideration those specifications that contain one or the other, but not both simultaneously. While coefficients differ little according to whether simple or average weighted tariffs are used, we tend to prefer the former specification since the weighting scheme at least has the benefit of exogeneity.

Taking all such considerations into account leaves us with Models 1 and 7, estimated using OLS, Poisson PML and negative binomial PML. In terms of estimation methodology, we prefer negative binomial PML for the reasons set out in the previous Section. We have therefore decided to present simulation results using parameters from Table 15 column 1 and Table 16 column 1. The difference between the two relates only to the choice of road quality indicator: percentage of paved roads in the first case, and the Buys *et al.* (2006) index in the second. If it is necessary to choose between these two formulations, we would opt for the former. This is because it represents a single policy variable, for which a counterfactual can be given a precise interpretation. The Buys *et al.* (2006) index renders that task more difficult, since the policy simulation really includes not only a road upgrade, but also an increase in national per capita income and an improvement in governance. Nonetheless, we will present both sets of results for the sake of completeness.

As noted above, when describing the quality component of our dataset, it appears that a small handful of countries are associated with a large proportion of minimum quality scores on the ECA road network as mapped here (see Tables 8-9). Combining that result with our regressions showing the importance of minimum road network quality in determining trade flows suggests that it may be possible to capture part of the gains from a region-wide upgrade by focusing on infrastructure quality in just a small selection of countries. Indeed, given that road upgrades are a costly exercise—an issue to which we return below—it may be of considerable interest to policymakers to have an indication of the extent to which investing in roads in a small number of critical countries has the capacity to be bring important trade benefits for the region as a whole. We therefore identify two initial policy simulations that are of particular interest against this background:

I. Road networks in all ECA countries are upgraded to the sample mean or median, namely 74.52% or 85% of paved roads, or quality index scores of 58.45 or 52.39 respectively[16]; and

II. Road networks in the critical countries identified in Tables 8-9 only are upgraded to the same levels as in I[17].

The motivation for these simulations is that raising each country's level of road network quality to the currently prevailing mean (or median) in the region represents an ambitious but feasible scenario. Concretely, this means that under Simulation I, 13 ECA countries receive an upgrade, while under Simulation II it is limited to only three. By focusing on such benchmarks, we can also set up comparable reform scenarios for the other policy actions under consideration. Alternative benchmarks, such as an increase or decrease of x% in each indicator, results in simulations that are, in our view, less easily comparable than the ones under consideration here. In taking such an approach, we are following previous practice in the trade facilitation literature (e.g., Wilson *et al.*, 2005).

Concretely, the simulations are conducted as follows. Firstly, the policy shock is set up by recalculating both weighted average and minimum quality measures for all inter-country routes, in exactly the same way as described above. The only difference is that country scores below the thresholds listed above are increased to the relevant threshold level before recalculation. Next, percentage changes in average and minimum quality are calculated. These are then translated into percentage changes in bilateral trade values using our trade data and the estimated elasticities from our preferred regression models in Tables 15-16 column 1. In the case of the paved roads variables, the elasticities are 0.79 (average) and 0.60 (minimum), while for the composite quality index they are 1.29 and 0.08 respectively. Finally, estimated bilateral trade impacts are summed to give the estimated overall increase in intra-regional trade.

Results from the two simulations are presented in Tables 18 and 19. The first result that emerges from both Tables is that the potential trade gains from an ambitious but feasible program of road upgrades are large in absolute terms. These are highly variable, however, according to whether the paved roads data or the Buys *et al.* (2006) index is used. As discussed above, we believe the use of the paved roads data in the context of these simulations is preferable. Based on those data, it is reasonable to consider positive impacts of the order of 50%-60% of baseline trade, or between US$55 and $75 billion based on total intra-regional trade in 2003. While this is a large number, it aligns very well with the 60% figure obtained using different means by Cadot *et al.* (2006) for transit infrastructure in Central Asia. In any case, it should be noted that our figures are based exclusively on the projected increase in intra-regional trade. The estimation does not consider the flow-on effects to extra-regional trade. In sum, there are good reasons for considering them as a lower bound on expected total trade benefits from a road network upgrade.

A comparison of results from Simulations I and II also makes clear the crucial role played by just three countries in driving the above estimates. Focusing a road upgrading program of similar ambition on Albania, Hungary and Romania could bring intraregional trade benefits equal to over 50% of those projected from the full-blown, region-wide program in Simulation I. Given the significant cost reduction likely to result from focusing infrastructure investments on three countries rather than 13—a point to which we return below—the expected return on investment from such a focused program is likely to be impressive from a regional point of view.

In order to provide some context for the above results, we also conduct simulations designed to assess the projected trade impacts of policy changes affecting applied tariffs and documents required at export and import (trade facilitation):

III. Applied tariffs in all ECA countries are cut such that no tariff above 8% (approximate regional mean) or 6.5% (approximate regional median) *ad valorem* is applied; and

IV. The number of documents required to export is reduced in all countries to no more than 8 (mean) or 7 (median), and the number of documents to import is reduced to no more than 12 (mean) or 11 (median).

Results for both simulations are again reported in Tables 18-19. Focusing on the results obtained using paved roads data, it is striking that the increases in intra-regional trade associated with region-wide improvements in both traditional and "new" trade policies are considerably lower than for a road upgrade program conducted on a comparable scale. Trade flow changes from the tariff scenario are in the region of 6% to 8%—nearly an order of magnitude smaller, in other words, than the trade increases that flow from an infrastructure upgrade. The impact of trade facilitation measures is, however, considerably stronger than for a tariff reduction, of the order of 20%-30% of baseline trade. It therefore compares favorably with the gains to be expected from a three country road upgrade, but is still dwarfed by the gains from a region-wide upgrade.

Although the foregoing has focused on results obtained using paved roads data, rather than the Buys *et al.* (2006) index, it is also possible to draw some useful conclusions from simulations conducted using the latter measure. Although the results of a road upgrade are considerably less impressive—6% to 8% of baseline trade—they are nonetheless significant in dollar terms, and in the mean-based scenarios exceed the expected gains from tariff cuts. Once again, however, the expected gains from trade facilitation measures are quantitatively large—15% to 30% of baseline trade. In other words, both sets of results support the view that tariff reductions are by no means the only effective way of lowering trade costs and encouraging regional economic integration. Both infrastructure development and customs streamlining have important roles to play—and combined, their impacts are likely to exceed those stemming from tariff reforms.

Tables 18-19 also bring into focus the importance of minimum quality, or bottleneck, effects in driving the region-wide gains from a road upgrade. The main reason for the substantial difference in the projected impact of the road upgrade from one Table to the other is the strong difference in the coefficient on minimum quality in the two cases: it is much stronger when paved roads data are used. In sum, the spillover benefits of a road upgrade in one country are magnified the greater is the importance of minimum road quality across transit countries in determining bilateral trade flows.

5.1. The cost dimension

The policy simulations we have just discussed focus exclusively on the intraregional trade benefits that could be expected from the different policy options under consideration. However, in order to make a balanced assessment of those options, it is necessary to have information on both benefits and costs.

This is all the more true when one of the options—an infrastructure upgrade—has much higher direct costs than do the others[18].

Our purpose here is not to provide a detailed cost breakdown of the type that would be required before undertaking a particular road upgrade project. Our analysis has taken place at a considerably higher level of generality, and in particular has not delved into the state of individual road arcs. For that reason, our assessment of the costs will focus on producing a ballpark figure only, in the interests of establishing an order of magnitude such that the benefits and costs can then be sensibly compared[19].

The World Bank's ROad Costs Knowledge System (ROCKS) provides the starting point for our analysis[20]. ROCKS is a standardized database of costs associated with various types of road works. It classifies individual projects by country and type of work, and allows the user to obtain cost per km information in a common (real) currency. Most database entries also include extensive additional information as to the tasks performed, as well as geographical conditions that can be expected to affect costs.

Since we do not have information on the exact work that would need to be performed on each road arc in order to bring it up to the level of quality assumed in our counterfactuals, we simply assume that all arcs in countries undergoing an upgrade would require development or reconstruction work in terms of the ROCKS classification. This classification includes partial and full widening and/or reconstruction work, along with improvements to the road surface. In other words, the types of work that we are considering could reasonably be expected to lie towards the high end of the full range of unit costs in ROCKS, excluding those relating to entirely new construction projects.

Table 20 provides US$ per km cost data from ROCKS based on the types of work we have identified. We only take account of actual, incurred costs (not estimates), and focus on those from Eastern Europe and the Former USSR; the Western Europe and World cost columns are provided for reference only[21]. Based on this data, the range of expected unit costs for the countries under consideration here runs from around $36,000 per km to $666,000 per km, with an average of approximately $269,000 per km. We use these baselines to provide low, average and high cost estimates for the road upgrades implied by our Simulations I and II. (In the latter case, results are based on the critical countries identified using the minimum percentage paved roads criterion, and not the minimum Buys *et al.*, 2006 index.) We take the length of road to be upgraded in each country as the total length of arcs passing through that country as per our computerized map described above. In other words, we do not calculate the cost of upgrading the entire road network in each country, but only those parts of it connecting cities with year 2000 population above 300,000 people.

Results are presented in Table 21. Since our range of unit costs covers a wide variety of work types, the total cost estimates cover a correspondingly broad range. Focusing on mean unit costs for the region, we can see that a full upgrade (i.e., 13 countries) would involve a total cost of the order of US$8 billion. By contrast, focusing on three countries only would reduce that cost very considerably, to just over US$3 billion. Comparing these numbers with Table 18 shows that even once the costs of an upgrade are netted out, the trade benefits to the region from a road upgrade are very substantial: of the order of $45-$65 billion for a region wide program, and $30-$35 billion for a three country program, without allowing for any amortization of the cost of the upgraded road network over its expected lifespan.

6. CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH

This paper has extended and built upon recent work by Buys *et al.* (2006) on road transport infrastructure and trade, by adapting it to the context of the ECA region. It has been shown that an ambitious but feasible road upgrade program in ECA has great potential to boost intra-regional trade—by as much as 50% to 60%. Moreover, it is possible for the region to reap a large proportion of the overall gains by focusing attention on just three countries which both reflect important transit corridors and significant limitations in terms of infrastructure quality: Albania, Hungary and Romania. Such a concentrated program of road upgrading would come at significantly reduced cost (perhaps 40%) compared with attaining the same level of road quality on a region-wide basis, yet would bring around 50% of the total expected trade benefits.

The results presented here suggest a number of considerations for decision-making in this area. Firstly, road quality and infrastructure clearly matter for trade in the ECA region. In quantitative terms, our simulation results suggest that a feasible but ambitious scenario of road upgrading is likely to bring great intra-regional trade benefits than comparable actions affecting either tariffs or customs procedures. In any case, and regardless of which parameter estimates we use, the combined impact of upgrading road network quality and improving trade facilitation appear likely to produce gains well in excess of those that could be expected from comparable tariff reductions. Such a result aligns generally well with the recent literature on trade facilitation using CGE models. These suggest that the expected gains from such measures may indeed be of greater quantitative significance than those from liberalization of "traditional" trade policy measures (see e.g. Hertel & Keeney, 2005; Kinneman & Lodefalk, 2006). It is also consistent with other recent work that has shown the importance of transit country conditions, in particular in the Central Asia region (Cadot *et al.*, 2006).

A second important policy implication that emerges from our findings is that when transiting is taken into account, a large part of the trade benefits from infrastructure upgrading is driven by a small number of countries in the ECA region. This highlights the fact that infrastructure projects can have important intra-regional spillover effects. These factors should be taken into account when assessing costs and benefits of various options for trade facilitation and development assistance strategies. Where such spillover effects of road infrastructure upgrading are present, there may be a strong argument for regional coordination and shared funding responsibilities (see Schiff & Winters, 2002 for a review of the issues involved). In the present case, that suggestion takes on particular importance in light of the fact that Hungary is now a member of the EU, while Romania is soon to be such. It could be argued that allocation of EU funding should take into account the potential trade impacts not only on a national level, or even in terms of national-EU interactions, but also through the links that these countries have more broadly in the ECA region.

A final policy message that could usefully be highlighted given our results is that the trade benefits that flow from infrastructure upgrades can be obtained by countries acting unilaterally, or through regional instances. As is the case for many policy measures that come under the broad heading of trade facilitation, it is not necessary to wait for multilateral or regional agreement before taking action to bring about greater integration into the trading system. Indeed, national and regional trade facilitation programs sponsored by the World Bank, regional development banks, bilateral donors, and public-private partnerships, for example, could be seen as important ways in which countries and regions can position themselves so as to reap maximum benefit from future rounds of multilateral liberalization.

While our results are highly suggestive in policy terms, there nonetheless remain a number of important research questions to be considered in future work. The trade facilitation literature has shown that according to country circumstances, the various modes of transport—road, rail, sea and air—can all be important determinants of trade performance (e.g., Wilson *et al.*, 2005). Future research could usefully focus on the relative benefits and costs of upgrading infrastructure quality for each mode. As there is likely to be considerable variance in results across countries, regions and even sectors, it will be necessary to take a detailed approach to these questions, including through an attempt to account for the interactions amongst the different modes.

The present paper has focused exclusively on intra-regional trade. It will be important in future work to consider in addition the impacts of infrastructure upgrades on extra-regional trade. To do this, it will be necessary to compile a detailed dataset that interfaces road and international air or sea routes, taking account of the location of principal sea and air ports. By helping move towards a more complete picture of the benefits of infrastructure upgrades, such an exercise would provide important additional information for policymakers.

Finally, the cost and benefit estimates that we have provided in this paper should not be regarded as the last word in terms of policy assessment. The available data does not allow us to pay detailed attention to the state of maintaining particular road links. We have had to rely on national aggregates in assessing the extent to which network quality matters for trade. The flipside of this is that our cost estimate does not take account of the actual work that would need to be performed as part of a concrete upgrade program, as opposed to the hypothetical version considered here. This means that there is still considerable need for case specific cost-benefit analyses to be undertaken in this area. They should be a vital input into the decision-making process.

NOTES

1. Fink *et al.* (2002a, 2002b), Clark *et al.* (2004) and Wilson *et al.* (2005) analyze the related issues of port efficiency, telecommunications costs and trade facilitation. Djankov *et al.* (2006) and Nordas *et al.* (2006) examine the impact of time as a trade barrier. In each case, the relevant dimension is found to have empirically significant trade impacts.

2. Although Nordas & Piermartini (2004) include applied tariffs in their gravity model, they do not specifically address the relative impacts of policy reforms. Francois & Manchin (2006) produce suggestive results in this area, based on their observation that variations in infrastructure quality account for a larger percentage of the variation in trade flows than do changes in foreign trade barriers. However, they do not undertake policy simulations of the kind we envisage here. The firm level data analyzed by Clarke (2005) produce results that go in the same direction.

3. In preliminary work (not reported), we experimented with two other methodologies. Neither weighting by city population, nor using the median rather than the mean, was found to significantly alter the distance measure (i.e., the correlation was in excess of 0.9, with no outliers).

4. We have obtained identical results using CEPII's alternative distance measures, including one that is weighted by population.

5. A simple OLS regression with great circle distance as the dependent variable, and road distance as the independent variable (with a constant) confirms this observation: while the constant is positive and significant at 1%, the coefficient on road distance is 0.66 (and also significant at 1%). A Wald test strongly rejects (1%) the joint hypothesis that the constant is zero and the coefficient on road distance is unity.

6. Once again, we need to highlight the importance that Russia plays in this result: it accounts for 11 out of 33 cases in which the difference between our distance measure and CEPII's is greater than 100%.

7. In fact, equation (4) contains a simplification. To be strictly consistent with the theory as set out above, it would be necessary to specify fixed effects by sector, importer-sector and exporter-sector, and to allow all of the trade cost coefficients to vary by sector (to take account of changes in the elasticity of substitution). Our simplification is intended to reduce the number of parameters, and to avoid the co-linearity problems that generally result when such a large number of parameters is included in a relatively small dataset.

8. It would be preferable from a theoretical point of view to use the value of exports on a fob basis, rather than the value of imports on a CIF basis. However, import data are generally believed to be more accurate than export data, and are therefore preferred here. This is a common expedient in the empirical literature, though it is not without its critics (e.g., Baldwin, 2006).

9. Due to lack of data availability, we use customs formalities in 2005 as a proxy for 2003. Similarly, when TRAINS data is missing for a given year, we take the most recent available data prior to 2003.

10. All estimations were performed in Stata 9.1SE using heteroskedasticity-robust standard errors with clustering by country pair. The tables of regression results report standard errors in italics underneath the corresponding parameter estimates. Statistical significance is indicated as follows: * (10%), ** (5%) and *** (1%). Estimated fixed effects are suppressed for the sake of brevity.

11. An additional problem in this case is missing data for the tariff and trade facilitation variables. These also reduce our sample size quite considerably, as can be seen by comparing the number of observations across models in Table 11 or 12. We attempt to deal with that issue by estimating a variety of specifications, some of which drop the offending variables and thereby enlarge the effective sample. While omitted variable bias is likely as a result of such an approach, the output in the various Tables suggests that it is not too serious in this case.

12. An alternative is to treat the "zero trade" problem as one of sample selection. This leads naturally to application of a Heckit-type estimator (e.g., Francois & Manchin, 2006). However, reliance only on the non-linearity of the inverse Mills ratio for identification in effect makes a strong distributional assumption that may often be rejected in practice (Davidson & MacKinnon, 2004, pp.488-489). At the same time, over-identification via variable exclusion has tended to rely on unconvincing assumptions in this area (e.g., that common religion impacts fixed but not variable trade costs, as in Helpman *et al.*, 2006). We therefore prefer the approach suggested by Santos Silva & Tenreyro (forthcoming), which does not suffer from such drawbacks.

13. Cravino *et al.* (2006) adopt a similar approach in the related area of foreign investment. In their Monte Carlo simulations, Santos Silva & Tenreyro (forthcoming) use models from the Gamma PML class, which are closely related to the negative binomial (Cameron & Trivedi, 2001).

14. As a final robustness check (not discussed in detail), Table 17 presents results for a model which includes a dummy variable to take account of EU accession. This was done in the interests of better controlling for unobserved heterogeneity on a country-pair basis. Given that our dataset is limited to a single year, it is not possible for us to control for all such factors. Nonetheless, the fact that our estimates change relatively little once an EU dummy is introduced provides some comfort with respect to the core estimates presented above.

15. Whether or not parameter changes following a policy shock are economically significant in particular circumstances is a point that we do not pursue here. We note, however, that the macro-econometrics literature is far from conclusive on this point (e.g., Estrella & Fuhrer, 2003).

16. For reference, these levels equate to (approximately) Poland and Croatia respectively in the case of paved roads, and Belarus and the Kyrgyz Republic in the case of the composite index.

17. For paved roads, the countries are Albania, Hungary and Romania. For the quality index, they are Georgia, Romania and Uzbekistan.

18. Both tariff reductions and trade facilitation also involve costs. In a direct sense, they are likely to be quite limited. Indirectly, or in a political economy sense, they may well be substantial from the point of view of individual actors. The political economy of reform affecting infrastructure, tariffs and procedural barriers is an area that would benefit from increased attention in the future, although it is outside the scope of this paper.

19. For an example of how this issue can be dealt with in a more detailed way, see Buys *et al.* (2006).

20. ROCKS can be obtained from: http://www.worldbank.org/transport/roads/rd_tools/rocks_main.htm.

21. We have also eliminated two outlying observations, with unit costs around double the next highest data point.

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TABLES AND FIGURES

Table 1. Merchandise exports as a percentage of gdp, 1995-2004 (Source: World Development Indicators.)

Country *or Region*	**1995**	**2000**	**2004**
Albania	41.37	36.60	37.73
Armenia	64.36	61.52	65.71
Azerbaijan	47.17	55.32	83.67
Belarus	74.20	125.40	131.50
Bosnia and Herzegovina	66.11	92.24	90.19
Bulgaria	84.04	89.74	100.88
Croatia	64.55	66.85	71.71
Czech Republic	84.00	109.81	129.11
Estonia	101.28	162.29	130.56
Georgia	20.05	32.09	47.98
Hungary	63.44	128.47	113.41
Kazakhstan	44.45	75.73	80.69
Kyrgyz Republic	56.05	77.32	75.28
Latvia	59.59	65.35	80.73
Lithuania	84.66	81.42	96.81
Macedonia, FYR	65.69	94.90	84.70
Moldova	90.42	96.94	106.36
Poland	38.21	48.39	67.70
Romania	51.27	63.21	76.74
Russian Federation	35.91	57.84	48.11
Serbia and Montenegro	7.82	63.17	65.56
Slovak Republic	89.42	122.22	138.75
Slovenia	88.93	98.85	102.63
Tajikistan	126.67	148.98	110.46
Turkmenistan	132.47	150.45	116.59
Ukraine	59.34	91.26	95.13
Uzbekistan	46.29	40.07	64.15
World	*35.30*	*41.32*	*44.87*
Low income	*31.84*	*33.30*	*37.79*
Lower middle income	*36.84*	*44.96*	*57.51*
Upper middle income	*47.86*	*58.85*	*67.04*
High income	*34.25*	*39.64*	*41.51*

Table 2: Delays at export and import (days) and cost to export and import (USD). (Source: World Bank, 2005 & 2006.)

	2005		2006			
Country *or Region*	**Export Time**	**Import Time**	**Export Time**	**Import Time**	**Export Cost**	**Import Cost**
Albania	37	38	34	34	818	820
Armenia	34	37	34	37	1,600	1,750
Azerbaijan	69	79	69	79	2,275	2,575
Bulgaria	26	24	26	25	1,233	1,201
Bosnia and Herzegovina	32	43	22	25	1,150	1,150
Belarus	33	37	33	36	1,472	1,472
Czech Republic	20	22	20	22	713	833
Estonia	12	14	3	5	640	640
Georgia	54	52	13	15	1,370	1,370
Croatia	35	37	26	18	1,250	1,250
Hungary	23	24	23	24	922	1,137
Kazakhstan	93	87	93	87	2,780	2,880
Kyrgyz Republic	NA	127	NA	127	NA	3,032
Lithuania	6	17	6	17	704	782
Latvia	18	21	11	12	965	965
Moldova	33	35	33	35	1,185	1,285
Macedonia, FYR	32	35	32	35	1,070	1,070
Poland	19	26	19	26	2,260	2,260
Romania	27	28	14	14	1,300	1,200
Russia	29	35	39	38	2,237	2,237
Serbia and Montenegro	32	44	11	12	1,240	1,440
Slovak Republic	20	21	20	21	1,015	1,050
Slovenia	20	24	20	24	1,070	1,107
Tajikistan	NA	NA	72	44	4,300	3,550
Turkmenistan	NA	NA	NA	NA	NA	NA
Ukraine	34	46	33	46	1,009	1,025
Uzbekistan	NA	139	44	139	2,550	3,970
Europe & Central Asia	*31.6*	*43*	*29.2*	*37.1*	*1,450.20*	*1,589.30*

Country *or Region*	2005 Export Time	Import Time	2006 Export Time	Import Time	Export Cost	Import Cost
East Asia & Pacific	*25.8*	*28.6*	*23.9*	*25.9*	*884.8*	*1,037.10*
Latin America & Caribbean	*30.3*	*37*	*22.2*	*27.9*	*1,067.50*	*1,225.50*
Middle East & North Africa	*33.6*	*41.9*	*27.1*	*35.4*	*923.9*	*1,182.80*
OECD	*12.6*	*14*	*10.5*	*12.2*	*811*	*882.6*
South Asia	*33.7*	*46.5*	*34.4*	*41.5*	*1,236.00*	*1,494.90*
Sub-Saharan Africa	*48.6*	*60.5*	*40*	*51.5*	*1,561.10*	*1,946.90*

Table 3: Overall Trade Restrictiveness Index for ECA countries (% ad valorem equivalent). Sou Kee et al. (2006).

Country or *Region*	**OTRI - Tariffs**	**OTRI - Tariffs & NTBs**
Albania	10.9	11.4
Belarus	9.1	15.9
Czech Republic	4.0	5.0
Estonia	1.1	2.3
Hungary	6.1	11.3
Kazakhstan	5.4	14.0
Kyrgyz Republic	6.9	7.4
Lithuania	2.0	5.0
Latvia	3.0	9.8
Moldova	4.7	7.4
Poland	10.8	15.2
Romania	11.9	15.8
Russia	10.4	22.6
Slovenia	9.8	18.2
Ukraine	9.3	21.6
ECA Average	*7.0*	*12.2*
OECD Average	*5.6*	*11.4*

Table 4: Market Access Overall Trade Restrictiveness Index for ECA countries (% ad valorem equivalent). Source: Kee et al. (2006).

Country or *Region*	**MA-OTRI - Tariffs**	**MA-OTRI - Tariffs & NTBs**
Albania	11.3	16.7
Belarus	9.8	15.4
Czech	6.2	10.7
Estonia	9.3	15.3
Hungary	7.6	13.3
Kazakhstan	5.7	15.3
Kyrgyzstan	11.8	19.2
Latvia	10.8	20.0
Lithuania	14.5	23.0
Moldova	17.1	25.9
Poland	8.2	13.8
Romania	8.8	15.7
Russia	4.3	12.2
Slovenia	8.0	13.9
Ukraine	7.1	15.2
ECA Average	*9.4*	*16.4*
OECD Average	*7.0*	*13.1*

Table 5: Breakdown of cities included in the ECA road netw

Country	No. of Cities > 300 000
ALB	1
ARM	1
AZE	2
BGR	3
BIH	1
BLR	5
CZE	3
EST	1
GEO	1
HRV	1
HUN	1
KAZ	7
KGZ	1
LTU	2
LVA	1
MDA	1
MKD	1
POL	10
ROM	6
RUS	63
SRB	1
SVK	1
SVN	1
TJK	1
TKM	1
UKR	18
UZB	3

Table 6: Comparison of percentage paved roads data. (Sources: World Road Statistics, World Development Indicators, CIA World Fact Book online).

Country	WRS	*Year*	WDI	*Year*	CIA	*Year*	Preferred
Albania	39	*2002*	39	*2002*	39	*2002*	39
Armenia	100	*2003*	97	*1998*	100	*2003*	97
Azerbaijan	49	*2004*	47	*2003*	47	*2003*	47
Belarus	87	*2004*	100	*2003*	100	*2003*	87
Bosnia and Herzegovina	52	*1999*	52	*1999*	52	*2005*	52
Bulgaria	99	*2004*	92	*2002*	92	*2003*	92
Croatia	NA	*NA*	85	*1999*	85	*2004*	85
Czech Republic	100	*2003*	100	*2002*	100	*2003*	100
Estonia	24	*2004*	23	*2003*	23	*2003*	23
Georgia	39	*2004*	39	*2003*	39	*2003*	39
Hungary	44	*2003*	44	*2002*	44	*2005*	44
Kazakhstan	93	*2004*	96	*2003*	96	*2003*	96
Kyrgyz Republic	91	*1999*	90	*2004*	91	*1999*	90
Latvia	100	*2004*	100	*2003*	100	*2003*	100
Lithuania	28	*2004*	27	*2003*	89	*2003*	89
Macedonia, FYR	64	*1999*	64	*1999*	64	*1999*	64
Moldova	86	*2004*	86	*2003*	86	*2003*	86
Poland	70	*2003*	70	*2003*	70	*2003*	70
Romania	30	*2004*	50	*2002*	30	*2003*	30
Russian Federation	NA	*2001*	67	*1999*	85	*2004*	85
Serbia and Montenegro	96	*2004*	62	*2002*	62	*2002*	62
Slovak Republic	87	*2004*	87	*2003*	87	*2003*	87
Slovenia	100	*2004*	100	*2003*	100	*2003*	100
Tajikistan	NA	*NA*	83	*1995*	NA	*2000*	83
Turkmenistan	81	*1999*	81	*1999*	81	*1999*	81
Ukraine	97	*2004*	97	*2003*	97	*2003*	97
Uzbekistan	87	*1999*	87	*1999*	87	*1999*	87

Table 7: Calculation of the Road Quality Index for Europe and Central Asia.

Country Name	% Paved	Source	Year	GDP/cap	CPIA	Quality	Quality Index
Albania	39	WDI	2002	4301	3	124.45	32.45
Armenia	97	WDI	2003	3408	3.5	253.94	66.21
Azerbaijan	47	WDI	2003	3414	3	137.96	35.97
Belarus	87	WRS	2004	5748	2.5	241.61	63.00
Bosnia and Herzegovina	52	WDI	1999	6030	3	167.61	43.70
Bulgaria	92	WDI	2002	7079	4	289.36	75.45
Croatia	85	WDI	1999	11021	4	296.75	77.37
Czech Republic	100	WDI	2002	17040	4	368.73	96.14
Estonia	23	WDI	2003	12297	4	106.60	27.79
Georgia	39	WDI	2003	2459	2.5	107.30	27.98
Hungary	44	WDI	2002	14575	4.5	189.73	49.47
Kazakhstan	96	WDI	2003	6208	2.5	265.46	69.21
Kyrgyz Republic	90	WDI	2004	1664	3	200.93	52.39
Latvia	100	WDI	2003	10025	4	331.61	86.46
Lithuania	89	CIA	2005	11174	4	308.72	80.49
Macedonia, FYR	64	WDI	1999	5914	3	197.13	51.40
Moldova	86	WDI	2003	1491	3	189.55	49.42
Poland	70	WDI	2003	11287	4	255.27	66.56
Romania	30	WRS	2004	7235	3.5	115.45	30.10
Russian Federation	85	CIA	2004	8524	3	266.13	69.39
Serbia and Montenegro	62	WDI	2002	4400	3	181.15	47.23
Slovak Republic	87	WDI	2003	12665	4	310.85	81.05
Slovenia	100	WDI	2003	18441	4.5	383.53	100.00
Tajikistan	83	WDI	1995	1030	2.5	164.97	43.01
Turkmenistan	81	WDI	1999	3668	1	173.65	45.28
Ukraine	97	WDI	2003	5211	3	268.06	69.89
Uzbekistan	87	WDI	1999	1631	1	156.35	40.77

Table 8: Main sources of minimum paved road percentages across 702 international (country-pair) routes.

Country	No. of Routes	Percentage of Total Routes	Percentage Paved Rank
Albania	130	18.52	24
Hungary	108	15.38	23
Romania	220	31.34	26

Table 9: Main sources of minimum road quality indices across 702 international (country-pair) routes.

Country	No. of Routes	Percentage of Total Routes	Quality Index Rank
Georgia	142	20.23	26
Romania	184	26.21	25
Uzbekistan	96	13.68	22

Table 10: Variables and sources.

Variable	Description	Year	Source
$Border_{ij}$	Dummy variable equal to 1 if countries i and j share a common land border	NA	Mayer & Zignago (2006)
$Colony_{ij}$	Dummy variable equal to 1 if countries i and j have ever had a colonial link	NA	Mayer & Zignago (2006)
$Comlang\_Ethno_{ij}$	Dummy variable equal to 1 if the same language is spoken by at least 9% of the populations of countries i and j	NA	Mayer & Zignago (2006)
$Dist\_Cepii_{ij}$	Great circle distance between countries i and j	NA	Mayer & Zignago (2006)
$Distance\_Mean_{ij}$ or $Dist_{ij}$	Distance between countries i and j calculated as the mean of road distances between city pairs in those countries	NA	Own calculations
$Docs_{ij}$	Sum of number of export documents in origin country and number of import documents in final destination country	2005	World Bank (2006)
EU	Dummy variable equal to 1 if both countries belong to the set {Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, Slovenia}	NA	Own calculations
$Paved\_Ave_{ij}$	Average of quality index in origin country i, destination country j and all transit countries (based on road routing), weighted by distance traveled in each country as a fraction of total distance between i and j.	2003	Own calculations
$Paved\_Min_{ij}$	Minimum of quality index in origin country i, destination country j and all transit countries (based on road routing)	2003	Own calculations
Q_Ave_{ij}	Average of quality index in origin country i, destination country j and all transit countries (based on road routing), weighted by distance traveled in each country as a fraction of total distance between i and j.	2003	Own calculations
Q_Min_{ij}	Minimum of quality index in origin country i, destination country j and all transit countries (based on road routing)	2003	Own calculations
$Tariff_{ij}$	1+Simple average tariff applied by country j to imports from country i	2003	WITS – UNCTAD TRAINS
$Tariffw_{ij}$	1+Trade weighted average tariff applied by country j to imports from country i	2003	WITS – UNCTAD TRAINS
Trade_k	Merchandise imports in BEC sector k (aggregated from HS-1996) into destination country from origin country, in US dollars	2003	WITS – UN Comtrade

Table 11: Regression results using OLS with origin, destination and sector fixed effects. Road network quality proxied by percent paved roads.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ldist	-2.08***	-2.09***	-2.07***	-1.89***	-2.19***	-2.06***
	0.15	*0.15*	*0.15*	*0.13*	*0.14*	*0.14*
lpaved_ave	0.18	0.20	0.35	0.53	0.56	
	0.44	*0.44*	*0.45*	*0.43*	*0.41*	
lpaved_min	0.56***	0.55***	0.50**	0.49**		0.59***
	0.21	*0.21*	*0.21*	*0.20*		*0.21*
ltariff	-4.72***				-4.76***	-4.73***
	0.91				*0.91*	*0.91*
ltariffw		-3.72***				
		0.73				
ldocs	-3.06	-3.12	-3.21		-2.39	-3.19
	2.47	*2.44*	*2.18*		*2.48*	*2.47*
border	0.24	0.23	0.22	0.28*	0.24	0.25
	0.17	*0.17*	*0.18*	*0.17*	*0.17*	*0.17*
colony	0.29	0.31	0.31	0.27	0.32	0.28
	0.31	*0.30*	*0.30*	*0.27*	*0.33*	*0.31*
comlang_ethno	1.01***	1.01***	0.98***	1.10***	1.09***	0.99***
	0.33	*0.34*	*0.34*	*0.30*	*0.34*	*0.32*
_cons	24.60***	24.71***	26.75***	18.67***	26.59***	25.47***
	7.54	*7.43*	*5.80*	*2.24*	*8.29*	*7.30*
Observations	2440	2440	2937	3382	2440	2440
R2	0.62	0.62	0.61	0.58	0.62	0.62
Model F	58.99***	58.93***	75.78***	70.21***	58.19***	59.30***

Table 12: Regression results using OLS with origin, destination and sector fixed effects. Road network quality proxied by Buys et al. (2006) quality index.

Variable	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
ldist	-2.17*** *0.15*	-2.18*** *0.15*	-2.15*** *0.15*	-1.96*** *0.13*	-2.18*** *0.13*	-2.14*** *0.15*
lq_ave	0.53 *0.50*	0.57 *0.50*	0.74 *0.50*	1.07** *0.48*	0.57 *0.49*	
lq_min	0.08 *0.29*	0.07 *0.30*	0.04 *0.30*	0.22 *0.28*		0.18 *0.29*
ltariff	-4.73*** *0.91*				-4.73*** *0.91*	-4.77*** *0.92*
ltariffw		-3.75*** *0.72*				
ldocs	-2.64 *2.44*	-2.70 *2.40*	-2.69 *2.15*		-2.57 *2.46*	-2.85 *2.44*
border	0.25 *0.17*	0.24 *0.17*	0.24 *0.18*	0.28* *0.17*	0.26 *0.17*	0.26 *0.17*
colony	0.29 *0.33*	0.31 *0.32*	0.30 *0.32*	0.27 *0.27*	0.29 *0.33*	0.31 *0.33*
comlang_ethno	1.08*** *0.34*	1.08*** *0.34*	1.06*** *0.35*	1.18*** *0.31*	1.08*** *0.34*	1.03*** *0.33*
_cons	27.19*** *8.22*	27.19*** *8.10*	25.93*** *5.81*	18.65*** *2.33*	27.15*** *8.24*	29.41*** *8.06*
Observations	2440	2440	2937	3382	2440	2440
R2	0.62	0.61	0.61	0.58	0.62	0.61
Model F	58.37***	58.16***	76.27***	70.45***	58.53***	58.80***

Table 13: Regression results using Poisson PML with origin, destination and sector fixed effects. Road network quality proxied by percent paved roads.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ldist	-1.32***	-1.34***	-1.10***	-1.04***	-1.36***	-1.40***
	0.18	*0.18*	*0.19*	*0.16*	*0.18*	*0.17*
lpaved_ave	1.37***	1.38**	1.84***	1.79***	1.50***	
	0.52	*0.54*	*0.70*	*0.66*	*0.52*	
lpaved_min	0.20	0.23	0.47**	0.57**		0.33*
	0.19	*0.19*	*0.20*	*0.23*		*0.19*
ltariff	-6.71***				-6.97***	-6.44***
	2.08				*2.08*	*2.10*
ltariffw		-4.77**				
		2.01				
ldocs	2.40	2.04	0.78		2.41	2.15
	3.41	*3.45*	*3.85*		*3.26*	*3.38*
border	0.19	0.18	0.22	0.26*	0.17	0.20
	0.14	*0.15*	*0.17*	*0.16*	*0.15*	*0.16*
colony	-0.09	-0.04	0.09	-0.11	-0.09	-0.24
	0.23	*0.23*	*0.24*	*0.26*	*0.23*	*0.21*
comlang	0.90***	0.91***	1.37***	1.55***	0.93***	0.58**
	0.22	*0.23*	*0.25*	*0.29*	*0.22*	*0.25*
_cons	3.34	4.31	9.28	12.19***	9.71	9.81
	9.68	*9.95*	*14.02*	*3.43*	*7.67*	*9.45*
Obs.	2559	2559	3864	4914	2559	2559
Model Chi2	16491.58***	19052.58***	22548.4***	18989.39***	17830.7***	17733.07***

Table 14: Regression results using Poisson PML with origin, destination and sector fixed effects. Road network quality proxied by Buys et al. (2006) quality index.

Variable	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
ldist	-1.22***	-1.24***	-0.93***	-0.93***	-1.27***	-1.40***
	0.20	*0.20*	*0.21*	*0.17*	*0.19*	*0.17*
lq_ave	1.79***	1.86***	2.58***	2.74***	1.88***	
	0.61	*0.62*	*0.77*	*0.69*	*0.61*	
lq_min	0.24	0.28	0.68***	0.77***		0.38
	0.24	*0.24*	*0.25*	*0.27*		*0.25*
ltariff	-6.56***				-6.78***	-6.52***
	2.09				*2.09*	*2.09*
ltariffw		-4.73**				
		1.99				
ldocs	1.78	1.38	-0.14		1.89	1.96
	3.31	*3.31*	*3.56*		*3.20*	*3.31*
border	0.24*	0.23	0.30*	0.30**	0.22	0.21
	0.14	*0.14*	*0.15*	*0.14*	*0.14*	*0.16*
colony	-0.19	-0.14	-0.04	-0.26	-0.20	-0.24
	0.21	*0.21*	*0.21*	*0.24*	*0.21*	*0.21*
comlang	0.96***	0.98***	1.46***	1.67***	0.97***	0.59**
	0.21	*0.22*	*0.22*	*0.28*	*0.21*	*0.25*
_cons	8.67	9.37	11.86	8.06**	9.13	16.10**
	7.68	*7.87*	*11.46*	*3.66*	*7.36*	*7.65*
Obs.	2559	2559	3864	4914	2559	2559
Model Chi2	17375.34***	20347.11***	22004.65***	17985.38***	18113.92***	18609.34***

Table 15: Regression results using Negative Binomial PML with origin, destination and sector fixed effects. Road network quality proxied by percent paved roads.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ldist	-1.74*** *0.17*	-1.76*** *0.17*	-2.10*** *0.21*	-1.98*** *0.18*	-1.86*** *0.16*	-1.68*** *0.18*
lpaved_ave	0.79* *0.40*	0.79* *0.41*	1.00** *0.47*	1.08** *0.46*	1.21*** *0.38*	
lpaved_min	0.60*** *0.20*	0.61*** *0.21*	0.84*** *0.23*	0.89*** *0.23*		0.74*** *0.20*
ltariff	-4.03*** *0.78*				-3.96*** *0.79*	-4.05*** *0.78*
ltariffw		-2.47*** *0.70*				
ldocs	-4.03* *2.21*	-3.64* *2.19*	-0.96 *2.29*		-3.12 *2.30*	-4.79** *2.23*
border	0.01 *0.15*	-0.02 *0.15*	-0.10 *0.20*	-0.19 *0.23*	0.02 *0.15*	0.04 *0.15*
colony	-0.14 *0.23*	-0.13 *0.23*	-0.28 *0.29*	-0.37 *0.30*	-0.09 *0.25*	-0.14 *0.24*
comlang	1.09*** *0.25*	1.08*** *0.26*	1.55*** *0.34*	1.73*** *0.36*	1.17*** *0.25*	0.98*** *0.25*
_cons	26.48*** *6.75*	25.27*** *6.70*	28.28*** *8.57*	18.61*** *2.32*	26.72*** *5.92*	30.91*** *6.64*
Obs.	2559	2559	3864	4914	2559	2559
Model Chi2	3761.55***	3796.71***	3087.89***	3558.61***	3574.03***	3677.03***

Table 16: Regression results using Negative Binomial PML with origin, destination and sector fixed effects. Road network quality proxied by Buys et al. (2006) quality index.

Variable	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
ldist	-1.81***	-1.83***	-2.17***	-2.09***	-1.82***	-1.74***
	0.17	*0.18*	*0.21*	*0.18*	*0.16*	*0.18*
lq_ave	1.29***	1.31***	1.22*	1.85***	1.34***	
	0.49	*0.50*	*0.63*	*0.66*	*0.48*	
lq_min	0.08	0.09	0.35	0.37		0.35
	0.28	*0.29*	*0.35*	*0.38*		*0.27*
ltariff	-3.93***				-3.93***	-3.96***
	0.79				*0.79*	*0.80*
ltariffw		-2.38***				
		0.71				
ldocs	-3.49	-3.10	-0.36		-3.42	-4.21*
	2.27	*2.25*	*2.34*		*2.29*	*2.30*
border	0.06	0.02	-0.10	-0.22	0.06	0.06
	0.15	*0.15*	*0.20*	*0.24*	*0.15*	*0.15*
colony	-0.15	-0.14	-0.23	-0.33	-0.15	-0.07
	0.26	*0.26*	*0.31*	*0.31*	*0.26*	*0.27*
comlang	1.15***	1.16***	1.67***	1.92***	1.16***	1.02***
	0.26	*0.26*	*0.35*	*0.37*	*0.25*	*0.25*
_cons	26.97***	26.04***	30.85***	19.02***	26.94***	32.49***
	6.02	*5.98*	*8.32*	*3.05*	*6.04*	*5.82*
Obs.	2559	2559	3864	4914	2559	2559
Model Chi2	3620.45***	3599.94***	3033.17***	3381.13***	3593.32***	3468.80***

Table 17: Regression results using a dummy variable for EU accession.

Variable	Model 13 OLS	Poisson	Neg. Binomial	Model 14 OLS	Poisson	Neg. Binomial
ldist	-2.03***	-1.27***	-1.62***	-2.13***	-1.21***	-1.71***
	0.15	*0.17*	*0.17*	*0.15*	*0.19*	*0.18*
lpaved_ave	0.12	1.32**	0.62			
	0.44	*0.52*	*0.40*			
lpaved_min	0.57***	0.20	0.60***			
	0.21	*0.19*	*0.20*			
lq_ave				0.45	1.74***	1.02**
				0.51	*0.64*	*0.50*
lq_min				0.06	0.24	0.05
				0.30	*0.24*	*0.28*
ltariff	-4.66***	-6.68***	-4.03***	-4.68***	-6.56***	-3.94***
	0.92	*2.09*	*0.78*	*0.92*	*2.09*	*0.79*
ldocs	-2.92	2.58	-3.70*	-2.49	1.87	-3.20
	2.46	*3.42*	*2.17*	*2.43*	*3.32*	*2.24*
border	0.26	0.22	0.05	0.27	0.25*	0.09
	0.17	*0.14*	*0.15*	*0.17*	*0.14*	*0.15*
colony	0.30	-0.12	-0.10	0.31	-0.21	-0.09
	0.31	*0.24*	*0.25*	*0.34*	*0.22*	*0.28*
comlang	0.98***	0.88***	1.05***	1.05***	0.95***	1.11***
	0.33	*0.22*	*0.25*	*0.34*	*0.21*	*0.26*
eu	0.27	0.16	0.55**	0.23	0.07	0.50**
	0.23	*0.19*	*0.23*	*0.24*	*0.20*	*0.24*
_cons	24.09***	5.35	25.25***	26.82***	6.33	26.69***
	7.49	*8.22*	*5.71*	*8.16*	*9.04*	*6.87*
Obs.	2440	2559	2559	2440	2559	2559
Model F/Chi2	59.01***	16035.04***	3885.77***	58.59***	17336.16***	3730.64***

Table 18: Simulation results (increase in aggregate intra-regional trade) using estimated coefficients from Model 1 (Negative Binomial PML).

	Shock to Mean		Shock to Median	
	US$bn	% of baseline	US$bn	% of baseline
Simulation I (region wide road upgrade)	56.71	50.4	74.66	66.32
Simulation II (3 country road upgrade)	34.99	31.07	38.38	34.09
Simulation III (tariff reduction)	6.19	6.38	8.23	8.49
Simulation IV (trade facilitation)	19.02	17.56	35.89	33.15

Note: Implied baselines are slightly different across simulations due to rounding and variations in effective sample size.

Table 19: Simulation results (increase in aggregate intra-regional trade) using estimated coefficients from Model 7 (Negative Binomial PML).

	Shock to Mean		Shock to Median	
	US$bn	% of baseline	US$bn	% of baseline
Simulation I (region wide road upgrade)	9.83	8.73	6.64	5.90
Simulation II (3 country road upgrade)	4.73	4.20	4.07	3.61
Simulation III (tariff reduction)	6.04	6.23	8.03	8.28
Simulation IV (trade facilitation)	16.47	15.21	31.08	28.71

Note: Implied baselines are slightly different across simulations due to rounding and variations in effective sample size.

Table 20: Estimated costs (US$ per km) of road reconstruction and development work. Source: ROCKS.

	Eastern Europe	Former USSR	Combined	Western Europe	World
Observations	82	8	90	2	205
Average	266686	295560	269253	359172	280691
Median	227031	283737	234153	359172	211445
Minimum	36762	128935	36762	306353	8219
Maximum	666219	464811	666219	411991	2678092
Std Deviation	147025	118359	144373	74698	276780

Table 21: Estimated costs (US$ million) of upgrading principal national roads (km). (Simulation II based on countries identified using minimum percentage paved roads criterion.)

Country	Road Length	Simulation I Low Cost	Simulation I Mean Cost	Simulation I High Cost	Simulation II Low Cost	Simulation II Mean Cost	Simulation II High Cost
Albania	375	14	101	250	14	101	250
Armenia	328	0	0	0	0	0	0
Azerbaijan	989	36	266	659	0	0	0
Bosnia and Herzegovina	1880	69	506	1252	0	0	0
Bulgaria	3628	0	0	0	0	0	0
Belarus	5673	0	0	0	0	0	0
Croatia	2679	0	0	0	0	0	0
Czech Republic	3397	0	0	0	0	0	0
Estonia	1059	39	285	706	0	0	0
Georgia	1246	46	335	830	0	0	0
Hungary	4100	151	1104	2732	151	1104	2732
Kazakhstan	13006	0	0	0	0	0	0
Kyrgyzstan	1685	62	454	1122	0	0	0
Latvia	1847	0	0	0	0	0	0
Lithuania	2331	0	0	0	0	0	0
Macedonia	910	0	0	0	0	0	0
Moldova	1075	40	289	716	0	0	0
Poland	12818	0	0	0	0	0	0
Romania	7664	282	2064	5106	282	2064	5106
Russia	41438	0	0	0	0	0	0
Serbia and Montenegro	3834	141	1032	2554	0	0	0
Slovakia	2655	0	0	0	0	0	0
Slovenia	1016	0	0	0	0	0	0
Tajikistan	1713	63	461	1141	0	0	0
Turkmenistan	1310	48	353	873	0	0	0
Ukraine	14071	0	0	0	0	0	0
Uzbekistan	2986	110	804	1989	0	0	0
Total	*135713*	*1100*	*8055*	*19930*	*446*	*3269*	*8088*

Figure 1: Network of major roads in Europe and Central Asia.

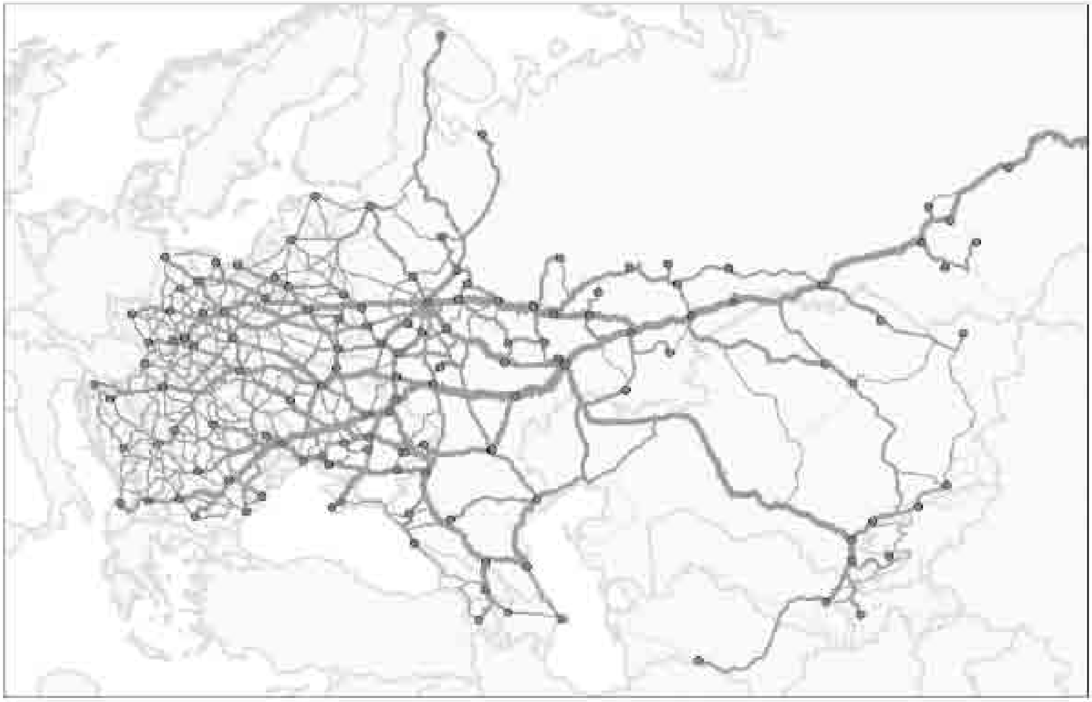
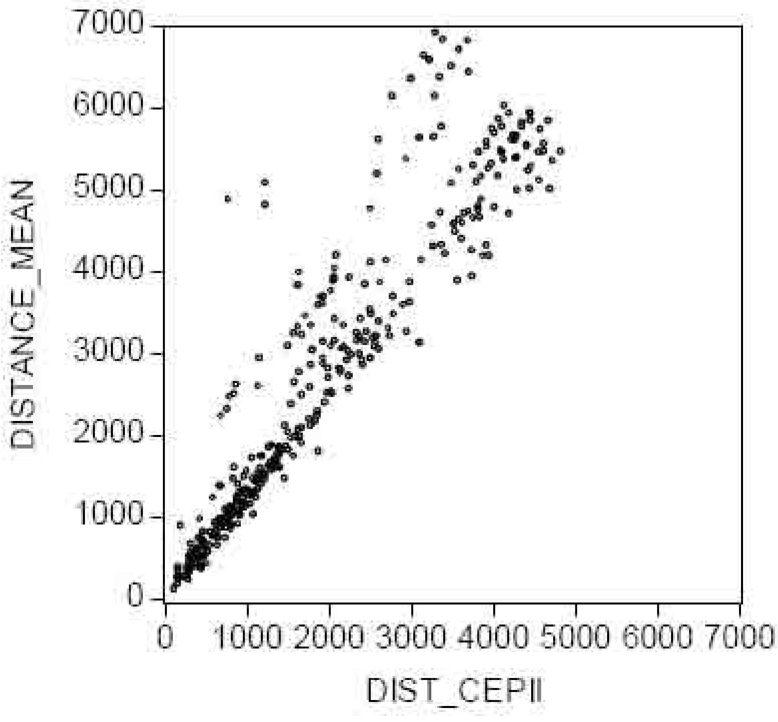


Figure 2: Scatter plot of mean road distance against great circle distance.



Dynamic Ports Within a Globalised World

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SUMMARY

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1. INTRODUCTION

Globalisation implies international mobility of goods and services, as well as persons and capital. Inevitably, such ‘flows’ underline the significance of seaports and airports as throughput, storage and/or processing nodes. In the present contribution, we take a closer look at the growing importance of ports in a globalising world.

First and foremost, we concentrate on the specific goods flows. The changed world economy, characterised by an international redistribution of labour and capital, and an integration and globalisation of the markets, has generated enormous growth in international trade. The increase in and altered structure of international business and goods flows has undoubtedly impacted on the port sector. Conversely, those flows have been and still are affected by rising port productivity and greater port efficiency, which have resulted in lower generalised costs. The enhancement of port competitiveness has, in recent years, become a goal in itself.

However, the link between globalisation and the port sector does not end with goods flows. Increased mobility of capital has led to systematic shifts in ownership structures, as in the case of the consolidation wave among terminal operating companies, which used to be known as stevedores. The latter, often local or national, companies have been taken over by international groups. This gives rise to the question of whether or to what extent profits generated by those groups are reinvested in the country concerned, or whether they are diverted to other countries or regions. A similar question arises in relation to public investments. Public authorities that invest in port infrastructure and hinterland connections are increasingly confronted with the issue of who actually receives the returns on such basic investments.

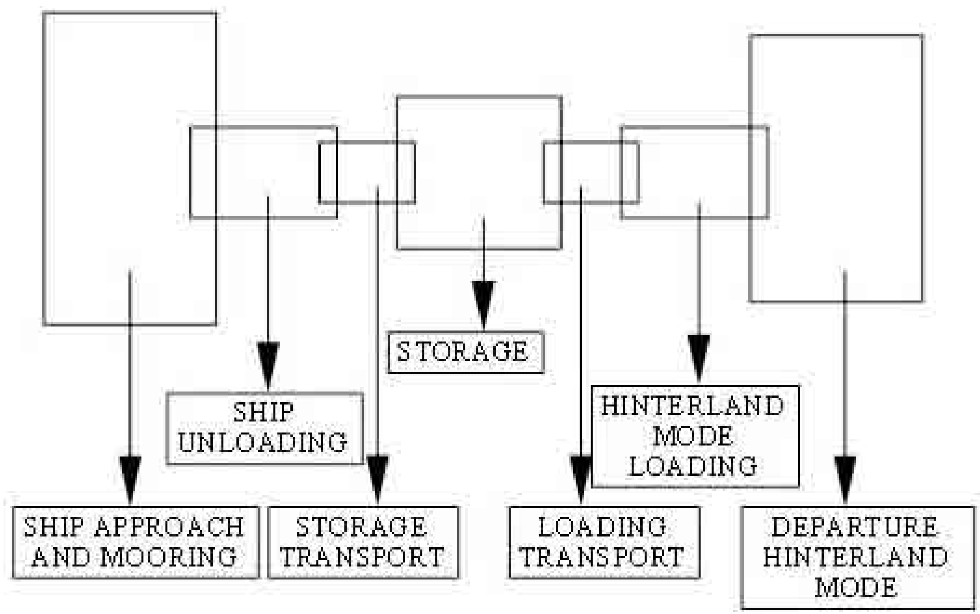
In the next paragraph of this contribution, we deal in greater depth with the structure of ports. It used to be the case that seaport activity was most commonly approached from an aggregated perspective. However, the heterogeneous nature of ports, characterised by a multitude of market players and diverse interrelationships, also necessitates a more detailed level of analysis. The consequences of the globalisation process are, after all, not equally far-reaching or readily tangible for all market players.

Subsequently, we consider the primary product for the port sector, namely the maritime goods flows. Besides changes in economic output, growth in international trade has had an important impact on the scope and the direction of seaborne trade. In the next paragraph, we consider a number of important trends in the maritime and port industries, particularly those globalisation-related evolutions that have had an unmistakable influence on the port industry: the trend towards mergers and scale expansion, among shipping companies as well as terminal operating companies; the concentration of crucial port resources in the hands of a limited number of international groups; the emergence of a potentially new role for port authorities. Finally, we put forward some points for further discussion, with a view to resolving some uncertainties.

2. THE PORT AS AN ECONOMIC ENTITY

Since time immemorial, port activity has revolved around physical throughput of goods and passengers. With the emergence of new, specialised functions, such as forwarding and shipping agencies, the initial transhipment function has however evolved. Jansson and Shneerson (1982, p. 10) go one step further, and also connect the throughput process with maritime and hinterland transportation, where storage occupies a central position (cf. Figure 1).

Figure 1. **Sub-processes of cargo throughput**



Source: Jansson and Shneerson (1982, p. 10).

Because of a variety of agglomeration benefits (scale, location, urbanisation), some ports have developed into ideal locations for particular types of industry. Consequently, they are important links, not only in trade and transport chains, but also in industrial production chains.

Contemporary seaports are still characterised by such a combination of commercial, transport and industrial functions. Increasingly, they are the hubs from where the hinterland is supplied with imported goods, and where goods that need to be shipped from the hinterland are grouped together and loaded onto ships[2].

As the capacity of hinterland transportation rarely or never corresponds with the volume of goods to be transported to and from its port, and because the moment of unloading of a seagoing vessel does not always correspond to the moment of loading of the hinterland mode, the distribution function of the port inevitably involves the storage of goods. Each of these additional functions generates a number of derived activities that are not necessarily water-bound, such as customs inspections and cargo preparation.

Depending on the direction of the goods flow, shipping companies and hinterland modes act either as suppliers to or customers of the port and companies located within the port perimeter. However, the enterprises that fulfil the various logistics tasks within the port may also be considered as suppliers or customers.

Consequently, every port is, in itself, a chain consisting of consecutive links, while the port as a whole is a link in a global logistics chain. Over the course of time, the relative significance within the port of those separate links has clearly changed. This is due to, among other things, important efficiency-enhancing technological developments, such as the increasing degree of containerisation, the growing dimensions of vessels, quicker cargo-handling, etc. Consequently, it no longer suffices to concentrate on one or even a few links in the chain.

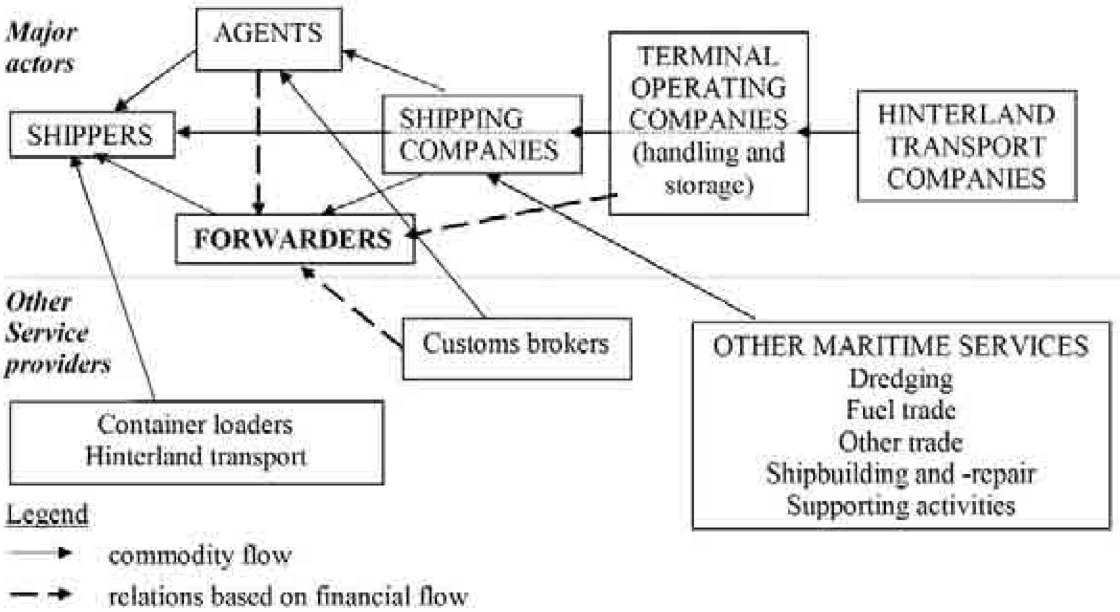
This evolution in the function and purpose of seaports obviously has a number of consequences for their organisation and management (Meersman, Van de Voorde and Vanelslander, 2003). Port operations involve a substantial number of parties, at the policymaking, the managerial and the operational levels. These different players may be subsumed under a single company, as in the case of certain private ports in the UK, or they may represent a multitude of enterprises and institutions within the port.

The port as a physical entity is managed by a port authority, which is in turn monitored and/or regulated by a higher, often public and political or administrative authority. The authorities may thus be represented to various degrees in the port.

In addition to a port authority, and depending on the size of the port, there are usually a considerable number of companies who have established themselves in the port area. Recent empirical research has focused on gaining insight into these various port actors and how they interrelate (cf. Coppens *et al.*, 2006). A first empirical application relates to the port of Antwerp.

The port authority occupies a central position. The other actors may be roughly divided into two groups: the port users and the service providers. Among the port users are, first and foremost, the shipping companies. Also belonging to this group are the shippers and industrial enterprises who are established within the port perimeter and have lands in concession. The service providers are a heterogeneous group: pilots, towage services, agents, forwarders, ship repairers, suppliers of foodstuffs and spare parts, waste reception facilities, and bunkerers. Stevedores, who are increasingly evolving into Terminal Operating Companies, constitute a special case. They provide services (transhipment, storage, stripping and stuffing...) to shipping companies and shippers, for which they are effectively remunerated. At the same time, they pay the port authorities for terminal concessions.

Figure 2. **Adjusted relations between port actors: commodity and financial flow point of view**



Source: Coppens *et al.,* 2006.

Figure 2 illustrates quite clearly how the large number of actors involved in port activities, each with their own objectives, gives rise to a strong degree of heterogeneity within and between ports[3]. As a result, the consequences of increasing globalisation for the various market players will not be equally far-reaching and tangible.

3. THE PRIMARY PRODUCT OF EVERY PORT: THE MARITIME GOODS FLOWS[4]

Seaborne trade more than doubled between 1970 and 2000 (Figure 3). In 2004, 6.7 billion tons were loaded onto ships and transported by sea. The tanker market accounts for slightly over a third of that figure, while the principal dry cargo markets (iron ore, grain, coal, bauxite/aluminium and phosphate) account for just under a quarter. Strikingly, however, the share of other dry cargo, which is shipped primarily in containers, has grown very strongly.

Figure 3. **International seaborne trade for selected years**
(million tons loaded)

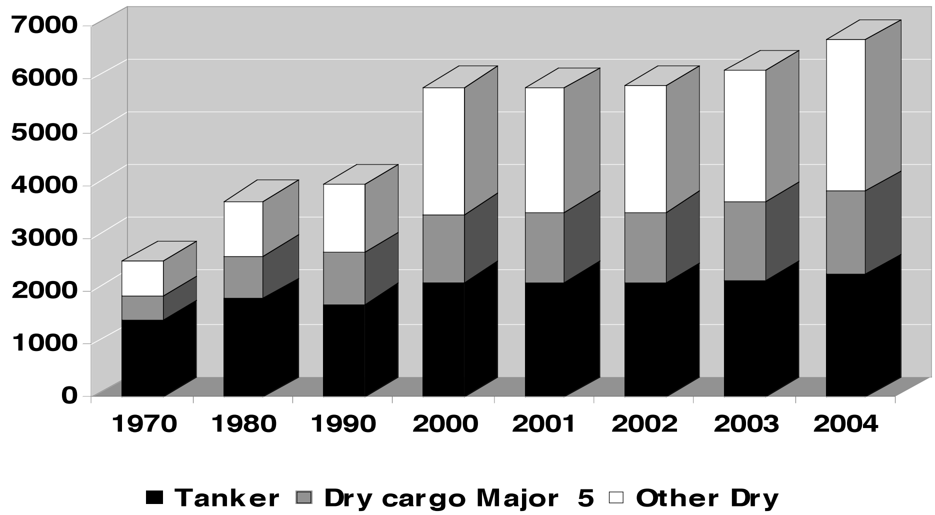
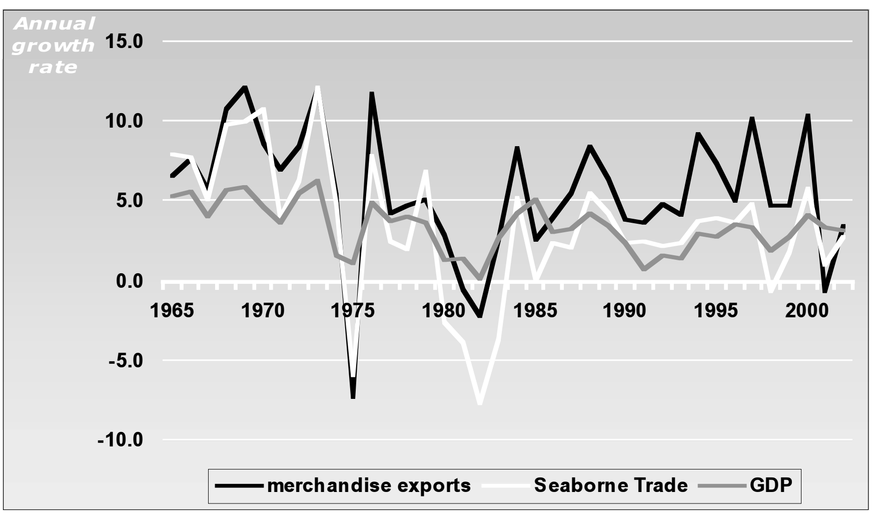


Figure 4. **Seaborne trade, world exports and economic activity**



Source: Based on Fearnley's Review and WTO International Trade Statistics.

The driving force behind this evolution in maritime transport has been strong growth in international trade, coupled with an international redistribution of labour and capital, and an integration and globalisation process in the markets (Figure 4).

The market share of the developing countries in total world trade has increased substantially in recent decades (Table 1). They now account for about 30% of world merchandise imports and exports. By contrast, the share of the developed countries has declined by about 10 percentage points, which implies that they are still responsible for about two-thirds of global trade. The share of East Asia, unlike that of other developing regions, has grown almost continuously since the 1960s, with the exception of a slight decline during and after the Asian crisis. Together, the NIEs and China account for almost the entire recorded increase in the developing countries' share in world trade. It is also striking that the composition of merchandise trade has changed, as is apparent from Table 1. In Japan and Korea, there has clearly been a shift from primary commodities and labour-intensive manufactures to high-skill and technology-intensive manufactures. Likewise in China, the share of electronics in exports is quite noticeable. India, for its part, is clearly still in an earlier developmental stage, as we deduce from the fact that primary commodities still account for a very considerable share in exports.

Table 1. **The origin and destination of merchandise trade, 1970-2003**

	Market share (per cent)					*Average annual growth in value*			
	1970	*1980*	*1990*	*2000*	*2003*	*1970-1980*	*1980-1990*	*1990-2000*	*2000-2003*
Merchandise exports									
Developed countries	**75.0**	**65.3**	**72.0**	**65.7**	**64.8**	**18.8**	**7.3**	**5.9**	**4.6**
Developing countries	**19.2**	**29.5**	**24.3**	**31.6**	**32.1**	**25.6**	**3.1**	**8.9**	**5.8**
of which									
East Asia	4.2	7.1	12.0	18.6	19.4	26.6	11.7	10.4	6.9
First tier NIEs	2.0	3.8	7.6	10.3	9.4	28.2	14.4	8.8	2.6
China	0.7	0.9	1.8	3.9	5.8	20.0	12.8	14.5	20.8
Merchandise imports									
Developed countries	**75.6**	**70.8**	**73.1**	**69.5**	**68.4**	**19.4**	**6.9**	**6.2**	**4.3**
Developing countries	**18.8**	**24.0**	**22.5**	**28.7**	**29.0**	**23.6**	**4.0**	**8.3**	**5.4**
of which									
East Asia	5.1	7.2	11.7	16.7	17.6	24.4	10.9	8.9	7.0
First tier NIEs	2.7	4.3	7.4	9.8	8.7	25.7	11.9	8.1	1.2
China	0.7	1.0	1.5	3.4	5.4	23.7	13.5	13.0	22.3

Source: UNCTAD Trade and Development Report 2005, Table 4.2

Note: The group of first-tier NIEs comprises Hong Kong (China), the Republic of Korea, Singapore, Taiwan Province of China. East Asia comprises China, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, Viet Nam and the first-tier NIEs.

The shares of South-East Europe and the Commonwealth of Independent States (CIS) are not included in this table, which explains why the shares do not add up to 100.

The ascendancy of Asia has unfolded in four phases, each of which is significant to the evolution of maritime trade. Initially, it was Japan that dominated industrial output in Asia. In a subsequent phase, the so-called Tigers came to the fore, spearheaded by the rapid industrialisation of Korea and Taiwan and the hubs of Hong Kong and Singapore. During the ASEAN phase, Thailand and Malaysia took the lead. The present phase is marked by strong economic growth in China and the rise of India. China's influence on the international markets and global trade flows is quite apparent. If the industrialisation of India continues, its merchandise trade may also be expected to undergo fundamental change.

Demand for metal products has risen most significantly in China in recent decades. This is due to very substantial investments in buildings and infrastructure. It may well be the case that, as soon as this growth in investment subsides, so too will demand for metal products and imports of ores and minerals.

Table 2. **Product structure of exports from selected Asian countries, 1965–2003**

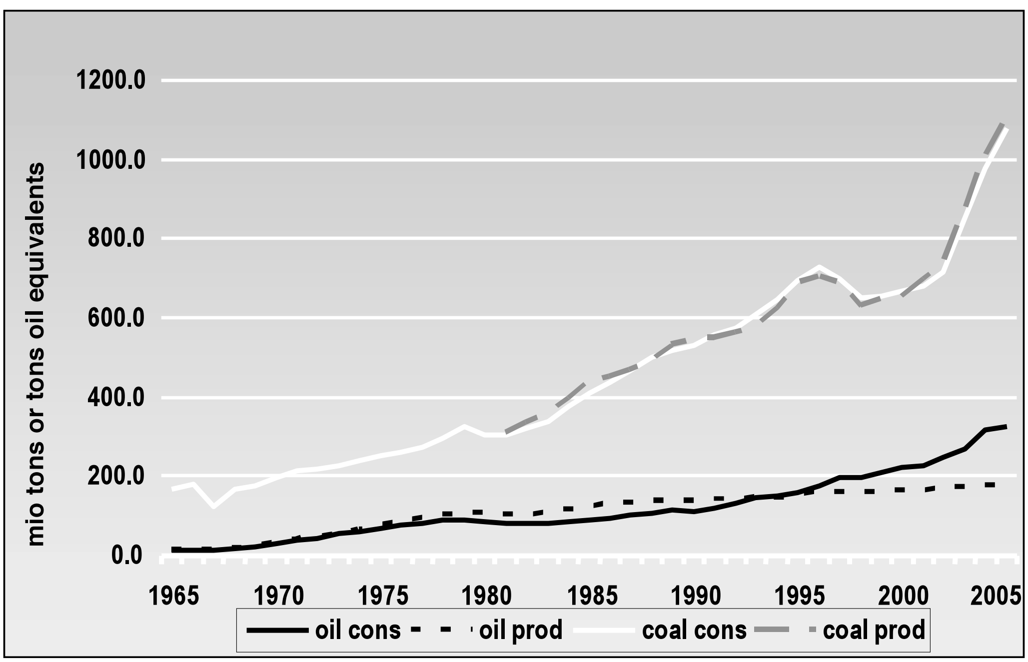
Percentage of total merchandise exports	Japan 1965	Japan 2003	Republic of Korea 1965	Republic of Korea 2003	China° 1987	China° 2003	India° 1975	India° 2003
Primary commodities	8.8	2	40	7.3	37.7	0.2	55.1	23
Labour- and resource-intensive manufactures	23.9	3.3	41.4	10	35.7	27.7	27.8	40.3
Low-skill and technology-intensive manufactures	30.6	9	8.7	11.8	4	7.2	6.1	9.2
Medium-skill and technology-intensive manufactures	15	45	2.8	22.8	6.4	12.1	5.7	8.4
High-skill and technology-intensive manufactures	9.8	15.2	0.5	10.4	7.8	7.1	2.8	12.4
Electronics	7.5	22.6	0.9	35.8	3.4	30.3	0.8	1.9

° Data for earlier years not available.

Source: UNCTAD Trade and development report/ UNCTAD Secretariat calculations, based on UN COMTRADE.

At present, China still satisfies its energy needs primarily with coal, but there has been a noticeable increase in the consumption of oil (Figure 6).

Figure 6. **Energy consumption and production in China**



Source: BP *Statistical Review of World Energy*, June 2006.

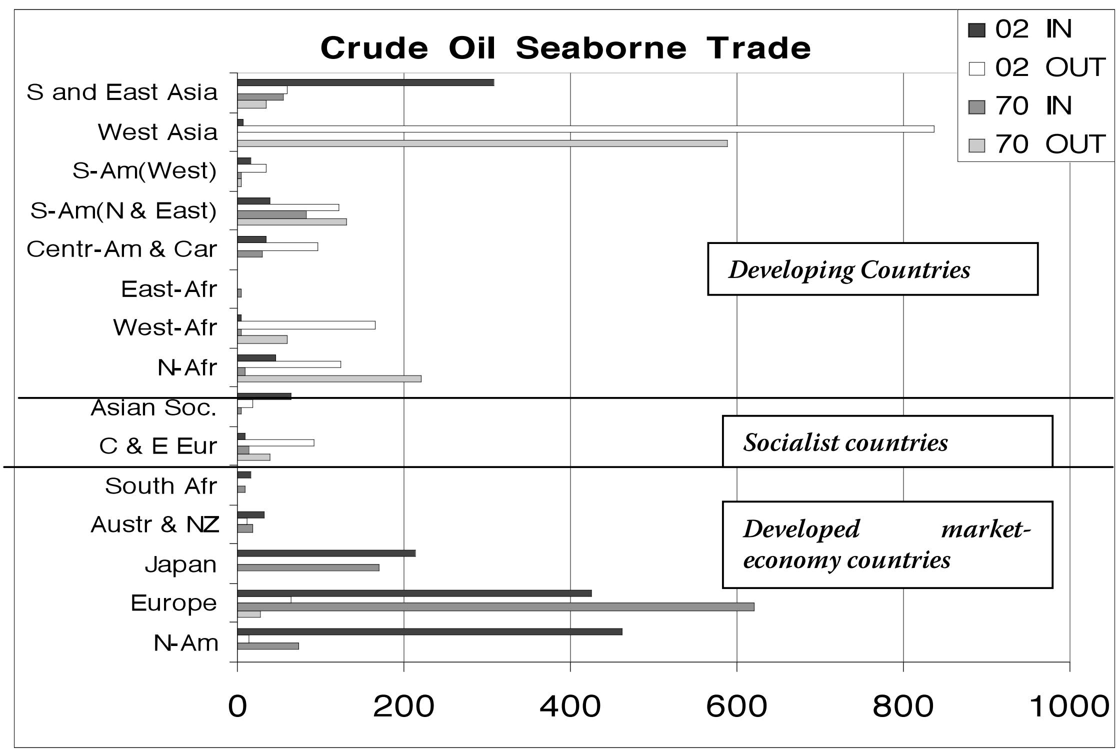
Evolutions in the oil industry are crucial to tanker shipping. As Table 3 shows quite clearly, Europe and the USA are still the largest oil importers. Increased economic activity in Asia, particularly in China, has resulted in an increase in demand for oil products, supplied primarily from the Middle East.

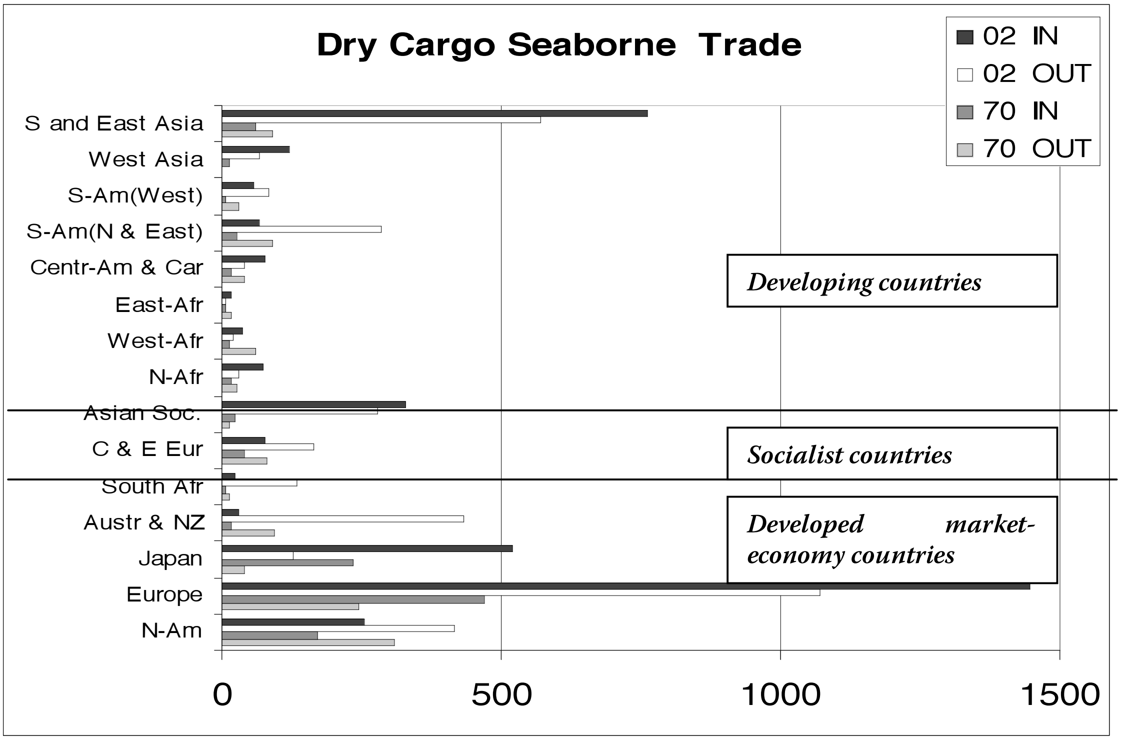
Table 3. **Oil: Inter-area movements 2005**

Million tonnes / From	To: USA	Canada	Mexico	S. & C.	Europe	Africa	Austral	China	Japan	Other	Rest of	Total
USA	-	7.4	10.1	15.5	11.6	0.7	-	0.4	4.0	3.5	0.9	**54.1**
Canada	107.1	-	0.1	0.2	0.8	-	-	-	0.3	-	-	**108.5**
Mexico	81.8	1.7	-	6.7	10.5	0.1	-	-	-	1.6	0.2	**102.6**
South & Central Ameri	140.9	5.3	2.1	-	15.1	1.0	-	5.3	0.1	3.3	-	**173.1**
Europe	53.3	22.0	2.4	2.3	-	12.9	-	0.6	0.3	6.0	4.5	**104.3**
Former Soviet Union	23.0	-	0.1	3.0	287.0	0.5	-	19.6	2.3	3.5	10.0	**349.0**
Middle East	116.5	7.1	0.5	7.8	156.1	37.2	5.6	67.4	211.7	369.2	3.0	**982.1**
North Africa	26.7	8.4	0.3	5.7	97.0	4.1	0.2	3.2	0.1	5.4	0.6	**151.7**
West Africa	96.5	2.0	-	8.4	34.6	4.4	0.2	28.6	3.0	38.1	0.9	**216.7**
East & Southern Africa	-	-	-	-	1.3	-	-	6.7	4.0	1.2	-	**13.2**
Australasia	0.7	-	-	-	-	-	-	1.2	3.2	5.8	-	**10.9**
China	1.6	0.1	-	1.6	0.2	0.1	0.4	-	2.3	14.0	0.4	**20.7**
Japan	-	-	-	-	0.4	-	0.4	3.3	-	1.0	-	**5.1**
Other Asia Pacific	8.3	0.2	0.1	0.3	6.1	0.7	26.8	30.3	24.8	14.6	0.5	**112.7**
Unidentified *	10.3	5.5	-	0.3	34.3	-	1.9	0.3	2.1	2.1	-	**56.8**
TOTAL IMPORTS	666.7	59.7	15.7	51.8	655.0	61.7	35.5	166.9	258.2	469.3	21.0	2461.5

Source: BP *Statistical Review of World Energy*, June 2006.

Figure 7. **Evolution of seaborne trade for selected country groups**





Source: UNCTAD, *Review of Maritime Trade*.

An important consequence of these structural developments is that seaborne trade has shifted very strongly and, indeed, continues to do so today, as illustrated in Figure 7. Moreover, quite a few imbalances have manifested themselves. In 2004 on the trans-Pacific route, for example, 10.8 million TEUs were shipped from Asia to North America, while only 4.3 million TEUs were carried in the opposite direction. And on the Asia-Europe route, 8.4 million TEUs were shipped to Europe, compared to 5.6 million TEUs to Asia. On the Transatlantic route, imbalances are less outspoken[5]. As a result of current imbalances on trade routes, shipping companies are compelled to develop appropriate strategies for the repositioning of empty boxes and to establish well-balanced networks.

The enormous growth in maritime trade to and from Asia is also reflected in the performance of the leading shipping companies, as Table 4 demonstrates.

Table 4. **Largest shipping companies**

Market capitalisation, end-2004	**Country**	**$bn**
Carnival Corp.	US	36.8
AP Moller - Maersk	Denmark	36.3
Royal Caribbean Cruises	US	10.9
MISC	Malaysia	7.5
Mitsui OSK Lines	Japan	5.8
Nippon Yusen Kabushiki Kaisha	Japan	5.3
Teekey Shipping Corp.	US	3.4
Frontline	Norway	3.3
Bollore	France	3.3
P&O	UK	3.2
Kawasaki Kishen Kaisha	Japan	3.1
Neptune Orient Lines	Singapore	2.7
China Shipping Container Lines	China	2.4
Evergreen Marine Corp.	Taiwan	2.3
Shun TAK Holdings	Hong Kong	2.3

Source: Lloyd's List LL-Bloomberg Top 50 shipping.

The evolutions in international trade affect not only maritime goods flows, but also performances by ports. It is therefore no surprise that many of the fastest growing ports are located in China (Table 5).

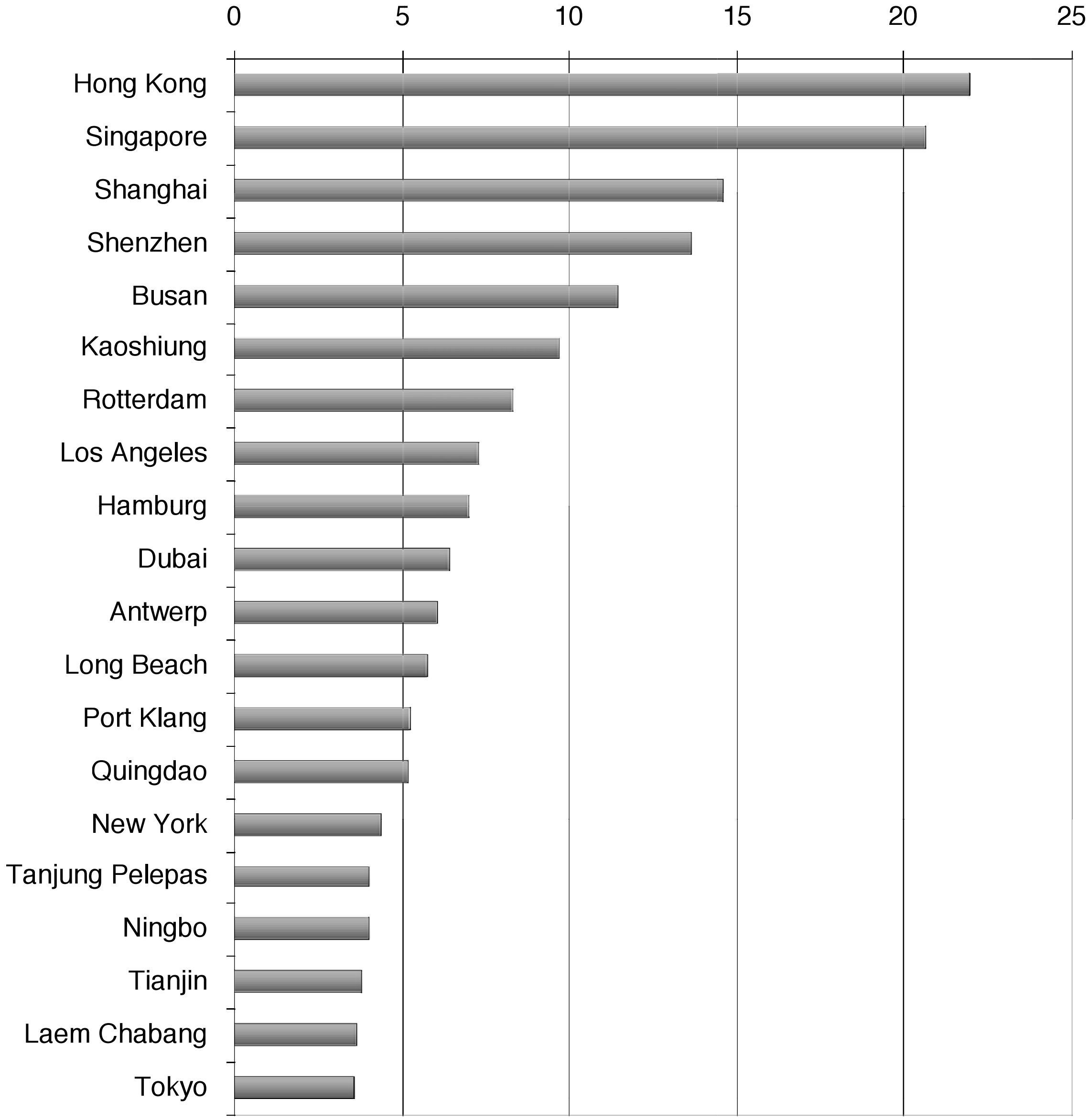
The Asian ports also record the busiest container traffic (Figure 8). According to ISL (2005), Asian ports account for about 65 per cent of world container traffic, with just over a quarter of all container traffic passing through the top-8 Chinese ports. Strikingly, though, most of the traffic in the large Asian container hubs is intraregional traffic. To a large extent, this is a reflection of the growing importance of production sharing in Eastern Asia, and the existence of triangular trade patterns. This means that, rather than exporting directly to developed countries, the industrially relatively more advanced countries, such as the Republic of Korea, export intermediate production inputs to China, for example, where these inputs are in turn used in production for export to developed countries.

Table 5. **Total cargo traffic – the ten fastest growing and declining ports in 2004**
(Only ports with an annual cargo traffic of more than 50 million tons are included)

Port	Country	million tons 2003	2004	% change over prev. year
Highest growing ports				
Sepetiba	Brazil	44.7	59.3	32.5
Tianjin	China,	161.8	206.2	27.4
Guangzhou	China,	171.9	215.2	25.2
Ningbo	China,	185.4	225.9	21.8
St.Petersburg	Russia	42	51.2	21.7
Dubai Ports	UAE	63.6	77.4	21.6
Port Hedland	Australia	89.8	108.5	20.8
Shenzhen	China,	112.4	135.2	20.3
Shanghai	China,	316.2	379	19.8
Qinhuangdao	China,	125.6	150.3	19.7
Least growing ports				
Dunkirk	France	50.1	51	1.8
Corpus Christi	USA	77.2	78.4	1.5
Newcastle	Australia	82.7	83.6	1
Yokohama	Japan	125.9	127	0.8
Tees and Hartlepool	UK	53.8	53.8	0
Chiba	Japan	169.6	169.3	-0.2
Dampier	Australia	88.9	87.9	-1.1
Marseilles	France	95.5	94.1	-1.5
Richards Bay	South Africa	87.5	85	-2.9
Sao Sebastiao	Brazil	54.9	53.1	-3.2

Source: ISL Port Data Base 2005

Figure 8. **Top-20 container terminals and their throughput, 2004**
(millions of TEUs)



Source: UNCTAD, *Review of Maritime Trade*, 2005.

4. GLOBALISATION AND PORTS: SOME UNMISTAKABLE TRENDS

The above-cited growth in seaborne trade, port throughput and port capacity has formed the basis for a sharp increase in competition between ports (see among others Huybrechts *et al.,* 2002). Greater competition always induces strategic behaviour, including in the port and maritime sector.

Heaver *et al.* (2001) have studied the various forms of co-operation and concentration in the maritime sector. The configuration outlined still holds today, though some companies are now very actively and even aggressively seeking partnerships. Table 6 provides an overview of the various types of cooperation within the sector. We restrict ourselves to ship-owners, terminal operating companies and port authorities.

Table 6. **Strategic co-operation in the maritime sector**

Market actors	Shipowners	Terminal operating companies	Port authorities
Ship-owners	• vessel-sharing agreements • joint ventures • consortia • alliances • mergers/acquisitions • conferences		
Terminal operating companies	• joint ventures • dedicated terminals • capital participation • consortia	• mergers/acquisitions • joint ventures	
Port authorities	• concessions concerning dedicated terminals		alliances

Source: Heaver *et al*. (2001).

The question arises whether this evolution, with a continuing scale expansion based on horizontal and vertical cooperation agreements, will continue to manifest itself in the future. And, if it does, with what consequences, particularly in the container business? Which timescale will ship-owners follow in their search for new cooperation agreements? What kind of strategy might the other market players, i.e. the non-ship-owners, adopt[6]? Will ship-owners become the dominant players and be able to impose their will on other parties, such as port authorities and terminal operating companies?

The answers to these questions remain uncertain. Moreover, the market is not static; on the contrary, it is extremely dynamic. One may reasonably assume every market player to behave proactively, and to try and anticipate on possible strategic moves by other players. In the following paragraph, we take a closer look at the three most important market players: the ship-owners, the terminal operating companies and the port authorities.

4.1. Ship-owners: a constant striving for scale expansion

Among ship-owners, there was and still is a clearly discernible trend towards scale expansion. Initially, this manifested itself in horizontal cooperation and/or mergers and takeovers. In the second instance, ship-owners began to focus more on terminal operating companies and hinterland transportation services, a logical consequence of the evolution towards a complex logistics chain approach, whereby each link is expected to contribute to the optimisation of the chain. To the extent that ship-owners have gained control of logistics chains, their market power has been enhanced (see, among others, Song and Panayides (2002).

As far as rates and revenues are concerned, the shipping industry is an extremely cyclical business. It is noticeable, though, that even in periods when rates are relatively low because of overcapacity, ship-owners tend to continue investing in additional capacity. Table 7 provides an overview of recent containership deliveries and orders.

The single purpose of ordering additional capacity is to make new capacity available at a lower operational cost per slot. Moreover, to the shipping companies and their shareholders, operating a mixed fleet is a form of risk spreading. Additional cost control may be realised through mergers and takeovers, and ensuing capacity reduction. In 2005, for example, P&O Nedlloyd was taken over by the A.P. Moller Group, while CP Ships was acquired by TUI AG, the parent company of Hapag Lloyd.

Table 7. **Medium/large containership deliveries and orders**
(position at 1 January 2006; number and nominal TEU capacity)

		No. of vessels	TEU
Deliveries of new vessels in 2005		214	901 000
Total fleet (1 January 2006)		2 586	7 671 700
On order for delivery in:	2006	324	1 295 500
	2007	362	1 355 600
	2008	289	1 287 900
	2009	67	348 800
Total on order		1 042	4 287 700

Note: Table only includes cellular vessels with a nominal capacity of 1 000 TEU.
Source: LSE/Boxfile Containership Database.

Furthermore, strategic and financial considerations by the holdings that control the shipping companies will result in even tighter capacity management through strategic alliances, new partnerships and the rerouting of vessels, with possible consequences in terms of direct port calls. On the side of the ship-owners, then, the market may be expected to stabilise, albeit that rationalisation and concentration will inevitably result in fewer, but larger market players. The competitors of Maersk, for example, could employ a number of strategies to counter that company's dominant position: mergers and takeovers, closer focus on global alliances, the provision of niche services. However, the medium-large shipping companies will still be the next takeover targets of the mega-carriers, not in the least because precisely this kind of shipping company may find it hard to cope with heavy investments in vessels and terminals.

The question arises whether and to what extent the leading ship-owners may be expected to deploy larger ships. Will vessel sizes continue to increase to between 10 000 and 12 000 TEU, or even up to 18 000 TEU, the so-called Malacca-max type? Most probably not. After all, one may safely assume that ever larger ships will affect the cost function. Moreover, ship-owners know from past experience in tanker shipping that it would be unwise to put themselves in a situation where their vessels are able to call at only a very limited number of ports and where port authorities realise full well that the ship-owners' price elasticity is extremely low. Finally, scale and cost benefits realised at sea can be wasted on higher terminal and storage costs, as well as increased hinterland transportation costs, associated with the shipment of larger cargoes.

4.2. Terminal operating companies: the "free capacity" game

Terminals are important links in the logistics chain. However, shipping companies are often larger and more powerful, and are thus able to impose their rules of play: the economic benefits that ship-owners seek to achieve through large-scale expansion and corresponding cost reductions must not be wasted through quayside bottlenecks or, in a subsequent phase, bottlenecks in hinterland transportation. Ship—owners will not accept any waiting times and/or other time losses.

This pressure from ship-owners has, in the first instance, affected the traditional structure of what used to be known as stevedoring businesses, but which have since developed into much more complex terminal operating companies. In most cases, this evolution was occasioned by a need for substantial investment capital that could no longer be made available by the original owners. A wave of mergers, takeovers and externally financed expansion projects ensued, causing a concentration movement, coupled with market entries by new, primarily Asian, market players such as PSA and Hutchison Whampoa[7]. This evolution at once created a buffer against possible vertical integration on the initiative of ship-owners.

On the other hand, though, investment capital became available, which quickly translated into additional overcapacity. Table 8 provides an overview of recent and planned investments in a number of Northern European ports. The consequence is strong capacity growth at a moment in time when, globally, there is already a problem of overcapacity and when, in certain European ports, some terminals are seriously underused. Typical examples of the latter can be found in Amsterdam, Cagliari, Zeebrugge and Sines.

At the level of port and terminal investments, we also gain insight into the further internationalisation of capital flows. Table 9 provides an overview of port project finance deals in 2005.

Table 8. **New and planned container capacity in selected Northern European ports**

Port	Terminal	Additional capacity / planned introduction
Amsterdam	CERES Paragon Containerterminal (Amerikahaven)	1,250,000 TEU / 2008
Antwerp	Deurganckdock terminals	6,400,000 TEU / 2007-2008
Bremen	CTIV	950,000 TEU / 2007 950,000 TEU / 2009
Flushing	Westerschelde Container Terminal	2,000,000 TEU / no date specified
Hamburg	Eurogate container Terminal Hamburg CTH HHLA Container Terminal Burchardkai CTB HHLA Container Terminal Altenwerder CTA HHLA Container Terminal Tollefort CTT	1,900,000 TEU / 2010 2,400,000 TEU / 2010 600,000 TEU / 2010 1,050,000 TEU / 2010
Le Havre	Port 2000	Phase 1: four berths at a tidal terminal / 2005-06 Phase 2: two berths at a tidal terminal / 2008-09 Phase 3: six berths at a tidal terminal / depending on traffic increase
Rotterdam	EUROMAX Terminal Tweede Maasvlakte	3,000,000 TEU / 2007 up to 16,000,000 TEU / no date specified
Zeebruges	Albert II dock	1,000,000 TEU / no date specified

Sources: various port authorities

Table 9. **Port project finance deals in 2005**

Project	Date	Value	Arranger	Lenders
Gangavaram	December 2005	$260m	State Bank of India Capital Markets	State Bank of India, Punjab National Bank, Canara Bank, DBI Bank, Central Bank of India, Union Bank of India and State Bank
DCT Gdansk	October 2005	€180m	Macquarie	Macquarie, DVB Bank
Antwerp Gateway	May 2005	€143m	Barclays Capital, KfW IPEX-Bank	Barclays Capital, KfW IPEX-Bank, DNB Nor Bank, KBC Bank
Sodrugestvo Group, soya bean terminal, Kaliningrad	March 2005	$75m	Standard Bank London	Standard Bank London
Pusan Newport offshore tranche	February 2005	$465m	ANZ, Banca Intesa, BTM, Calyon, DZ Bank, Kookmin Bank	ANZ, Banca Intesa, BTM Calyon, DZ Bank, Kookmin Bank, ABN Amro, WestLB, KfW, SMBC, Standard HVB Chartered
Pusan Newport onshore tranche	February 2005	W350bn ($354m)	Kookmin Bank, Samsung Life Insurance, Woori Bank	Kookmin Bank, Samsung Life Insurance, Woori Bank
Multi-Link Terminals' port project in Kotka, Helsinki and StPetersberg	January 2005	€71m	DVB Bank	DVB Bank

Source: Lloyds Shipping Economist, based on Cargo Systems, Jan/Feb 2006

In addition to the great expansion in terms of terminal capacity, an evolution is also discernible in the manner in which terminals are organised. Some operate combinations of gantry cranes and straddle carriers, while others are evolving towards fully automated handling.

From the perspective of the ship-owners, the trend towards ever-greater concentration among terminal operators obviously poses an economic risk: less mutual competition, lower productivity growth, longer handling times for cargoes, and – above all – higher rates. Ship-owners will thus no longer be confronted with different, competing terminal operating companies, but with larger players who are active in various ports and who are therefore able to negotiate package deals. Consequently, port competition will, most probably, gradually shift from the level of individual port authorities to that of private terminal operators, i.e. large groups that offer regional networks.

The question arises how shipping companies will respond to such an evolution. As they are at risk of losing relative market power, they may be expected to focus increasingly on acquiring so-called "dedicated terminals", possibly under joint ventures with terminal operators who are active in the local market[8].

As far as the port authorities are concerned, an evolution towards more dedicated terminals need not be a negative development, as it will make shipping companies less footloose, in the sense that a long-term relationship is forged that will make them less inclined to relocate (Heaver *et al.,* 2001). In the short term, dedicated terminals may result in a temporarily low utilisation rate of terminal capacity.

4.3. Port authorities: safeguarding the control of infrastructure

In the midst of the competitive struggle between ship-owners and terminal operating companies, we notice that the market power of the port authorities is waning. Competitive strength is no longer considered in itself, but in the context of other, directly competing ports. In the future, ports will be regarded as competitive to the extent that they are part of strong, efficient logistics chains. Those logistics chains are controlled only very partially by the port authorities and industry located within the port.

In the present negotiating game between ship-owners and terminal operators, the port authorities do however hold one important trump card, i.e. the power to grant concessions, and to determine the duration of such concessions. Once a long-term concession has been granted, the port authorities lose a substantial share of their market power. Moreover, a concessionary who fails to achieve the goals presented in his business plan can usually not be penalised. Port authorities therefore have an incentive to include interim options in long-term concessions that are coupled with the actual realisation of objectives agreed beforehand with the concessionary.

In the past, certain port authorities have been known to pursue strategies aimed at enhancing their position in the port competition debate. A typical example was the decision in 1999 by the port authority of Rotterdam to acquire a 35% stake in the capital of terminal operator ECT. These kinds of temporary or longer-term operations raise the spectre of conflicts of interest, not in the least because port authorities may subsequently find themselves in a position where they need to grant further concessions[9].

A more recent trend is the sale of ports and/or port authorities. As has been the case in the air transport sector for some time, we again see the entry of international capital, often from a sector that is seemingly unrelated to the port sector. In 2006, for example, the American investment bank Goldman Sachs led a consortium with the purpose of taking over Associated British Ports (ABP), the largest ports group in the UK. The motivation for such takeovers lies in the strategic value added of investments in port infrastructure, the almost guaranteed return, and the fact that it is becoming increasingly difficult to develop additional port infrastructure, certainly within Europe.

4.4. An interim conclusion

With regard to the recent evolution in the maritime and port sectors, we draw the following interim conclusions. Ship-owners are benefiting maximally from constantly growing world trade. Indeed, shipping companies are undergoing massive scale expansions in consequence of a strong concentration trend. Even in periods when rates are low, a substantial amount of additional capacity is created, among other things to achieve lower operational costs per slot.

A similar concentration trend has begun to manifest itself among terminal operating companies. However, the big difference is that, in the case of terminals, we are witnessing the entry of international capital, whereas such companies primarily used to be local or national players.

This evolution towards ever larger shipping companies and terminal operating companies has coincided with a declining relative market power of port authorities. Concessions policies and port dues are the only two remaining trump cards in those port authorities' hands; unless, that is, if in this area too a concentration movement should unfold leading to a limited number of groups operating in different ports.

5. AN ATTEMPT AT CHANNELLING THE UNCERTAINTY

So how will the sector evolve in the future? To be sure, there are still a great many uncertainties in the short, medium and long term. However, the previously described trends do provide a number of elements that can help us channel those uncertainties (Meersman, Van de Voorde and Vanelslander, 2005).

We may reasonably assume that the substantial growth that has manifested itself in the economy and in international trade will persist. Moreover, we know this growth will automatically impact on seaborne trade. Still, there are no indications that profit margins in the maritime shipping industry are set to increase. This in itself is peculiar, as we are concerned here with a relatively risky investment for which one might reasonably expect to receive a premium. The main reason why this is not the case is that just about all shipping companies are continuing to invest in capacity expansion.

At the level of individual shipping companies, stakeholders may be expected to continue to demand that management achieve better results. Consequently, management will in turn put pressure on other links in the logistics chain, which will give rise to cooperation agreements with other market players as well as, undoubtedly, further vertical integration.

A number of shipping companies have, in the recent past, already taken some long-term decisions, including with regard to fleet expansion. At the aggregate level, this may lead to considerable overcapacity should demand decline. In the short to medium term, overcapacity will automatically result in lower freight rates and lower returns on investment, and thus put additional pressure on other market players within the logistics chain. Such a situation may be expected to occasion rationalisations through partnerships, takeovers and mergers with a view to reducing costs. In the slightly longer term, a shortage of own operating capital may give rise to cooperation agreements that go beyond the level of dedicated terminals.

So the new playing field slowly becomes visible: drastic scale expansion by ship-owners and terminal operating companies, coupled with horizontal and vertical integration.

The question arises what will remain of the third, relatively important, player, namely the port authority. It is clear that, besides its economic role, the port authority also fulfils the role of a kind of referee. For this reason, it is advisable to pursue a port policy that is diversified in accordance with the various market players. Large shipping companies should be approached differently than small ones, if only because of the difference in terms of market power. Terminal operators are best approached differently than ship-owners, etc. An adequate policy presupposes that one stays aware of cluster effects, while not neglecting the singularity of individual companies and sectors.

From the perspective of the port authority, port policy should not be restricted to the management of container traffic. Most ports are active in just about all seaborne trade flows, including in liquid and dry bulk, container throughput and other unit loads, in just about all goods categories and on all geographical relationships. Each of those submarkets has its own degrees of freedom. In the case of VLCCs and ULCCs, price elasticity will be much lower than in the case of containerships, if only because there are few alternatives for certain types of transport.

An issue that will undoubtedly be raised in the short term is that of cooperation, possibly across borders, between public and port authorities. Important incentives for such cooperation are the achievement of cost saving and avoidance of subsidised overcapacity, and the potentially ruinous competition that may otherwise ensue. It speaks for itself that this does not exclude the possibility that, from a business economic perspective, cross-border cooperation is achieved between companies in the various ports.

The most obvious business policy is mutual capital participation. Only, it should be pointed out that, in a number of European countries (e.g. Italy, Portugal, Belgium and the Netherlands), the capital that has been invested in recent years has come primarily from the Far East. Consequently, the crucial question arises whether this implies that, in a next phase, certain technologies, which are already applied in some Asian ports, will be imposed upon European ports.

There is an urgent need for a tool that allows an accurate analysis of the connection between the various market players and an assessment of the potential consequences of the divergent strategies that each of these parties may deploy. The objective of any private company is profit maximisation, an increase in market share and/or market power. However, the manner in which one strives to achieve those goals may vary, as may the consequences for the other market players.

As has become apparent in this paper, the scenarios that are expected to occur, and that therefore need to be examined, are more or less fixed. But their timeframe remains uncertain. As is the case in the price-setting process in the maritime industry, and in successfully protecting oneself against price fluctuations and other risks, timing and optimum speed of action will determine who ultimately comes out on top.

NOTES

1. With thanks to Dr. Thierry Vanelslander for his co-operation, suggestions and critical remarks during the writing of this contribution. It speaks for itself that only the authors are responsible for any errors or inaccuracies.

2. This ties in closely with the definition of seaports proposed by Branch (1986, p. 1): "*A seaport has been defined as a terminal and an area within which ships are loaded and/or discharged of cargo, and includes the usual places where ships wait for their turn or are ordered or obliged to wait for their turn, no matter the distance from that area. Usually, it has an interface with other forms of transport and in so doing provides connecting services*."

3. As a consequence of this strong heterogeneity, the objectives of a port authority, for example, are in part determined by the extent to which that authority is subjected directly or indirectly to outside influences, external control, or direct competition from other ports. It is therefore not surprising that these objectives often differ greatly and have been known to shift significantly over longer periods of time (Suykens, 1986, p. 108).

4. The data presented in this section are taken primarily from the *Review of Maritime Trade* (UNCTAD), *World Trade Report* (WTO), UNCTAD *Trade and Development Report.*

5. UNCTAD (2005), *Review of Maritime Trade*, p.15

6. It has been quite noticeable in recent years how most port authorities and higher administrations have focused primarily on the container business. It remains to be seen whether this is a wise strategy, given that not all goods can be containerised. Moreover, value added and profits achieved in, for example, project cargo shipping are usually substantially higher than in container transport.

7. In 2005, the four largest terminal operating groups handled 40% of container traffic. These four groups are Hutchison Port Holdings (HPH), PSA Corporation, APM Terminals and P&O Ports. In March 2006, Dubai Port World (DP World) took over the P&O Ports group, in a deal covering 29 container terminals and logistics operations in more than 100 ports, in 19 different countries.

8. An interesting example from 2006 concerns the joint venture between the Mediterranean Shipping Company (MSC) and the Singapore terminal operator, PSA, with a view to the exploitation of three berths at the Pasir Panjang Terminal in Singapore. MSC and PSA are also co-operating in Antwerp..

9. In the future, each commercial action undertaken by a port authority shall have to be assessed in the light of how far that port authority can go as a regulator and interface with higher authorities. In this context, the European Commission has considered the following set of criteria: transparency, non-discrimination, objectivity.

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Airports and International Economic Integration

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SUMMARY

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INTRODUCTION

The importance of transportation as an integration force was recognized in antiquity. The Minoans used shipping to keep their empire together and by the times of Classical Greece standard financing regimes for maritime trade had become a feature of commercial and trade policy. The Romans engaged in civil transport engineering activities as a key feature of their integrated economic and political system, as well as for military reasons; they, for example, could march an army to any part of the Empire in 40 days. The British Empire focused on developing ports and vittling stations to integrate its colonies, and the railways were developed as part of the political, economic, and social integration processes in Canada and the US. More recently the incorporation of a Common Transport Policy as a cornerstone of the Treaty of Rome can be seen as a continuation of this policy.

The modes of transportation have evolved with time and, whilst feet, horses and sail were the mainstay of economic integration in the past, and still are in some countries, they were superseded initially by steam-powered locomotion in the Industrial revolution and subsequently by cars, truck and trains. The aeroplane is now playing an increasingly important role in the 21st century transportation system. This role, although by no means dominant, however, often tends to be underplayed, and this seems to be for a number of reasons.

One of the difficulties in developing transport policy is that transport is too often treated as an end in its own right and in this context air transport emerges on many measures as a relatively small contributor to the overall transportation system. Tied to this is a tendency, to adopt an Americanism, for political lobbying supporting a ‘favourite son’. By the former I mean that transport tends to be treated as a final output rather than an input into some ultimate activity. But as Denys Munby (1968) eloquently expressed it some forty years ago, “Only the psychologically disturbed or inadequate want transport for its own sake”[1]. This leads to the second point, namely that there is a tendency to think of transport in terms of modes rather than the attributes that users seek and this inevitably leads to lobbying for particular forms of transport (e.g., rail and truck) or types of service (e.g. intermodal). The plethora of powerful ‘trade associations’ representing the views of particular transport interests reflects this. The inevitable consequence of this is that most transport policy is driven by the ability of various supplying transport industries to articulate their respective cases rather than then the desires of consumers, or any overall concern with the wider social welfare. The lobbying power of air transport is inevitably limited because it is still a relatively new mode of transport and its labour force is small[2].

This traditional approach to thinking of transport as somehow being wanted because it is a ‘good’ in its own right, has the consequential, possibly inevitable outcome that policy is based upon supply *per se* rather than the social benefits associated with this supply. The derived nature of the demand for transport is ignored. This can stymie the efficient role of transport in national economic and regional development, and in fostering international integration. What is in fact important is the impact that transport may have on allowing the comparative economic advantages of various regions, at whatever level of aggregation, to be fully exploited. The use of transport, however, to try to force economic integration to take place where there is none naturally can be counterproductive[3].

Air transport, like other modes, is essentially a facilitator of trade and mobility, an important input into most forms of economic growth, and can act as a means for fostering social and political integration. This is true irrespective of the geographical level of aggregation being considered. It seldom provides economic stimulation in its own right, however, but more commonly acts as a lubricant to mechanisms that already create a comparative advantage for an area or country[4]. But it is also true that transport consumes resources, most narrowly in a market sense but more broadly in a sustainability sense. One can, therefore, have too much transport, and one can have serious mix-matches of the types of that transport that are available. This has inevitable adverse consequences for social well-being, often only felt in the long-term and beyond the horizon of current policy makers, that may be on a par with too little transport. Thus the underlying issue is the provision of optimal transportation services, including air transport, given the demands at the time and the resources that they require.

Added to this, neither the global economy nor the technology of transport remains stable; both are continually changing for a variety of reasons. The focus here is on air transport and, more narrowly, the role of airports in international economic integration. For the ECMT this is a relatively new area of interest – air transport not being within its original remit that was largely reserved for the ‘favourite sons’ at the time of its formation (namely, road and rail modes) and one feels it may be being smuggled in now. It is also a mode pushed gently aside for future consideration by the, then, European Economic Community when it sought to embrace a Common Transport Policy within the Treaty of Rome. It was only subsequently embraced after legal actions regarding the way the sector was behaving and as more general impetus for an anglo-saxon approach to markets emerged under the Single European Market initiative. The UN was a little more farsighted when it established the International Civil Aviation Organisation to oversee the development of the global market in air services. The Chicago Conference of 1944 may not have shaken the world in what it achieved but, at the very least, it sets parameters and established common jargon within which subsequent discussions could take place, and institutionalized a forum for those discussions.

While limiting the analysis to airports, and inevitably airlines and air navigation services that are elements of the larger system, it should not be forgotten that air transport is part of a multimodal system that embraces both other modes of physical transport for access and egress purposes and a variety of ‘virtual transport’ modes to move complementary information. The amount of information, for example, that has to be transported to allow every commercial flight to take place safely is immense. Airports by themselves, and divorced from these other transport modes, would serve no economic integration function.

1. AIR TRANSPORT

Air transport is now a major global industry in its own right and airports are a vital component within the industry. In round numbers, the commercial air transport sector moves some 1 600 million passengers a year over a 15 million kilometre network using 18 000 aircraft. It carries 30 million tons of freight involving 130 billion revenue ton kilometres. In geographical terms there are over 190 nations in the network and over 1 400 city pairs are served. In economic terms, the industry involves over $260 billion in turnover and is estimated to carry 40% of international cargo traffic by value – a more important reflection of its social value than physical indices often cited as indicative of the relative importance of transport modes. In national accounting terms, air transport accounts for about 1% of the Gross Domestic

Product in Europe and in the US, although, of course, the specifically Keynesian nature of national accounting systems provides little guidance as to its wider impacts.

To serve this system there are over 10 000 airports that handle a significant amount of commercial traffic, and systems of air navigation, information dissemination, and control for routing and managing it. The overall costs of the airports represent about 4% of the overall costs of air transport, although there are wide variations by region and type of traffic. The monetary cost of using airports does not, however, reflect the full resource implications for the carriers that use them because in many cases landing fees are regulated and there are additional time costs of waiting for the use of facilities. Most major European have, for example, heavily congested for many years (Button and Reynolds-Feighan, 1999).

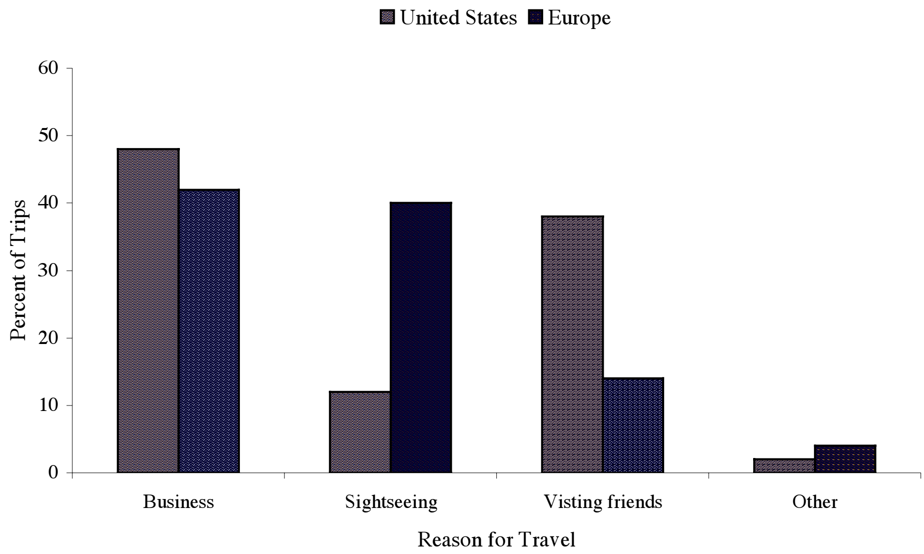
The importance of air transport has grown over the past forty years for a diversity of reasons. Technology has enhanced the performance of aircraft in terms of their range, payload, and reliability. This, as well as improved design, has reduced both the commercial and social costs of their operations. The nature of many economies has been transformed with the growth of the service sector and a move towards more precise production and management techniques for manufacturers. The latter often requiring expensive components and spare parts entailing significant inventory holding costs – air transport offers access to these components almost on demand and thus holding costs are reduced. Added to this, those engaged at the professional level in modern service and manufacturing industries travel by air as part of their employment far more than their counterparts in traditional sectors – US evidence suggests by up to 60% more.

The increases in income enjoyed in many societies, the aging of their populations, and the availability of more leisure time has resulted in a massive growth in tourism and leisure travel. Outside of Europe over 50% of tourists travel by air, and within Europe, where trips are often shorter, the percentage is only slightly smaller[5]. Family and employment patterns are also changing with families becoming more geographically dispersed. This is often on a permanent basis as people migrate, but increasingly also on an almost weekly bases when two spouses have their jobs some distance apart and travel to meet up at weekends. Air transport provides the basis upon which social ties are retained in these situations and, as such, allow, for a far more efficient and integrated labour market. The variations in the use of air transport between the US and Europe (Figure 1) provide some insights into the importance of these factors in the way air transport is used in different global regions. Labour mobility is very much higher in the US, and often over longer distances, and thus visits to kith and kin become more important in the fabric of life[6].

Economic regulatory reform in the air transport sector, initiated with the domestic liberalization of the US air cargo market in 1977 and the passenger market in 1978, but subsequent followed by phased liberalization of both domestic and international markets within most of Europe after the introduction of the three ‘Packages’ from 1987. More broadly, many countries have relaxed their international trade arrangements (air service agreements) to facilitate freer markets on a bilateral basis. The US has been active in this realm since 1979 with its Open Skies initiatives, although it has only been in the past 15 years that these have really had an impact.

These reforms, and especially those involving US markets about which the best data is available, have been studied extensively. The general finding is that they have been beneficial for the vast majority of air transportation users in terms of costs and service options, but that there are problems of market instability due to the potential for excess competition to emerge amongst the airlines (Button and Stough, 2000). What is certain is that air transport is no longer the preserve of the wealthy and senior executives, but is widely used for social reasons and by all levels of management.

Figure 1. **Reasons for Air Travel**



Source: US Air Transport Association.

A notable feature of these regulatory reforms, and many of the others in the transport arena, has been their focus on the mobile elements of the system – the airlines, buses, and trucks. It is only relatively recently that in most countries transportation infrastructure has been the subject of any significant institutional reforms. **Table 1** lists some of the major initiatives in air transport and the pattern is transparent.

Table 1. **Major Regulatory Reforms and Initiatives in Aviation**

1977	US Air Cargo Deregulation Act
1978	US Airline Deregulation Act
1979	Term “Open Skies” used
1984	UK-Netherlands liberal ASA bilateral
1987	EU’s “First Package”
1987	UK Airports Act (privatisation)
1989	EU’s “Second Package”
1989	Northwest-KLM strategic alliance
1992	EU’s “Third Package”
1996	NAV Canada established
1999	“Single European Skies” initiative
2001	NATS UK established

This pattern, in part, reflects the belief that competitive forces can easily be introduced for the operational side of transport but that it is more difficult to handle the potential monopoly power inherent in infrastructure. Airports, for example, are often seen to have economic powers approaching those of a nature monopoly, despite the potential countervailing power enjoyed by large airlines and the innovative methods of economic regulation now available. The situation is changing as airports develop and public sector funding is often inadequate to meet the investment costs and as questions of the efficiency of regulations are raised.

The spatial pattern of air transport use varies considerably as do trends in the various regions of the World (**Table 2**). Forecasts are always conditional on a plethora of factors, and the various bodies producing them offer differing predictions. In general they are posited on the broad continuation of long standing relationships between air transport and a set of exogenous variables whose future paths are seen as fairly predictable.

Table 2. **Air Traffic by Region (2005)**

Region	Passengers		Cargo	
	thousands	change (%)	thou. tonnes	change (%)
Africa	107 750	9.1	1 334	7.0
Asia/Pacific	845 444	7.2	25 028	5.0
Europe	1 231 957	7.3	15 479	2.56
Latin America/Caribbean	251 974	10.4	3 584	1.2
Middle East	93 224	9.5	3 318	7.9
North America	1 478 472	4.0	29 919	0.0
Total:	4 008 821	6.3	78 661	2.5

Source: Airports Council International.

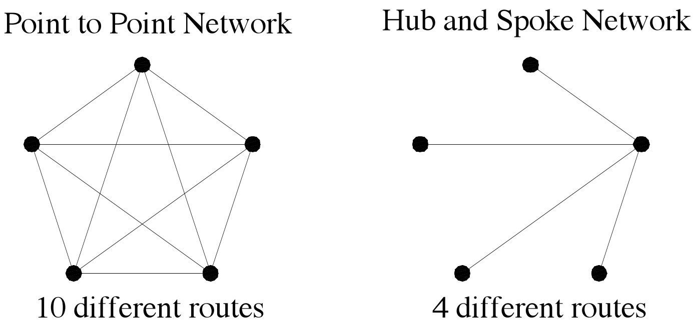
Boeing Commercial Airplanes (2005) provides widely used sets long-term forecasts that have proved relatively robust in the past. These suggest continuing growth in all air transport markets, although with quite considerable variation by region. Air passenger traffic is anticipated to grow annually at about 4.8% globally until 2020 and cargo traffic by 6.2%. Regional growth in international passenger traffic is forecast to grow by ??? on the North Atlantic, 5.1% on pacific routes, and 5.1% between North and South America. These variations being a function largely of differences in key drivers such as economic growth and of the current level of supply – some markets are already very well developed with limited scope for further rapid development.

2. AIRPORTS AND AIR SERVICE NETWORKS

The liberalization of many airlines markets, but many fewer airports and air navigation systems, has led to major changes in the nature of the international air transport services provided. Past regulations of international routes under restrictive bilateral air service agreements, although often differing in detail had generally entailed fare controls, the limitation of carriers allowed to serve the market, capacity controls, and a pooling of revenues. Most countries offering international services (the US being an exception) limited them to state owned, 'flag carriers'. The airports to be used for services were also often set within these agreements.

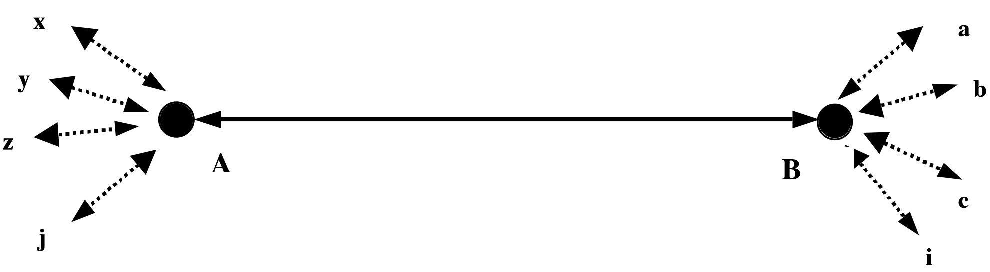
The move away from micro-regulation has generally resulted in the resultant markets imposing more cost effective structures on airlines with the supply and form of services offered influenced by consumer demand patterns rather than governmental opinion. This holds at both the domestic and international levels. The largely *ad hoc* networks of point-to-point services that grew up under the command-and-control regimes have changed. The hub-and-spoke system now adopted by most major carriers funnels traffic from smaller airports through larger ones to smaller destination airports. The hub-and-spoke system offers the potential for economies of scale, scope, and density on the costs side whilst producing economies of market presence on the revenue side[7]. **Figure 2** provides a hypothetical comparison of the different forms of route structures.

Figure 2. **A point-to-point network versus a hub-and-spoke system**



At the intercontinental level, the main hub airports act as collection points for feeder traffic into long-haul routes and as the bases for the trunk-haul services – hub A collects passengers from x, y, z… in **Figure 3** to travel to hub B. Given the need for the dispersion of traffic at the other end of such services, the receiving airport (B) of the long haul traffic acts as a dispersion point for traffic terminating at a, b, c… . This gives rise to the 'dog-bone' style of international hub-and-spoke operations seen in the figure. The pattern is not only applicable to passenger air traffic, but includes much of the cargo moved as well. Indeed the major express carriers (UPS, FedEx, DHL, etc) have large international hubs around the world akin to the passenger airport hubs, as do the airlines specializing in larger units of cargo.

Figure 3. **The dog bone pattern of duel hub service networks**



The spatial implications on national economies of the main, intercontinental airports can thus be extensive, and indeed most have significant amounts of economic activity associated about them, but to fully exploit their potential, airlines must have appropriate access to them. One of the difficulties at the international level is that many air service markets remain regulated, reducing the ability of airlines to make use of the airport capacity that does exit. One example of this are the restrictions that still exist on some elements of the North Atlantic market because of restrictive bilateral air service agreements. These, in particular, limit the use of Heathrow but have wider network implications. But they also exist in numerous other markets, especially involving developing countries, and there has been a recent tendency for international carriers to seek out these enclaves where they are protected from the full rigors of competition for their own commercial gain (Button *et al.*, 2006).

3. THE MODERN ROLE OF AIRPORTS

Most forms of transport allow for both connectivity and interconnectivity, and nodes in the various modal networks, such as railway stations, seaports, bus stops, and airports, act as facilitators for these, and they do so in a variety of contexts. Their detailed functions may vary, and each node may serve a combination of functions. In broad terms these functions embrace roles as:

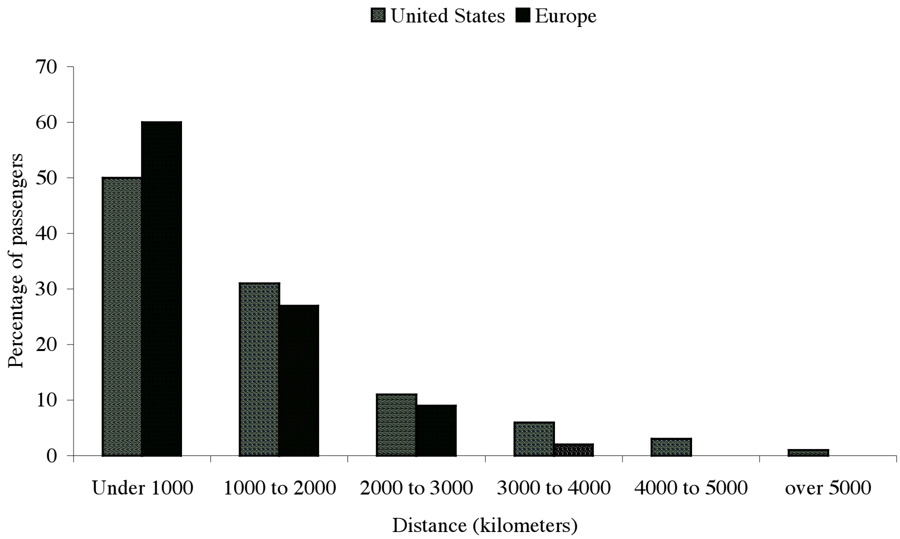
- origin and terminal points for trips (a very rare event in air transport since most movements start and end away from an airport).
- points of interchange for a single supplier of a particular mode of transport that results in an on-line service (e.g. point where users of a single airline, or airlines of the same airline 'alliance', change equipment – normally seen as a hub airport in the airline context).
- points of interchange between several suppliers of a particular mode of transport that leads to inter-lining (e.g. users who change equipment between two independent airlines).
- points of intermodal transportation interchange (e.g. where users switch between rail and air transport).

In this general sense there is nothing particularly special about the economic characteristics of airports, they act like any other node in any transport network. Their particular importance lies in the overall nature of the air transport mode, its attributes, and the role that it is now playing in the modern global economy.

Air transport's comparative advantage lies in situations where long distance, fast, and reliable transport is required for the movement of people and relatively low bulk commodities. For example, **Figure 4** provides information about the distribution of the lengths of passenger air trips in Europe and in the US and it is clear that many are very long. Air transport is the dominant mode for intercontinental personal travel.

But added to this, because there is no physical track involved in the traditional sense, air transport is highly flexible in the range of spatial services that it can offer, thus reducing the risks inherent in high-cost, durable track modes. By its nature, it also can serve locations that are physically difficult to reach even if not physically remote in spatial terms. It is widely used in Asian, for instance, for relatively short haul movements where there are often significant water barriers to cross and in places where mountain ranges impede easy land movements. Against this, air transport is not normally cost effective in the carriage of bulk commodities or for local distribution services.

Figure 4. **Distribution of Air Trips in the US and Europe**



The airports in the global air transport system are varied in size and in the functions that they serve. While within Europe many of them exclusively service short and medium haul international operations, and link these with domestic services in the larger countries, there are a number of larger facilities that tie Europe into the intercontinental economy Heathrow, Gatwick, Frankfurt, Schiphol, and Charles de Gaulle. By way of contrast, the large US's airports, because of the size and the geography of the country, primarily serve a domestic function although there are increasing volumes of international traffic as globalization takes place. The situation in other parts of the world is equally variable. **Table 3** provides a guide as to the scale of the largest airports, which are predominantly in the US and Europe, and highlights the very different roles they play in terms of their national and international transport markets[8].

Table 3. **Major Airports Ranked by Passengers (2005)**

Airport	Country	Passengers (thou.)	Flights (thou.)	Intercontinental seats (%)	Regional seats (%)
Atlanta	USA	85 907	17 496	8.5	91.5
Chicago (O'Hare)	USA	76 767	17 952	11.1	88.9
London (Heathrow)	UK	67 915	9 118	51.1	48.9
Tokyo (Haneda)	Japan	63 282	6 310	0.0	100.0
Los Angeles	USA	61 485	10 978	19.4	80.6
Dallas/Fort Worth	USA	59 064	12 912	4.0	96.0
Paris (Charles de Gaulle)	France	53 756	9 436	44.2	55.8
Frankfurt	Germany	52 219	9 044	43.3	56.7
Las Vegas	USA	44 280	7 736	0.8	99.2
Amsterdam	Netherlands	44 163	7 782	34.7	65.3

Source: Pilling (2006).

The economic impacts of airports on the economy where they are location are akin, in general terms, to other transport nodes although each case has its own particular features depending on such things as its scale, the productive capacity of the local region, and role of the mode in the larger transport network. Broadly, investing or expanding in an airport at any location may have the following effects:

- *Primary effects.* These are the benefits to a region in the construction of an airport – the design of the facility, the building of the runways, the construction of the terminals and hangars, the installation of air traffic navigation systems and so on.

- *Secondary effects.* These are local economic benefits of running and operating the airport – employment in maintaining the facility, in handling the aircraft and passengers, in transporting people and cargo to and from the terminal and so on. These secondary effects can be extremely important to some local economies in terms of employment, income and, for local government, taxation revenue.

- *Tertiary effects.* These stem from the stimulus to a local economy resulting from firms and individuals having air transport services at their disposal. These differ for those living in hub cities, compared to those on a spoke or having no major carrier. Hubs offer more direct flights favoured by business travellers. But the hub also benefits those on the spokes because without a hub-and-spoke structure many would find it difficult to travel long distances at all. Hubs allow interconnectivity. In the US over half of the 15,000 city pairs served by a major carrier have less than one passenger per day.

- *Perpetuity effects.* These reflect the fact that economic growth, once started in a region, becomes self-sustaining and may accelerate. An airport can change the entire economic structure of a region – it can shift its production function. This type of dynamic economic impact of an airport is the most abstract and the most difficult to quantify. It has been little researched.

- Separating these elements is not easy and, for assessing genuine transport impact effects, not are all relevant. The primary and secondary effects, while they may be important in a Keynesian demand management effect, where short-term job stimulation is sought, usually have little to do with longer term economic development and integration. The key elements are those relating to growth in non-air transport activities, either by allowing the local economy to move up its production function (the tertiary effect) or by causing the production function to permanently shift out (the perpetuity effect).

Direct measurements of the tertiary and perpetuity effects of airport developments are scarce, are calculated in a variety of ways[9], and they often embrace a cocktail of the various effects. But some do offer general guidance as to the local benefits of major airport development (Button *et al*., 1999). Examples include:

- US Metropolitan Standard Areas - hub airport increases region's employment by 12 000.
- Chicago O'Hare – 50% increase in traffic will increase employment in the region by 185 000.
- Atlanta - 264 foreign-based firms, direct international services was 3rd most important thing in location
- Fifty-seven companies in Europe – air transport network the 3rd most important factor in location.
- Zurich – 34% of firms considered the airport as 'very important' and 38% as 'important' as location factor.
- Schiphol Airport (Netherlands) – 85 000 jobs for the country.

These studies, and most others, tend, however, to rely on standard impact analysis, with all its limitations, and focus on all uses of an airport rather than the purely international dimensions, to reach their conclusions. They seldom really say much about the specific international economic aspects.

Perhaps more germane to the issue of airports and international economic integration is the effect on local and regional economies of air service improvements, and in terms of whether a city's airport serves a wide range of good international destinations. Button and Taylor (2000) used econometric analysis that normalized for differences in such things as population sizes, time zones, and military expenditures to look at the economies of major US cities in the 1990s and found that those with airports offering direct North Atlantic services enjoyed higher levels of high-technology employment and income than similar cities without, and that there was a increase, albeit less than in proportion, in such employment as more European cities were served[10].

Further support for the economic integration benefits that can come from allowing airports to be fully integrated into the global air transport network can be seen in studies looking at the implications of freeing up the North Atlantic air routes, and, *ipso facto*, allowing more efficient utilization of airports. The liberalization of use of secondary UK airports as part of a mini-deal in 1995 under the North Atlantic bilateral agreement with the US saw a growth of international services from existing UK gateway airports (Manchester, Birmingham, and Glasgow) and the emergence of new ones (Bristol, Edinburgh and Belfast).

A major study by the Brattle Group (2002) finds significant benefits for air travellers from such a change, and although inevitably this comes about through a variety of channels, a significant part is due to more flexible use of airports. Similarly, Button and Drexler (2006), taking job creation as a guide to economic benefits, find that European countries where access to their airports is in effect limited by restrictive bilateral air service agreements would enjoy significant gains by their removal.

One final way of trying to quantify the importance of airports to international economic integration is by looking at the way airline efficiency has improved by more flexible use of airports within the current regime of governance. In particular, the vast majority of major international carriers have joined into alliances – SkyTeam, OneWorld, Star Alliance. This facilitates, among other things, the ability to funnel traffic more effectively through their international hub airports. In the case of the Star Alliance, the European traffic of the US carriers United and US Airways is largely funnelled through Lufthansa's hub at Frankfurt Airport on code share flights. As seen from the results of various studies of the implications of this (**Table 4**), the overall impact has been beneficial to the international traveller and this, in turn, has inevitably been a stimulus to international mobility.

Table 4. **Studies of the effects of strategic alliance**

Study	**Alliances**	**Period**	**Findings**
Gellman Research Associates (1994)	BA/US Air, KLM/NW	1994	Profits increased for all parties with BA and KLM gaining more than their partners.
Youssef and Hansen (1994)	Swissair and SAS	1989-91	Increases in flight frequency; variations in fare levels; the strongest service levels had the lowest fare increases.
US General Accounting Office (1994)	KLM/NW, USAir/ UAL/Ansett, UAL/ BMA BA, UAL/Lufthansa	1994	All carriers enjoyed increased revenues and traffic gained at competitors' expense, not industry growth.
Dresner *et al*. (1995)	Continental/SAS, Delta Swissair, KLM/NW	1987-91	Mixed successes with traffic volumes; in general alliances did not benefit partners.
Park (1997)	KLM/NW, Delta/ Swissair/Sabena	1990-94	Traffic increases at the expense of rivals. Complementary alliances lowered fares while parallel alliances increased fares.
Oum *et al*. (2000)	Star Alliance, oneWorld Skyteam, KLM/NW	1992-94	Increased traffic on alliance routes.
Brueckner and Whalen (2000)	US international alliances	1999	Fares are some 18% to 20% lower on international alliance, inter-lining routes.

Source: Button and Drexler (2006).

4. TRENDS IN AIRPORT PROVISION AND IMPLICATIONS FOR INTERNATIONAL ECONOMIC INTEGRATION

Airports have traditionally been publicly (either by central or local government) owned and operated. The reasons for this vary between countries, but in many cases it has to do with their development from military institutions or as elements in regional or national economic development strategies. Some economic veneer has sometimes been added to the debate with airports, for example, being seen as public goods but the manifest ability to exclude users and their clear potential to suffer from congestion indicates the invalidity of this type of argument. Other quasi-economic arguments that have been muted include the need for integration into wider economic networks, the need to consolidate large amounts of investment money, and the wide range and intensity of environmental externalities associated with airports, although there have been few efforts to offer a rational explanation of why these challenges, if they are indeed an issue, cannot be tackled by other devices. The reasons for state provision of airport facilities, is thus *de facto*, one of control for mainly political reasons than one designed to enhance air transport from an economic perspective.

Given the lack of any counterfactual, there is limited evidence that public ownership has done much to enhance the efficiency of airports. This is now changing. The recent trend, initiated largely by the privatization of the UK airports in 1987, has been for the privatisation or corporatisation[11] of many airports (Hooper, 2002; Juan, 2005) The aim of these measures has largely been to reduce the degree of static X-inefficiency perceived to exist under state ownership and to inject more dynamic X-efficiency by confronting airports with the disciplines of the private financial market[12]. The impact on international economic integration, if this is indeed the result, should, therefore, be transmitted via lower costs of airport services and the provision of services more closely tied to the demands of those wishing to make use of air transportation.

The evidence to date regarding the move towards a more market-based approach to the provision of airport services is rather mixed. Parker (1999), for example looked at the situation regarding BAA before and after the UK Airport Act and found no significant improvement although, he does point to the possibility that the move to private ownership in itself may have brought about significant efficiency gains. Advanti and Borins (2001) used a sample of 201 airports and found economic benefits accompanying institutional reforms.

A somewhat larger set of data that embraces the of pooling time series and cross sectional information relating to airports across the globe, was used by the Air Transport Research Society. This, however, found that privatisation, at least in the forms examined, offered no efficiency gains, and in many cases state-owned airports emerged as more efficient (Oum *et al.*, 2006)[13]. One possible explanation for this is the monopoly power that many large airports enjoy allows them to rent seek. Certainly the operating margins of airports are high compared to the poor recent financial performance of the airline industry (**Table 5**)[14].

Table 5. **The Operating Margins of the Larger EU Airports**

Airport group	Operating margin (2001)	Operating margin (2002)
BAA plc (UK)	29.8%	30.6%
Fraport (Germany)	18.0%	15.8%
Aèroport de Paris (France)	6.0%	9.2%
Schiphol Group (Netherlands)	31.7%	32.0%
Luftartsverket (Sweden)	3.7%	9.1%
Flughafen München GmbH (Germany)	11.8%	3.7%
Avinor (Norway)	22.9%	17.1%
Aeroporti di Roma Spa (Italy)	16.8%	21.2%
SEA Aeroporti di Milano (Italy)	11.5%	10.4%
Manchester Airport Group (UK)	19.2%	19.3%

Finally, there is the position of airports in lower income countries, and in particular those in Sub-Saharan Africa countries where economic development has proved difficult in the past. As seen in Table 2, the African air transport market is still small but in addition to that it is the only macro-regional market where fares are rising and it has the worst safety record. Many African nations, however, are trying to foster economic growth by expanding high foreign exchange earning sectors such tourism and the export of exotics (fruits and flowers) both of which require high quality airport facilities[15]. But even those that rely heavily on extractive industries require good air transport for the movement of key personnel and components.

One major problem for these low-income countries is conforming to safety and security standards for international aviation as stipulated by the International Civil Aviation Organisation – a situation largely the result of their lack of adequate resources (Button *et al*., 2004). The World Bank recognises the problems, does a number of national governments (e.g. the US 'Safe Skies for Africa' Initiative), and resources beginning to be delegated to combat it. The full integration of the African economy into the global market, however, remains serious impeded by the inadequacy of the Continent's air transport infrastructure.

5. CONCLUSIONS

Air transport has become a major form of both passengers and cargo transportation. It serves to broaden the trade bases of countries as well as being central to the development of many specific industries such as tourism and the trade in exotics. Airports are an integral part of the air transportation network and their location and operational features affect the degree to which air transport as whole can facilitate economic development and integration. Getting a firm handle on the quantitative importance of the airports in the overall international value chain is virtually impossible because their close synergies with airline and air navigation systems, together with their larger link-ins with surface transport access and egress facilities. Tweaking the data from less direct analysis does provide some insights, however, that offer quantitative support for otherwise anecdotal evidence for a positive tie between airport provision and economic integration often found in the commercial press, and the more logical arguments that stem from theoretical models. As the nature of trade changes and its volume increases, the need for personal and cargo movements by air will inevitably increase with it. The challenge is to ensure that markets in airport services exist, and are flexible enough to allow the optimization of economic activities that ideally should take-place.

NOTES

1. Although judging from the models and pictures of favorite modes often seen when visiting the offices of those supplying transport or responsible for transport policy formulation, it is clear that for some people simply supplying their favorite transport is seen as an end in itself.

2. The one notable exception to this are air traffic controllers who, despite being small in number, exercise considerable power.

3. The oft-cited case of this regarding surface transport was the effort to link the poor Appalachian Mountains region of the US to the rest of the economy.

4. See the papers in Thisse *et al.* (1996).

5. Much of the European tourist traffic makes use of secondary airports or off-peak times at the major facilities and, although low cost carriers are impinging on the market, a large part of it is still carried by essentially charter airlines – e.g. 6.5 million tourists fly to Greece from the UK annually (81% on charters) and 24 million to Spain from the UK (80% on charters).

6. In some places air travel has also been a facilitator of the 'second-home phenomena' whereby family units remain integrated but make use of two residences together. The growth of low cost carriers in Europe has been a particular recent facilitator of this, but there has been a longer established pattern of second homes in the US.

7. Many low cost carriers such as Ryanair in Europe tend to have similar radial patterns of service but do not normally allow on-lining at their base points. Essentially they do not offer seamless services through these airports and a flight from A to B to C would require two separate tickets.

8. In some cases a major airport is closely tied to a larger multi-modal set of international terminals. For example, Schiphol Airport is seen as part of a much larger 'Mainport' strategy involving Rotterdam seaport, high-speed rail services and freeway facilities, as well as being a large air transport interchange point in its own right.

9. The methods used range from econometric analysis, through the application of local multipliers and input-output analysis, to expert opinion analysis.

10. The analysis of 41 US Metropolitan Standard Areas found that, for example, on the basis of assumptions regarding links between patronage and service frequency an increase in European destinations served from 3 to 4 results in some $160 million per annum benefit to the area. As expected, the effect falls of as more destinations are added.

11. Corporatisation is a fairly broad term that refers to transferring ownership to some form of non-profit making entity independent of government control, although it may be a government agency. Equally privatisation has not always been 100% and in some cases government have retained a significant stake in the airport.

12. The economic efficiency of airports, even within state ownership, has been found to vary considerably (e.g. Abbott and Wu, 2002; Nyshadham and Rao, 2000). The issue has traditionally been one of seeking to enhance efficiency within this ownership structure rather than change the nature of ownership itself.

13. This ATRS studies have been the subject of criticism by Tretheway (2006) because of apparent major shortcomings in the data bases that have been used.

14. The ability of airports to extract rent from the airlines, and thus indirectly from passengers and cargo shippers, various considerably depending on the exact nature of the local market and the institutional structures within which they operate (Button, 2006).

15. For example, Kenya exported 50 000 tonnes of flowers by air freight in 2003.

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Topic V:

International Transport and Domestic Policy

Financing future growth in infrastructure needs

by

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SUMMARY

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INTRODUCTION

Determining future transport infrastructure needs is traditionally the first stage in the investment planning process. However, this process generally takes place within the framework of national transport policy, even in cases where the infrastructure is used for international traffic flows. This report proposes to address this issue by considering the specific needs of international traffic flows with regard to inland modes of transport.

Obviously, these issues will be shaped by the way in which traffic flows develop over the next few decades, since new infrastructure needs and the associated financing problems clearly depend on the pace and scale of such growth. This uncertainty would be dispelled if growth were to remain zero or very close to zero. In the opposite case, namely if average growth rates were to be higher than 1.5% to 2% in European countries, growth in traffic raises the issue of the so-called decoupling of transport from economic growth.

We must therefore begin by dispelling these uncertainties regarding a possible decoupling, or at least by stating the assumptions underlying the situation in which we find ourselves.

1. A DIFFICULT FORECASTING EXERCISE

Decoupling can occur as a result of several mechanisms that are relatively well understood, particularly in the case of decoupling factors relating to economic development which we shall examine in section 2.1. on the basis of some recent statistics. However, these quantitative analyses have generally been restricted to the time series data currently available, and therefore to domestic goods traffic. We shall supplement these findings in section 1.2. by means of an analysis of international trade based on the specific concept of border effects. Section 1.3. will conclude this part of the discussion on the outlook for decoupling with a discussion of the potential price effects.

1.1. Decoupling and economic development

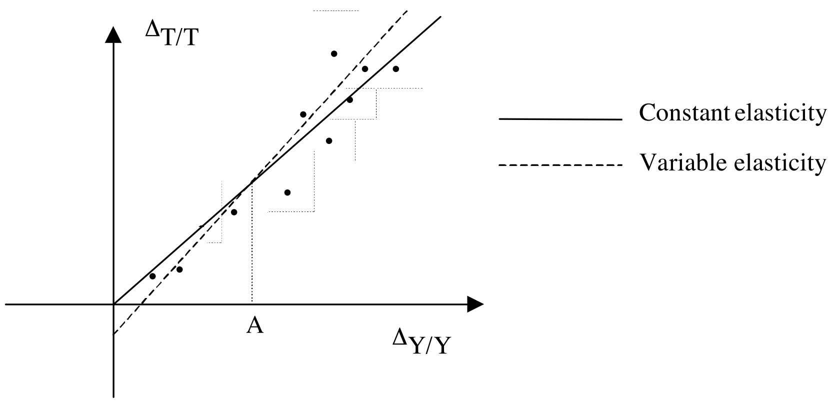
The central issue is clearly whether the nature of current growth, driven by the development of services and intangible goods, can be accompanied by relative stagnation in output and trade in goods. If we express this in terms of the elasticity of traffic flows to growth, then the decoupling hypothesis could be posited as the reduction of such elasticity over time. At all events, any forecasting exercise must take account of such erosion in that, even if we were to assume persistent and vigorous economic growth, it is feasible that the rate of growth in transport might not be as high as the rates observed in the past during periods of strong growth.

However, it is worth recalling that a declining rate of elasticity can result from use of a given econometric construct or might simply be an optical illusion, given that the very concept of elasticity is based on the premise that the ratio between variations in a transport activity indicator (denoted T) with respect to an output indicator (for example, national income, denoted Y) remains constant. It is expressed as follows:

$$e = \frac{\Delta T / T}{\Delta Y / Y}$$

In most statistical studies that propose an estimate, as most forecasting models do, this elasticity is assumed to be constant. Accordingly, when a small data set is available, like the one represented in **Figure 1**, *e* is measured by estimating the gradient of a (solid) straight line passing through the origin.

Figure 1. **Hypothesis of constant elasticity and reality of variable elasticity**



Let us assume that the ratio between the observed variations in T with respect to Y is more or less linear but that the straight line providing the best fit with this ratio does not go through the origin, as shown by the dotted line in Figure 1. It is clear that in this case the elasticity can no longer be held to be constant. In the case represented in Figure 1, the strength of the trend increases commensurately with the strength of economic growth.

Accordingly, there may be several reasons for the "optical illusion" of decoupling. The most obvious one can be seen from this Figure which shows that, if growth is high, the elasticity measured in terms of the gradient of the straight line through the origin underestimates the real elasticities (when to the right of point A). In another configuration, it is possible that estimates based on a recent period of low growth might suggest that the "gradient e" is historically decreasing, because in earlier periods of higher growth the "gradient e" was clearly steeper.

In place of a postulated elasticity of transport to growth that is variable over time and decreasing, we propose the hypothesis of *variable elasticity that increases in line with growth*, of which examples will be given in the following paragraph (see Figure 2 below). The development of freight models for France, and in particular the Quin-Quin Fret model developed at the *Laboratoire d'Economie des Transports*[1], has provided statistical validation of this hypothesis on the basis of the trends observed over recent decades, although there can be no guarantee that this will continue to be the case in the future.

It should be noted that these studies have clearly revealed the structural effects of output and trade: depending on the type of product considered, growth in tonnages of goods produced and transported is very low or even stagnant, and there is some evidence of a gradual decline in the tonnages transported. However, these studies also show that the range of these transport flows (in terms of average distance) continues to grow regardless of the type of product. This too is further evidence that changes in the spatial division of labour continue to increase average transport distances. Consequently, the hypothesis we are in the process of formulating (of variable elasticity that increases in relation to economic growth) does not relate to the tonnages produced and carried, but rather to tonne-kilometres.

The most recent econometric studies on decoupling have confirmed these trends, particularly those based on the concept of transport intensity. This indicator is in turn based on the concept of the energy intensity used in energy economics[2], which has been used by analogy in transport economics[3] to deal specifically with this concept of decoupling. *The intensity of freight transport is defined as the ratio between the number of tonne-kilometres of freight transported within a country and GDP of that country.* Since the issue of decoupling is closely linked to environmental issues, road traffic intensity is usually the parameter which is taken into consideration and which relates the number of tonne-kilometres of freight transported by road to GDP.

In 2006, Julien Brunel proposed an econometric study of decoupling[4] based on this indicator and statistics for the initial 15 EU Member States from the period 1982-98. In that study he used the following equation which, although almost entirely expressed in accounting terms, allows a distinction to be made between opposing effects.

$$\left[\begin{array}{c}\text{Intensity}\\ \text{of road}\\ \text{transport}\end{array}\right]=\left[\begin{array}{c}\text{Modal}\\ \text{share}\\ \text{of road}\end{array}\right].\left[\begin{array}{c}\text{Average}\\ \text{transport}\\ \text{distance}\end{array}\right].\left[\begin{array}{c}\text{Average}\\ \text{weight of one}\\ \text{dollar of}\\ \text{industrial}\\ \text{output}\end{array}\right].\left[\begin{array}{c}\text{Share of}\\ \text{industrial}\\ \text{output in}\\ \text{GDP}\end{array}\right]$$

The results can be summarised as follows, taking the factors in this equation from right to left:

- The share of GDP in industrial output tends to decline as soon as per capital GDP falls below USD 15 000. This is therefore the threshold at which it becomes a factor in decoupling.

- The average weight of a dollar of industrial output obviously tends to decline in economies in which heavy industry is becoming less important. It is also a factor in decoupling.

- Average transportation distance increases in relation to growth, even though it is observed to stabilise when per capital GDP approaches USD 25 000. This stabilisation can be interpreted as a kind of saturation of the spatial division of labour, although this is primarily due to the fact that the type of transport discussed in this study, given the lack of good statistical sources, solely takes account of national transport, whereas this spatial division of labour is primarily occurring at international level at the present time. This distance effect nonetheless remains a factor in coupling.

- The modal share of road increases in line with per capital GDP, which is a well-known trend that we shall return to later in this discussion. It is also a factor in coupling.

These results therefore confirm the indirect econometric estimates. So what, in view of this, is the outlook for decoupling? Quite simply, decoupling depends on growth: *if growth remains at a low level, the increase in distances is scarcely sufficient to compensate for the decline in tonnages and traffic as a whole either stagnates or declines; in contrast, in the event of growth rates higher than those observed in Europe to date, growth in traffic could be even stronger*, particularly if account is taken of more than just national traffic, as we are about to demonstrate.

1.2. Decoupling and border effects

In view of our particular focus on transport relating to international trade, we cannot disregard the fact that national and international traffic flows do not exhibit the same characteristics over time. What we can effectively see in the European area, as in other continents, is two contrasting effects: all things being equal (distance, demographics, levels of development, etc.), *national traffic levels are higher than international traffic levels, although the latter are growing more strongly.*

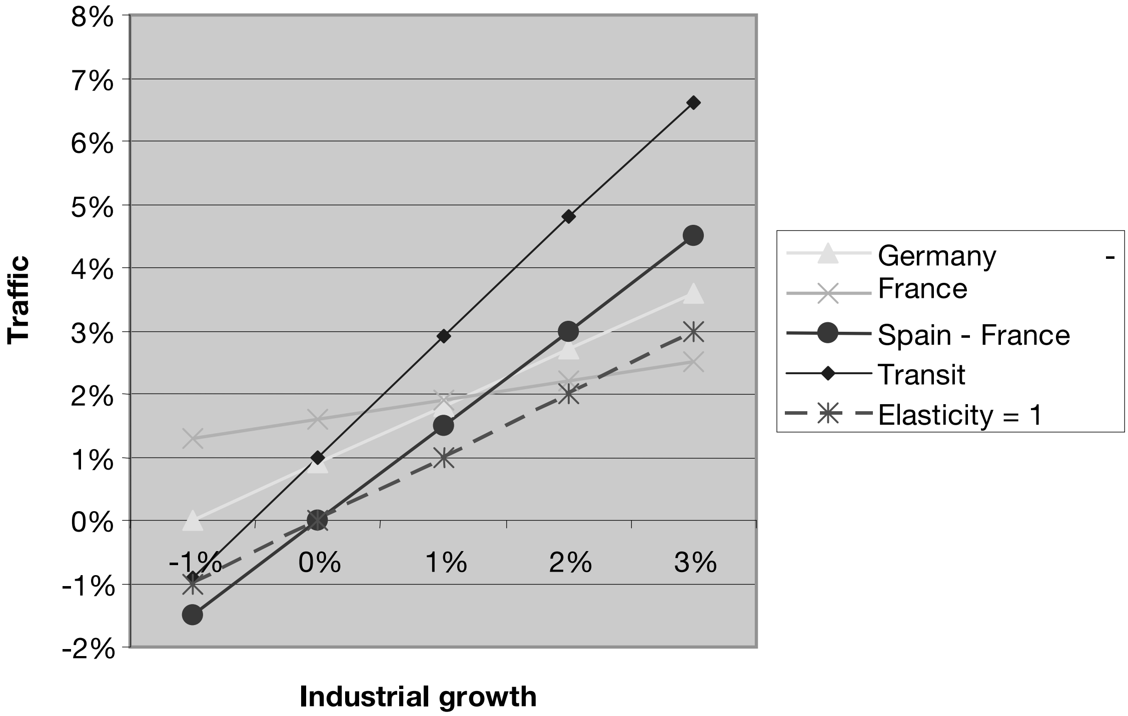
As has already been demonstrated[5], this simple observation is attributable to border effects and their gradual attenuation. More specifically, if any model is applied to traffic flows between two towns of a given size and located at a given distance from each other, there will clearly not be the same level of trade if a border exists between these two cities as there would be if there is no border. It is as though the border effect reduces traffic by a given coefficient. Estimates of the order of magnitude of this coefficient range from 4 in the case of Netherlands and Germany, to even higher values between other pairings of neighbouring countries[6].

In purely quantitative terms, internationalisation can be measured by what is usually the very steady decline in this coefficient. This confirms several economic analyses, including that of the spatial division of labour, whose accuracy has been constantly borne out as transport costs have fallen and customs barriers rolled back.

We can give a few findings which illustrate this process and which were obtained in a prospective study of traffic flows on the most congested corridor in France, namely the Rhone Valley[7]. To construct long-term simulations of traffic flows along this corridor, a distinction was drawn between different origin-destination pairings, of which four are considered here as part of our discussion. A variable elasticity model was constructed for each pairing to recreate the growth rate of these flows according to the rate of growth in industrial output, the most relevant indicator in statistical terms (assumed to be identical in the two countries in each origin-destination pairing). These findings, which we can analyse in terms of apparent elasticity (in the sense of the ratio between the rate of growth in traffic flows and the rate of growth in industrial output), are reproduced in **Figure 2.** To make them easier to understand, we have added a dotted line representing the notional case of constant equal elasticity.

The first striking result is that these apparent elasticities are positive (and generally greater than one) in cases where the industrial growth rate is not negative. *These significantly higher values than those observed in national traffic flows confirm that the spatial division of labour is primarily driven by the international division of labour at the present time. Either that or what we are seeing here is an indication of a continuing decline in border effects.*

Figure 2. **Impact of industrial growth on growth in different types of traffic flow through the Rhone Valley**



The other major result lies in the fact that some traffic flows respond significantly more strongly to growth than others. One example of this may be seen in trade flows between France and Spain, whose elasticity to growth in industrial output is always higher than that in trade between France and Germany. This may be attributed to the fact that the reduction in border effects between the latter two countries is a far older phenomenon which dates back to the creation of the Common Market as long ago as the 1960s. It is as though trade between the two countries, which is still highly buoyant, has reached the stage of maturity with elasticities of trade to growth close to national levels, whereas the elasticity of trade between Spain and France to growth remains at a higher level.

However, transit traffic is even more dynamic since it continues to grow even when industrial production is stagnating in sending and receiving countries, and this growth in traffic soars when industrial production becomes positive, for in this case the elasticity of traffic with respect to growth is always higher than 2. This kind of traffic – for example, between Spain and Germany or Italy and Portugal – is more long-distance than that between two neighbouring countries. Although this traffic is generally not extremely large in terms of tonnage, the long distances involved mean that its relative "weight" is greater in tonne-kilometres, which provide a better measurement of the actual use of networks. For example, for transit traffic passing through the Rhone Valley, the distance between the two closest of all the pairs of regions involved (Catalonia and Piedmont) is over 1000 km. This means that each thousand tonnes transported generates over one million tonne-kilometres of traffic on the network, since the multiplier factor is obviously even larger for all the other traffic in this transit category.

To illustrate the dynamism of this kind of traffic, we can point out that it stood at roughly six million tonnes at the end of the 1990s and that, assuming a 3 % average growth in industrial production, by 2020 there would be over 34 million tonnes passing through the Rhone Valley in the category of transit traffic alone.

We should add to these considerations the fact that one of the components of this long-distance traffic consists of the terminal-to-terminal transport of intercontinental trade, which is generally considered to have the highest growth potential. This can be justified by noting that it costs approximately one euro cent to transport a shirt from the Far East to Europe at the current price for a container shipped from Hong Kong and unloaded in Rotterdam, which suggests that the globalisation of trade is just beginning, especially for the very long-distance components of such trade.

With regard to intercontinental trade, it should be noted that the distances of the land traffic involved are expanding regularly with the growing concentration of traffic in ports, which has long been favoured by the increasing returns to scale of maritime and port economies. As a result, there is likely to be strong growth in this terminal-to-terminal transport in terms of tonne-kilometres.

Consequently, there is every reason to believe that international transport will remain dynamic, unless significant increases in transport costs were to restrict trade.

1.3. Decoupling and price effect

Decoupling is sometimes considered as the possible (or probable or desirable) outcome of a significant increase in transport costs. However, the reason why this price effect is taken into account lies in the fact that the long-term outlook for our transport systems that we are tempted to adopt is always highly dependent on the circumstances in which this outlook is examined. At the time of the drafting of this report, the price of oil is over 70 dollars a barrel and it is commonly claimed in the literature that at these energy prices, the mobility of goods and persons will gradually stabilise and even decrease.

This fails to consider the fact that in constant dollars, prices were even higher than in 2006 several times after the first oil shock of 1973. If income growth is added to the inflation effect, i.e. if the current price of oil is assessed in relation to *per capita* income in industrialised countries, which amounts to calculating in terms of buying power per barrel of oil, we can conclude that this "buying power" with respect to oil remains significantly higher than it has been over long periods in the past during which there was no significant and lasting slowdown in transport activities.

Admittedly it is to be expected that transport policies will address, as they should do, the problem of the depletion of non-renewable resources and the equally challenging problem of transport's contribution to greenhouse-gas emissions. It is also true that the price instrument should be used for this purpose, both to send a signal as to the scarcity of this resource and to internalise the external effects on the biosphere, and that this in turn will reduce the margin of certain transport activities, in particular for low value-added goods.

For example, it seems likely that the transport of grass sod by lorry from Riga to southern Spain, as shown in a news report on a German television channel, would no longer be profitable if fuel prices were to rise significantly and if driving time regulations were strictly enforced. If this transport were switched to rail, then the corresponding traffic and problems of capacity would be transferred to rail networks. If this long-distance trade were eliminated, then a share of the traffic (or of its growth) would disappear.

If such trends became significant, the apparent elasticity of traffic with respect to growth would decrease, but we can also imagine the possibility that rail service that is competitive in terms of price and quality of service could transport these goods in conditions comparable to those that have until now only been provided by road transport. The real anomaly is not that such long-distance transport of a low value-added product is done by road, but that the rail system is unable to offer more competitive service. However, this state of affairs is currently changing. For example, between 2000 and 2004, the market share of railways increased significantly in those countries where competition between operators has been promoted (+0.9 % in Germany and +1.9 % in the United Kingdom, as compared with -3.6 % in France, where the historic operator's monopoly has in fact been maintained).

We therefore think that it is reasonable to assume that the growth of traffic will only be slightly reduced by price effects and that although transport tariff trends may have a significant short-term impact, there will be less long-term impact on global traffic than on the modal split, which is obviously sensitive to the relative prices charged to passengers and carriers.

These observations are confirmed by all the evaluations that have been proposed for the price elasticities of traffic. Whether these elasticities are short or long-term or for freight or passenger traffic, they are always significantly below one (in absolute terms). It goes without saying that if there were a more serious and lasting "oil shock" than those experienced thus far, our assumption would no longer hold. Except under these exceptional circumstances, it should be noted that these low price effects justify tariff policies to which we shall return later.

On the whole, our working hypothesis for the rest of this report will be that, although domestic traffic measured in tonne-kilometres is tending to grow more moderately, international traffic will remain very dynamic and its elasticities with respect to industrial growth will be very significantly higher than 1. Large-scale studies on major projects confirm that this is the case. For example, studies conducted to evaluate the Lyon-Turin train link (high-speed-trains and freight trains) perfectly illustrate the analysis presented above.

With regard to the situation in the past, the statistics show 4 % average annual growth in traffic between Ventimiglia and Tauern between 1984 and 2004. For the future, the simulations carried out for these studies, based on an assumption of moderate growth in Europe, suggest that traffic through this Alpine Arc would rise from 126 million tonnes in 1999 to 248 million in 2017 and 345 million in 2030. This virtually doubling would correspond to an annual growth in traffic of slightly over 3 % and can reasonably be considered as an average assumption.

Given this outlook and the challenges that it implies, consideration should be given to what form an infrastructure policy adapted to the development of this international traffic might take.

2. PLANNING AND FINANCING NEW INFRASTRUCTURE

The decision to develop new infrastructure in a country is always the responsibility of its central government, whatever the purpose of this infrastructure. At most, the decision may become bilateral in the case of interlinking infrastructure that crosses a border. *With the internationalisation of traffic, differences are emerging between the responsibility for decision-making and financing and the responsibility for needs, which should be reflected in planning*. This is obviously not a new problem.

The problem of co-ordinating cross-border infrastructure and, of course, the related problem of financing it, have long been recognised. In particular, the experience of the European Community and its mishaps perfectly illustrates the difficulty of developing an international infrastructure policy. It is therefore worth taking a closer look at this experience.

2.1. The problems of trans-national infrastructure policy

The Commission's very first memorandum on the common transport policy already showed the difficulties encountered in 1961 (!), in particular the complete lack of financing.

This memorandum touched upon many aspects of the common transport policy which was, it must be recalled, one of the three common policies provided for by the Treaty of Rome (together with trade and agriculture). It was the basis for all aspects of the action programme proposed by the Commission in 1962[8]. A genuine common transport market was envisaged and common policies and regulations were gradually supposed to replace national policies and regulations, thereby establishing fair competition between different modes of transport and, of course, within each mode. Even though it was not the most important aspect, this memorandum addressed infrastructure in two ways.

Firstly, it suggested a harmonisation of charges for the use of infrastructure, an issue that is of course also relevant to the harmonisation of the financial intervention of States, since these charges cannot be isolated from all transfers made through taxation or public subsidies in the field of transport. This issue was addressed in a theoretical study that was to have a major impact on transport economics. This study, known as the "Allais Report"[9]", clarified the theoretical foundations of marginal social cost pricing, but without eliminating the obstacles to implementing this optimality principle concretely, i.e. measurability of social costs and cost functions, public financing needs linked to situations of increasing returns, etc.

However, at that time the more pragmatic and yet more ambitious approach to infrastructure was gradually to promote the co-ordination of investments, starting by recommending a procedure of consultation among States. However, the exchange of information long remained limited to a few cases of common interest, even though the *initial goal was to promote projects of Community interest, but above all a certain complementarity between national projects so that genuine Community networks might be established over time.*

It would be false to maintain that the procedures currently being used to evaluate and plan infrastructure in each State have taken into account what might be called a "Community interest" criterion. Nevertheless, the Commission has continued its efforts and has even taken policy initiatives, with the creation in 1966 of an Infrastructure Committee theoretically responsible for the co-ordination of national plans, and the adoption in 1978 of the Commission's proposals for improving the consultation procedure[10]. *It is obvious that what has really been lacking is specific and above all significant European financing*. In short, the States have paid for their own infrastructure and kept sovereign control over the allocation of their expenditures.

This is a common reaction that can be observed throughout the history of transport infrastructure: *whenever different tiers of government are given responsibility for infrastructure, each tier sets its own priorities*. A commune will only make an investment that will benefit users in neighbouring communes if the investment is of sufficient benefit to its own residents, and this rationale of a local level of solidarity will also be found at the regional level for regional roads and at the national level for national roads. *An international level of solidarity can only become a reality if financing is also made available at this level*. However, the fact is that the efforts made in the field of common regional policy, for example, have thus far had no equivalent in the field of common transport policy.

Nevertheless, if we only consider this level of the European Union, if is fair to say that considerable progress has now been made, even if we are still far from having a perfectly co-ordinated infrastructure policy.

2.2. Initial strategic directions and infrastructure plans

We can consider that the strategic directions regarding the infrastructure that should be developed are now clearly outlined if not well established with, firstly, the approach in terms of Trans-European Networks (TEN or, more accurately, TEN-T for transport networks).

With regard to this first point, we should point out that the concept of a trans-European transport network has only been formally introduced relatively recently, since it is only in Title 12 of the Maastricht Treaty that the EU is given the *objective of developing cross-border infrastructure networks and their international inter-operability*. This may be viewed as a fuller and more detailed reformulation of objectives very similar to the approach adopted to the co-ordination of national projects mentioned above which had originally been formulated 30 years before. However, behind this language, there is an important methodological difference since we can now consider that Europe with its 25 Member States at last has a long-term plan. Even though this plan is more the outcome of an aggregation of major national projects than of a genuine integrated long-term planning policy, it has the merit of existing, with the same hierarchical principle as that which guides national planning procedures. This hierarchy essentially consists of three levels.

The largest envelope concerns all of the TEN-T[11] that have been taken into consideration, including projects that have only been selected to spare regional susceptibilities or strike a regional balance. The total cost of this network (which contains projects that reasonably deserve priority and others that are less deserving) is estimated at over EUR 600 billion. This enlarged plan might be described as one that satisfies everyone's desires (and whims). It obviously does not have a definite time frame, which makes it possible to dream.

At a second level, we find a set of TENs which resemble a genuine plan, i.e. based on priorities set by the Van Miert Group, whence the name sometimes given to this plan. It includes all the priority projects that it would be desirable to carry out by 2020, the overall cost of which is estimated at approximately EU 235 billion.

Lastly, at the third level, we find what generally corresponds to medium-term planning, i.e. the short list of projects that it has actually been decided to construct. This includes the "Essen and Dublin projects", which must still be completed or initiated and which have a budget in the range of EUR 110 billion.

What remains very different from comparable procedures conducted at the national level is, of course, the fact that the Community level is largely left out of the decision-making process. Despite a good level of consistency, it can only encourage decision-making through policy and financial incentives. As for the States, they have preserved their sovereignty with regard to decision-making, especially since they provide the bulk of financing. Consequently, it is at the financial level that the problem is far from being solved.

Indeed, it should be borne in mind with regard to the above costs that the EU budget for TEN-T was EUR 4.17 billion for 2000-2006. The Commission had suggested boosting this joint effort to just over EUR 20 billion for the new period, 2007-2013. It is a known fact that the budget discussions were laborious, and that the final choices were late in coming. The result was especially disappointing for TEN-T: following the agreement on the Financial Perspective 2007-2013 that was reached at the European Council in December 2005, the Commission formulated a new budget proposal earmarking EUR 6.7 billion for TEN-T, as compared with EUR 20.35 billion in its initial proposal and 4.6 billion for 2000-2006.

This is tantamount to a cut in funding, once inflation is taken into account, and especially insofar as it applies to a 25-member Europe whereas the previous amount had been provided for EU-15. It goes without saying that the co-financing outlook for major priority projects will have to be revisited, since the assumption had been that co-financing would be capped at 30% for priority projects and 50% for their cross-border sections.

As a result, new infrastructure requirements and low funding capability are posing a classic challenge that needs to be addressed with a comprehensive sectoral policy response, it being plainly evident that the decision to invest and the capacity to finance are but two aspects of the overall regulation of international transport.

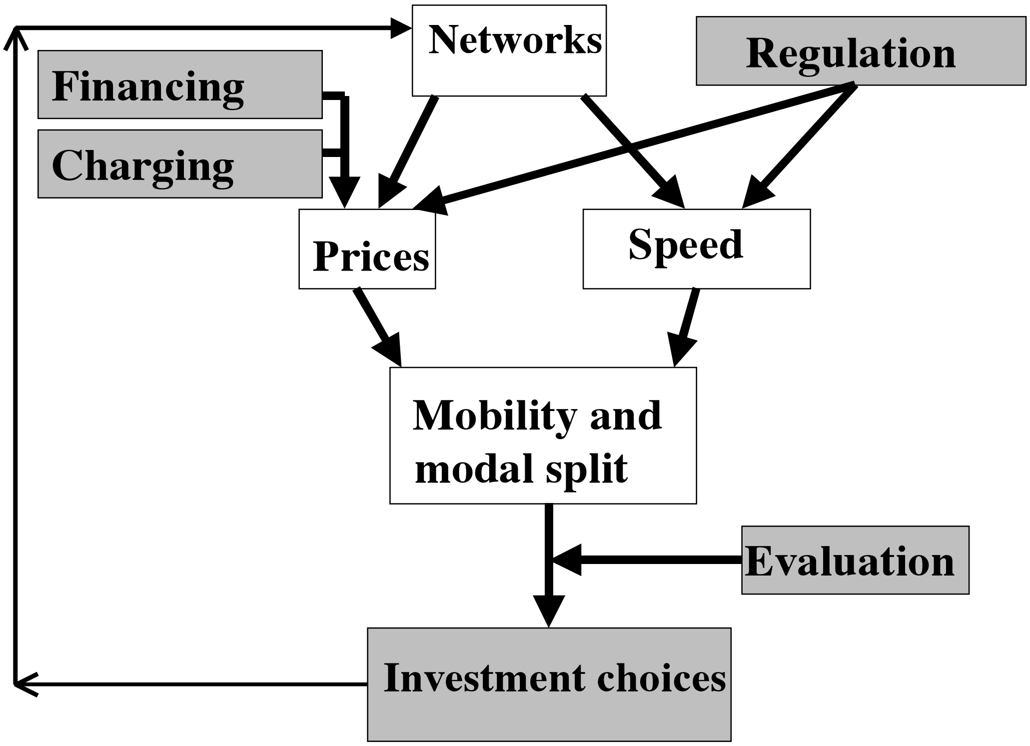
2.3. What sort of governance for trans-national networks?

Figure 3 represents the functioning of a transport market such as the continental transport market (passenger or freight) in the simplest possible terms.

At the heart of the market mechanisms is the supply of transport, which determines the mobility levels of passengers and freight provided by each mode. For centuries, the two main factors of intermodal competition have been prices and speed – the latter needing to be considered broadly, encompassing, for example, frequency or reliability.

For each mode of transport, the prices and speeds on offer are clearly dependent on the quality of infrastructure networks and how they are operated. Here we see the role of government's controls over the system – controls shown above in grey-shaded boxes. The first two means of control, which affect the relative prices of competing modes, are *financing methods* (for infrastructure and operations) and *charging for the use of infrastructure.* Another means of control that also affects relative prices, but speed as well, is *regulation* – a term that we use very broadly to encompass labour and safety matters as well as the general organisation of transport markets, including those for infrastructure supply and demand, in which the degree of both regulation and competition can vary.

Figure 3. **The international transport market and government's controls over the system**



The traffic levels resulting from this competition, reflecting the intensity of use of the transport networks, will depend on the efficiency of the corresponding modes. In sum, it is this relative efficiency that will determine the needs for new infrastructure and, in particular, a project's socio-economic and financial returns. As a result, the diagram shows as means of control the *evaluation of investments* and the *investment decision itself*, which should be used consistently with evaluation. It is these investment choices that over time will shape the development of competing networks, thus "closing the loop" of the system.

In this simplified diagram (Figure 3), transport is shaped fundamentally by market mechanisms, but mechanisms that remain in the hands of government, which exercises the five major means of control cited above.

Yet if this diagram is to have any relevance, it is clear that one must factor in all of the means of control and ascertain whether there is a good strategic fit between them, in terms of coherent TEN-T expansion, insofar as they are exercised jointly at the EU and national levels. Each means of control must therefore be examined from two standpoints: how they are duplicated at both these levels of decision-making; and how they interact with the other means of control comprising the system.

2.3.1 Financing as a means of control

In section 2.1, we already referred to the means of control that is portrayed in Figure 3 as a dotted arrow, i.e. financing, and more particularly the European Union budget's funding for TEN-T, which at EUR 6.7 billion looks modest indeed in comparison with an overall budget of EUR 862 billion in appropriation commitments for 2007-2013. One of the explanations for this meagre budget is that transport infrastructure has always had other sources of Community financing.

It is indeed a well-known fact that European budgets have financed many a transport operation. It is estimated, for example, that the European Regional Development Fund (ERDF) supplied about EUR 15 billion for such operations during the previous financing period (1994-99). At the same time, the Cohesion Fund has provided EUR 8 billion in transport project financing in the Union's least developed countries. This means that the TEN-T budget proper accounts for less than a quarter of aggregate appropriations for transport infrastructure.

But it is also acknowledged that this financing is fairly remote – both figuratively and geographically – from TEN policy. In many cases it is part of a spatial dissemination policy which happens to be in line with the most widespread conception of regional development policies. For instance, a programme to renovate a rural road would be a more likely target of funding than completion of an arterial road on a major corridor. In addition, the ERDF, like the Cohesion Fund, deals primarily with peripheral regions, which in most cases are connected only to the "extremities" of TEN-T. Clearly, however, these extremities are of no interest unless the central portions have already been built or are likely to be built fairly soon.

Consequently, where financing exists – because it so happens that at one point in its history the European Community had the resources to adopt a regional action policy – policy choices are not especially geared towards the development of major trans-European corridors. As a result, the official priorities of programmes like the ERDF include such considerations as "improving access to the regions by connecting the main networks to local small-scale transport systems". This is understandable, but only if the main networks do in fact exist; otherwise, the notion of accessibility becomes particularly naïve.

When the details of recent budgetary choices were set forth, those wishing to expand the TEN-T suggested that their own budgets be concentrated on areas not eligible under the terms of the ERDF's first objective, namely convergence. Eligible areas could then direct ERDF funding towards their TEN-T feeder sectors.

The main beneficiaries under the first objective, and the Conference of Peripheral Maritime Regions (CPMR) in particular, lost no time reacting. A CPMR policy position[12] affirmed that "the TEN-T budget should not be considered by the European institutions as a financial instrument reserved solely for developed regions of Europe to compensate them for their non-eligibility for Structural Funds." It is plain to see that the European Union is probably not prepared to limit the scattering of transport infrastructure financing for TEN-T development.

Nevertheless, the modest size of the budget available for these networks fully justifies a highly selective choice of projects eligible in the short term for Community financing, rather than to disperse meagre resources amongst a large number of projects. This tightening of priorities could be guided by two principles:

- reserving Community financing for cross-border sections;
- strict ranking of priorities, based on rigorous evaluations (see section 2.4. below).

It is not clear that on this basis projects in areas eligible for ERDF funding would emerge as the most useful for the public interest. Barring any possibility of redeploying regional action budgets, it would be reasonable to ensure that the budgets are complementary to specific TEN-T financing.

But TEN-T financing remains modest, and this would suggest exploring alternative funding sources, focusing on revenue that could be provided through a system of charging for the use of infrastructure.

2.3.2 Charging as a means of control

Of the three traditional functions of charging for the use of infrastructure – covering costs, steering demand, and redistribution – we are interested primarily in the first, since the question at hand is the extent to which charges can help finance new infrastructure.

A distinction must be drawn between two types of charging: tolls, which are collected for each passage on a section of infrastructure, and which generally add to the income of the infrastructure manager; and fees, which can be levied and collected in a manner very similar to a system of tolls or through some other means (axle taxes, vignettes, fuel taxes, etc.).

Tolls are ultimately simpler, or at least more direct, as a means of financing. For a given facility, they generate revenue that can provide full or partial funding.

This system was long regarded with some condescension by countries that did not practice it. Its concrete results with regard to motorways, the gradual incorporation of recommendations from economic analysis, and acknowledgement of the soundness of the user-pays principle changed that way of thinking. The fundamental issue here has shifted from culture shock (how can a civilised country charge to use its roads?) to a more pragmatic consideration (how to gain acceptance of a system that is economically efficient?).

In the case of railway networks, it was through just such a process that from the early 1990s[13] the principles of separating “wheels from rails” and charging for the use of railway infrastructure became readily accepted at the Community level, and that today half of the financing for a new service such as the Perpignan-Figueras rail link – the key link in a major TEN-T – is provided by charges for infrastructure use.

The toll system is particularly well suited for major international routes, and especially cross-border segments, because of the substantial and sharply rising proportion of transit users, as we showed in section 1.2**.** It is therefore not unusual that these users be called on to contribute, insofar as they pay no taxes in the countries that finance most of the infrastructure. It could even be considered that *this principle is objectively reinforced by the collapse of the Community TEN-T budget.*

Other fee-based systems pose more complicated problems with regard to covering the costs of new infrastructure. For one thing, it cannot be assumed that the revenue collected would be earmarked for the transport sector, insofar as its allocation would run counter to one of the major principles of public finance, namely the unity of revenue. It should be borne in mind that this principle is justified by the fact that to earmark particular income limits resource allocation, and it is unlikely to result in optimal allocation.

Rebutting this time-honoured theoretical principle is one of *realpolitik* to achieve the twofold benefits of "enshrining" infrastructure investment and making it more acceptable to charge users, especially in respect of certain new fee-based systems. In the case of the Swiss distance-related heavy vehicle fee, for example, not only is the revenue allocated entirely to the transport sector, to finance major cross-country rail links in particular, but one-third of it is paid to the cantons for their road-related expenditures.

More generally, many countries have instituted special funding mechanisms that correspond to a more or less direct return of usage charges, among them being France, Germany, Sweden and Switzerland. But this leaves open the question of which investments will get the funding, and there is a major risk that revenue generated by the use of existing TEN-T may not be allocated for their development.

Tolls would therefore seem better suited than fees for financing infrastructure for trans-national use, unless national governments are clearly determined to steer resources in that direction. Moreover, a toll-based approach is consistent with the concession or public-private partnership arrangements that are favoured at the Community level.

The recent Eurovignette mechanism[14] fits ambiguously into this alternative between tolls and fees, laying out a common framework for the taxation of TEN-T road infrastructure that will be applicable by May 2008 to vehicles over 12 tonnes and by 2012 to vehicles over 3½ tonnes. It applies to TEN-T proper but also to "parallel roads to which traffic may be diverted".

The level of tolls is clearly compliant with the user-pays principle and is designed to cover costs. The Directive is very explicit: "Specifically the weighted average tolls shall be related to the construction costs and the costs of operating, maintaining and developing the infrastructure network concerned. The weighted average tolls may also include a return on capital or profit margin based on market conditions."

This mechanism thus has all the appearances of tolls, except in respect of revenue allocation. It is the Member States that determine how the revenue shall be used, with the Directive stating simply that "revenue from charges should be used to benefit the transport sector and optimise the entire transport system".

This wide-open option is justified, *inter alia*, by the fact that it should be possible to use road use charges to finance railway infrastructure. Clearly, however, the word "should" opens the door to any number of ways in which the revenue could escape, and *this justifies the establishment of financing agreements to ensure that the revenue is returned.*

2.3.3 Regulation as a means of control

Once again, we consider this means of control in the broad sense, i.e. encompassing all of the dimensions that govern the sector's operations, including institutional mechanisms. The competitive orientation of these mechanisms may have greater repercussions on the funding of TEN-T than the level of the corresponding Community budget.

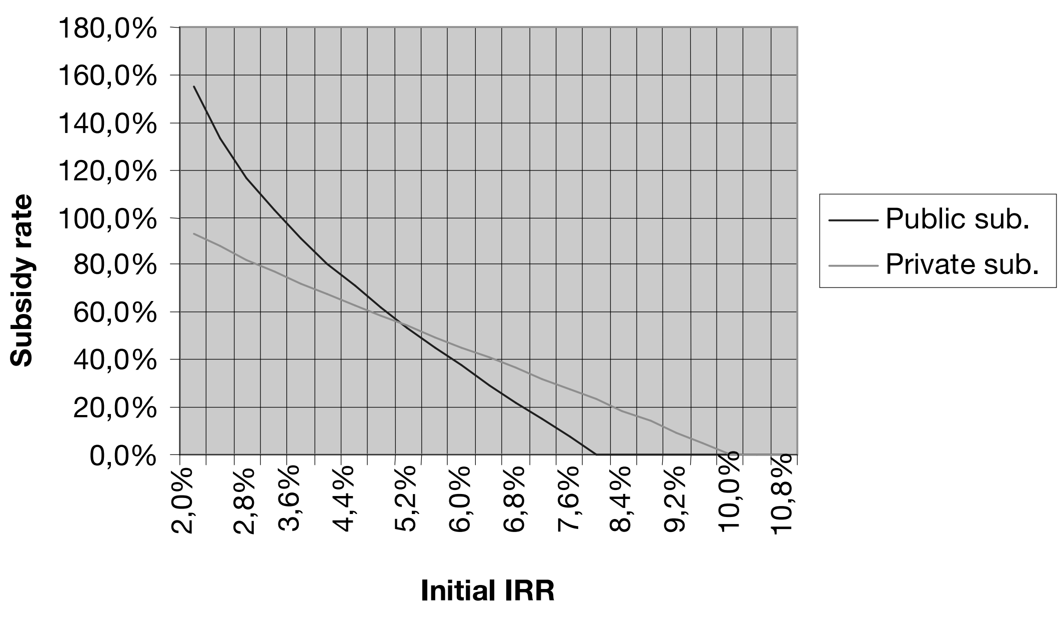
Indeed, the EU's stance towards concessions, tendering procedures and the creation of competition between operators, which have clearly helped to open up the market and improve the financing environment through the possibilities offered by public-private partnerships (PPPs). These partnerships are seen as being particularly necessary for key projects experiencing problems. One example is the projected high-speed train and combined transport line between Munich and Verona via the Brenner pass scheduled to be built at a cost of EUR 22 billion, and in particular its most costly section, i.e. the tunnel. The PPP system has also enabled other seemingly abandoned projects, such as the link between London and the Channel Tunnel in the case of the PBKAL project (Paris-Brussels-Cologne-Amsterdam-London), to be re-launched. The Dutch section of that project is also subject to a PPP. Obviously the EIB is helping to steer this policy approach[15], as may be seen from the EUR 17.4 billion it has committed to a series of transport-related PPPs.

The use of PPPs in the transport sector was discussed at length at the previous ECMT Symposium. While it is not our intention to reiterate the arguments in favour of this practice, we shall highlight one of the analyses presented which is particularly germane to our discussion[16].

The results of this analysis are illustrated in **Figure 4.** It is assumed that a public operator obliged to cover the costs of its borrowings plus that of a risk-insurance premium is offered guaranteed profitability, through a subsidy if necessary, at an internal rate of return IRR of 8%, and that the private operator, which must cover the same commitments but must also repay its own capital, is offered a guaranteed return at an internal rate of return of 12%. At the same time, however, the private operator is assumed to be capable of realising an additional 2% on the initial IRR of the operation compared with the public operator. Based on these assumptions, the curves in Figure 4 represent the rate of subsidy, compared with the initial cost of the investment, required for the operation.

Figure 4. **Subsidy rate according to initial IRR based on the assumption that the private operator is more efficient**

(target IRR of 8% for the public operator and 12% for the private operator, initial IRR with private operator = initial IRR with public operator + 2%)



These curves reflect a paradoxical outcome whereby the use of a PPP is of even greater interest to the community, and the public purse in particular, in that the project in question has a low rate of financial return (on the sole condition that the private operator is slightly more efficient than the public operator). As it happens, *projects relating to international traffic flows often offer a low rate of financial return, particularly the cross-border sections of such projects, due if nothing else to border effects.*

This result was based on a standard project and needs to be tailored to the specific values for the updated balance of each project. Recent examples have confirmed this theoretical result, however, as in the case of the Perpignan-Figueras rail link for high-speed and goods trains, where the concession system and creation of competition between operators can be considered to have been relatively beneficial in that, although the project consists in a technically complex and expensive border crossing, the border effects between Spain and France remain significant and the socio-economic profitability of the project is relatively modest, the subsidy rate required by the successful tenderer[17] amounting to merely half the cost of the project. This subsidy rate is significantly lower than that needed to finance comparable projects that are completed and then managed by public enterprises. For example, the first stage of the Rhine-Rhone high-speed train line, which has a comparable level of socio-economic profitability (if not slightly higher), requires a subsidy rate of over 72%.

There is therefore no reason to doubt the economic feasibility of these cross-border segments of TEN lines. And it should be stressed that the strategic option (as applied to rail links) of opening up the concession to competition and to public-private partnerships probably does not solve all the financing problems, although it can at least reduce their severity.

2.3.4 Evaluation as a means of control

Clearly, evaluation only offers real over the system if it allowed to play its part in the setting of priorities and the actual decision to invest. We shall assume the latter given that, even though some 30 TEN-T projects might seem to have been underestimated, we can consider the evaluations of those projects held to be a priority are not so far-fetched.

However, further progress in evaluation practices and the way in which the latter provide input to the decision to invest remain essential, as stressed by the European Court of Auditors in a special report on TEN-T[18]: “Complex annual administrative procedures for evaluating and selecting TEN-T projects have been established by the Commission and these have not always led to relevant information being available for the evaluation. Consequently, this has caused some problems in properly documenting the evaluation process. In addition, not all evaluation criteria established by the TEN regulation were fully addressed by the Commission.”

Among other recommendations, the report suggests that: “The Commission should also develop an explicit methodology for evaluating proposals submitted under TEN-T and publish it in a manual.”

These criticisms and suggestions were inspired by the need for relevant evaluations that can inform decisions regarding competing projects. *Each project involves the destruction of assets (costs and negative externalities) and the creation of assets (income and positive externalities). It is not the European Union’s vocation to promote and finance projects which destroy more assets than they create, particularly in view of the fact that the limited amount of funding allocated to the TEN-T precludes any wastage.*

On the contrary, the limited funding available means that the projects chosen must deserve priority aid, and in order to determine whether this is the case it must be possible to compare the public utility of the Munich-Verona link through the Brenner tunnel, say, with that of the Seine-Escaut river link. This in turn will be contingent firstly on resolving the problems regarding which method to use, and secondly on the performance of quality control.

The methodological problems are by no means negligible since the aim is to compare two very different types of project. In theory this problem can be solved through cost-benefit analysis, provided that the technical options in the evaluation, such as unit values for externalities, have all been standardised. A number of problems regarding which segments of the network to take into consideration will have to be addressed. In order to direct EU funds to the right area, should all the segments yet to be completed in a TEN-T project be evaluation or solely the cross-border ones?

It is also worth noting that the recurring methodological problem with evaluation, namely how to base it on accurate forecasts, is exacerbated in the case of international traffic flows by the fact that the statistics available on such flows are significantly less informative that those on domestic flows, as we saw in the first part of this report. Experience has shown that a particularly costly cross-border crossing such as the Lyon-Turin link called for a series of specific statistical surveys for both passenger and freight traffic. Although such statistics are needed to calibrate forecasting models, they are scarcely adequate since they provide *cross-sectional* rather than *time series* data. We have known for many years that in statistical terms the international level is far from being as well informed as national levels, and this clearly exacerbates the problems posed by evaluation.

Although these problems have supposedly been resolved through clear and properly disseminated recommendations, *quality control* of evaluation studies nonetheless remains necessary. *These studies are actually performed (or outsourced) by administrations or agencies that in many cases have been captured by pressure groups lobbying for the project concerned, which can result in deliberately distorted forecasts and evaluations.* It is therefore important that evaluations and all the studies on which they are based are systematically duplicated by competing studies and that all the sensitive aspects of the evaluation are subjected to repeated appraisal by other experts.

2.4. The decision to invest

The EU Court of Auditors, in the 2005 audit mentioned earlier, summed up the basic shortcomings in the decision-making system as follows: “The audit found that the execution of the 14 TEN-T priority projects is currently behind schedule. In particular, cross-border sections are facing major difficulties since they receive less priority at national level and require greater co-ordination efforts. Also, TEN-T financial aid is allocated in an overly fragmented way and is not sufficiently focused on cross-border projects (or project sections). As such, TEN-T cannot achieve its European added value to the fullest.”

It is therefore confirmed that the weak point in TEN-T projects lies in their cross-border sections and that it is on these sections that the limited financial resources of the EU budget ought to be concentrated. However, to avoid the “overly fragmented” aspect of this aid, it is necessary to have both the means and the political will to rank projects. The question of means raises the earlier issue of evaluation and the use that should be made of the latter in choosing priority projects.

In a national context, the choice of priority projects is a core issue in investment planning. In practice, the budget envelope for transport investment is usually insufficient for investments to be made at the optimal date[19]. Public financing capacity is therefore a constraint and the choice of investment a second-tier optimisation whose objective function remains the sum of the net present values (NPV) of the socio-economic benefits generated by all the projects implemented.

On the basis of a few standard assumptions it can be shown[20] that for a given public financing constraint the order of project implementation which optimises the social return of a programme, that is to say which maximises the net present value of the socio-economic benefits generated by the series of projects in the programme, is the order of ranking of projects according to decreasing values of the ratio: **NPV/euros of public funding invested**.

This ratio, which bears out both common sense and the standard theory of welfare[21], implies a certain degree of consistency between the socio-economic benefits of projects (which determine the NPV of each project) and their financial profitability (which determines the subsidies they will require). The numerator of the ratio represents the socio-economic value that each project generates for the community (its "full value added" to use the terminology of the EU Court of Auditors), whereas the denominator will be the direct outcome of the commercial income from the projects that will be used to determine how much additional public funding will be required for the project.

The best possible use of this public funding can easily be made at the national level, and this would seem to be more or less the case in a number of countries. The situation is obviously very different at the level of TEN-T projects in that the degree of priority with which a section in country A needs to be completed, compared with that of a section in country B, can vary substantially, not to mention the cross-border section.

If the requirement to secure a social return on funding is fully acknowledged at the EU level, then the most appropriate algorithm to make the best possible use of scarce budgetary resources would have to be fairly close to the following:

1) Divide the TEN-T into sections that are primarily national and that should therefore be financed by the country concerned and international sections that deserve significant aid from the EU. (The current breakdown, which identifies cross-border sections, is not necessarily the best, but does at least have the merit of being based on a simple, objective criterion and thus less vulnerable to lobbying in that it makes sections that are trans-European only in name completely ineligible for EU funding.).

2) Take note of national plans and the most likely completion schedules for the "national" segments of each TEN-T.

3) Establish on this basis the baseline situation and its schedule (needed for evaluations of international sections).

4) Carry out, using a clearly standardised methodology, socio-economic and financial evaluations of international sections (validated by numerous expert appraisals).

5) Classify projects eligible for EU financing according to the **NPV/euros of public funding invested ratio** and establish on this basis a programme compatible with the EU budget constraint (and also with the co-financing decisions of the bordering countries concerned).

To ensure that such an exercise is genuinely more than a statement of intent, that is to say a genuine financing programme, it is obviously necessary to have a high degree of co-ordination (as mentioned in the audit by the Court of Auditors) between the countries concerned and the Commission.

This collaboration can lead to changes in national programmes and consequently in the associated baseline scenarios and cross-border evaluations. But it should be noted that, in order to carry any weight in this collaboration, the international rationale must be matched with a significant financing capability. This is an enduring problem, although the very weakness of the EU budget implies that the contribution to project financing can only be significant if it is accepted that the projects benefiting from the funding are chosen on a highly selective basis.

It is also worth noting that if this contribution is *a priori* set as a given share of public funding for the project (which would obviously be desirable), then the classification ratio suggested clearly arrives at the same result regardless of whether the denominator represents all the public funding or merely European public funding

CONCLUSION

While there is every likelihood that international trade will continue to grow, and probably at very high rates for the longest trade flows, meeting future infrastructure needs will be complicated by the fact that investment planning still remains at the national level and EU financing capacity remains well below what might have been hoped (around a third for the period 2007-13).

The issue at stake is therefore how to optimise the planning of such investment under the constraint of limited budget resources. This requires that:

– *EU financing be concentrated in cross-border sections of TEN-T;*

– *The use of PPPs be confirmed and developed in a competitive market fully opened up to potential operators;*

– *User charges be treated as income assigned to the financing of the project, in accordance with the principle of PPPs, and that charges be set with the aim of maximising income;*

– *National programmes for investment in TEN-T be co-ordinated and that the socio-economic and financial evaluations of links eligible for EU funding be established on this basis;*

– *Projects be planned and financed in decreasing order of their socio-economic net present value/euro of public funding invested.*

The aim, in sum, is to lend strategic consistency to the controls we have identified in the system. The need for such strategic consistency is all the more pressing in that the budgetary resources available preclude any wastage, particularly on token gestures.

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Competition Policy in International Airline Markets: An Agenda and a Proposed Solution

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SUMMARY

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1. INTRODUCTION

One factor stands out amongst the myriad of drivers of the rapidly changing international commercial environment. The degree of globalisation by firms is increasing fast, fuelled by the desire to be horizontally as well as vertically globalised, in both their traditional lines of business as well as in newly diversified areas.[1]

The transport sector provides key services in the logistics chain that are complementary to the flow of goods and people between countries, without which international trade and commerce would not be possible. Transport industry efficiency and competitiveness is an important determinant of the efficiency, performance and competitiveness of all other markets and sectors that use transport services.[2] Let there be no misunderstanding: any overall transport policy, whether national, regional or international, must include due consideration of efficiency and competition issues.[3]

The transport industry operates at more than just one functional level – besides the actual carriage of goods and people, there are also providers of support services, and suppliers of essential facilities through which carriers operate, to name but two complementary services. Some operators may be vertically integrated across more than one such functional level, while others may be horizontally diversified within or across national boundaries. Such positions may be due to the existence of scale or scope economies, or due to vertical transactional efficiencies. As transport is a major choke point, any inefficiencies and anti-competitive conduct will be magnified as their results are transmitted into downstream functional levels.

Airline operations are a key part of the transport sector, affecting both people and firms through the carriage of passengers and freight. The performance of airline markets has such a profound impact on domestic and global welfare that their regulation merits separate academic, practical and policy consideration. An airline's performance will be a function not only of its own internal efficiency and management and its intra- and inter-market relationships, but also of the operations of its suppliers and infrastructure providers, and of its regulatory environment. Many countries give preference to national carriers. For example, Australia protects Qantas in its continuing refusal to grant Singapore Airlines rights to fly from Australia direct to the US, and by the inability of Emirates to secure more flights into Australia. The introduction of new competition on trans-Tasman routes (through the entry of Emirates and Virgin Blue) has resulted in much lower fares and higher quality service, and similar outcomes could be expected to emerge on trans-Pacific flights should new entry by a major carrier be allowed.[4]

The reasons for protecting national carriers can be many – the national interest, security, scale, and so on, but these gains come at a cost, especially in the form of less customer choice, higher fares, and inconvenient timetabling. The costs fall largely on consumers (individual and corporate), while the gains may accrue in large part to the airlines (but they will also face regulatory costs which may add to their costs) and their shareholders, some of whom may be residents of other countries. Where the true outcome lies in terms of net economic welfare is, however, hard to determine, but these sorts of questions should be asked and factored into any analysis of the best way to regulate competition in international airline markets.

Few major airlines operate in a purely domestic environment. More so than most areas of business, airlines work on an international scale, with most flying at least to adjoining countries. Amalgamations and alliances can provide a win-win situation. Through them airlines can become more efficient and offer better price-product-service packages to passengers and those organisations seeking timely delivery of freight. However, mergers and alliances cannot be evaluated fully within a purely national framework. They must be evaluated in a global rather than local context.

Markets work best when the competitive process works, either naturally or with regulatory help. Policy should be technologically neutral, should not be rigidly structural but should allow for a behavioural approach, should be flexible, and should provide for a transparent and accountable regulator whose decisions can be appealed to a suitable review authority.

As is the case for any economic phenomenon, the optimum degree of regulation is likely to fall well short of a ‘competition at all costs’ policy. This holds true for all levels of market aggregation – national, regional or global. The trick for policy makers is to determine what resources, laws and institutions are ‘just right’ – not too little and not too much – to achieve the global socially optimum level of competition. Ideally, intervention should be light-handed, subjecting the market to broad oversight and moving only when firms move outside the boundaries of acceptable behaviour as proscribed or prescribed by the statute.

In the last few years the transport sector both within and between countries has seen many changes (some structural, some behavioural) that must be taken into account in the development and implementation of competition policy. Huge mergers have occurred between, for example, port operators; railroad companies; airlines; road transport companies; and transport logistics groups.

Behavioural changes have been notable in airline markets, where the so-called legacy carriers have battled with the new breed of low-cost carriers (LCCs), as well as with the dynamic internal growth of carriers such as Emirates, and where alliances (either parallel or complementary) and code-sharing have been created between pairs of carriers, or even more widely in terms of the large global alliances such as Oneworld and Star, and now SkyTeam as well. These markets are the focus of this paper. They illustrate the main issues that must be considered in designing competition policy in markets where networking occurs.

Currently the competitive environment of the airline industry internationally is being driven from the bottom up, as airlines seek to shape their market and institutional environments to their own best advantage. They have seized the initiative from governments and regulators. It is time to develop a seamless international policy for promoting genuine competition in airline markets, as the potential to exercise market power (either the result of government-sanctioned activities or licences, or of unilateral or coordinated action) certainly exists. Whether this power is used to the competitive detriment of society, or whether there are offsetting public benefits (in the form of, for example, otherwise unobtainable efficiencies that are at least in part passed on to consumers), needs to be assessed on a case by case basis.

The present regulatory arrangements (or lack of them) are the product of historical efforts (or inaction) at national, bilateral, regional and multilateral levels. Airlines have developed their own forms of self-regulation, through conduct like code-sharing, parallel and complementary alliances, joint engineering services and IT-sharing. These can be viewed as industry attempts to make markets work better while not incurring the displeasure of competition authorities. In the absence of overarching policy guidance, markets always will self-regulate in an attempt to adjust in a privately-optimal way to emerging market forces of supply and demand. Once new structures and behavioural patterns become entrenched, it may be very difficult for new laws and administrative procedures to produce a first-best social outcome. The past deadweight losses of regulatory error or of slow or non-existent policy development and implementation are sunk. But we need to ensure that the market works better in the future.

Mergers and alliances between airlines based in different countries have outrun the ability of any one government's policy to deal effectively with them. Workable comprehensive regional or international agreements on competition policy issues are rare.[5] It is now urgent that a vigorous cooperative effort be made to develop such policies. Different rules or formulae to drive such a policy are possible. Each will have its own advantages and disadvantages, especially the errors that might result from enforcement and their consequences. In some instances it may be a matter of trying to 'shut the gate after the horse has bolted', at least in terms of having a structural impact on markets. But if this is the case, it is crucial that policies are set in place across jurisdictions that can control the future conduct of firms. Cooperation between nations will be essential in terms of policy development, institutions, administration, enforcement and appeals procedures. This represents a monumental policy challenge.

Our argument in this paper is that it is essential to progress to an integrated international policy position on promoting competition in transport markets. Piecemeal, uncoordinated developments in competition policy will not lead to a global optimum and will result in conflicting outcomes and static and dynamic inefficiencies, as was observed as recently as 2005 in the attempt by Qantas and Air New Zealand to form a tight commercial alliance covering all flights into, out of, and within Australia and New Zealand.[6]

In this paper we next consider briefly the role of the airline industry in the global economy, and then turn to a brief consideration of recent dynamic developments in the sector, especially with respect to mergers and alliances. History tells us that regional or international policy initiatives are never easy or conclusive. Qantas' and Air New Zealand's trans-Tasman experience between 2003 and 2005 is highlighted as a case study.

Discussion then follows on regulatory errors. We argue that a global authority is less likely to make decisions that are globally welfare-reducing than can happen with separate national authorities. We note that dealing only with one regulator significantly lowers firms' costs of complying with competition laws. This raises the question of institutions – their nature, form, location, power, transparency, accountability, responsibilities and goals. The creation of a truly international airline regulatory policy and enforcement regime will take time. We discuss some possible transitional paths before concluding with suggestions as to how, when and by whom an agenda for a truly international transport competition policy framework can be developed.

2. THE GLOBAL ECONOMY AND THE TRANSPORT SECTOR

In the hit musical *Cabaret,* Joel Grey told us that it was money that made the world go around. True, but without transport it would be much harder to make the world go around, even with money, money, money. Markets, whether national or international, need effective transport networks to serve them. An efficient and competitive transport sector, within and between borders, is necessary, but not of course sufficient, to ensure that players in global trade and commerce can operate efficiently and competitively.

It is clear that in recent years transport operators, broadly defined to include common carriers that provide passenger and freight services via road, rail, sea or air, as well as providers of transport infrastructure like ports, airports and toll roads, have diversified and integrated their operations within and beyond national boundaries. Many reasons lie behind these moves, including the search for a one-stop-package to be offered to users of transport services; the wish to supply this package to customers wherever in the world their business is located; the search for greater efficiencies and higher profits; attempts to secure first-mover advantages in a rapidly changing international environment; and a commercial desire to become a major integrated international firm in one or more segments of the transport sector.

An important overriding reason for these mergers lies in the existence of positive network externalities or bandwagon effects in the transport sector, whereby the extent to which one user's demand for the service is influenced by other users' demands. Thus, the demand for a flight between two cities will grow the more that other users demand it, because, for example, the route is then less likely to be cancelled for lack of demand, and so delivery networks can be built around the continued availability of the service. From a policy perspective, however, network effects can cause problems, as network boundaries will often transcend national boundaries, as in the case of international airline flights. Even within a country, it can be difficult to produce a socially optimum policy for a sector that experiences strong network effects, as it will be impossible to ignore the other sectors, either horizontal or vertical, that contribute to these effects.

A key thing to note about these transport sector mergers is that their impact will spread beyond the country(s) of origin of the firms involved. Any favourable, or negative, cross-border spillovers may provide a greater incentive for a country to assess them solely from a domestic perspective rather than considering them in a multilateral context. Different countries may see a given merger through a different self-interested lens, and so conflict can occur, leading to regulatory outcomes that are sub-optimal from a global perspective.

The 'three pillars of stagnation' is a phrase coined by Giovanni Bisignani, Director General of the International Air Transport Association, to describe the bilateral system of exchanging air transport traffic rights, national ownership rules, and the approaches taken by competition authorities. In his view these three factors limit change and profit prospects in international air transport markets.[7]

The regulation of international air transport services involves a complex web of over 3500 bilateral agreements that establish rules to identify the airlines that can fly on each route, determine the capacity that they can deploy, and limit the capacity that can be offered by airlines from third countries. The system imposes country-specific quotas in each country-to-country market pair, and competition on each route is limited to those suppliers designated by the relevant bilateral agreement.[8] As a result of these restrictive entry conditions, some carriers earn substantial profits on some routes, but this is far from a universal condition, and so it is claimed that regulation is not working, and reforms are urgently needed.

It is not our task here to evaluate the winners and losers from such restrictive regulation, especially with respect to entry. But we do note that competition-inducing reforms have occurred within the regulatory system, especially in terms of easier entry conditions. The density of networks has significantly increased, resulting in a greater number of possible routings between any two cities. However, incumbents have deliberately created excess capacity to deter entry, or have engaged in quality competition to raise their rivals' costs. The regulatory system itself has also increased costs. Airlines must construct networks through a maze of bilateral agreements. These can in part be overcome through alliances and code sharing, but this is likely to be a second- best solution.[9] Some routes are undoubtedly being served inefficiently because of limitations on market access associated with bilateral agreements.

Freedom to merge gives airlines greater ability to respond to market forces, especially to the threats posed by new entrants like the LCCs. Incumbent legacy carriers can respond by stressing their network advantages, and such responses will be assisted by changes in the ownership rules. Yet with greater freedom to merge there would likely be calls for a wider and unified regulatory authority, at least with respect to competition issues including, inter alia, entry conditions, mergers, and the use of market power. The effects of all these types of conduct transcend national boundaries, and therefore call for unique jurisdictional treatment.

It is worth remembering the observations of Evenett (2005, p. 17) as we explore the best way to regulate mergers and alliances in the international airline industry:

Competition enforcement agencies may see advantages in coordinating and sequencing investigations, and even in specializing in certain types of investigations, much in the same way that certain national competition law enforcement agencies in the same jurisdiction cooperate with one another. Arguably the current discussions on international cooperation on competition law and enforcement are a long way from this type of outcome, but the goal [should be] not to show what is practicable immediately but where the logic of internalizing cross-border spillovers leads to in terms of international collective action.

If regulation occurs through an uncoordinated network of national authorities, and mergers are denied, airlines will develop strategies to capture the gains from networking, including alliances with airlines based in other countries. That is, as noted earlier, they will respond to policy decisions and seek to re-engineer their operations and institutional environment in their own self-interest. From an overall social perspective, these responses and the initiating policies may well be second-best outcomes. Here, the gains from consolidation are not lost but are attenuated through a less socially-optimal regulatory regime. The alternative, providing for a regional or global authority, will produce the opposite set of outcomes, generating social efficiency gains but in all likelihood creating national concerns about competition effects and damage to national champions.

Bisignani has referred to 'dogmatic competition policies [that] also restrict our freedom', suggesting that inaction or inappropriate action by governments inhibits adjustment in airline markets in ways that are consistent with competitive behaviour. He observes that despite the existence of strong competitive forces in these markets, including LCCs and fifth freedom operators, decisions on mergers or alliances by single-country regulators take much time and that competition authorities everywhere are over-cautious with air transport. He asks:

What other global business is more fragmented than air transport? Where are the multi-national players, the Daimler-Chrysler's or the Pharmacia-Upjohn's of air transport? Some industries requiring large investments are fiercely competitive even with just a few very large players. In spite of that, most airline alliance projects, or the few merger attempts face long delays. …We need the economies of scales [sic] that mergers or acquisitions can provide with the proper competition supervision . . . the regulators must take up the challenge of change![10]

It is unlikely that the long-run first-best option for an international regime for transport competition policy will be immediately achievable. History will work against that. But having designed such a policy, we can consider various strategic paths for its implementation. The first steps may have to be small ones. It is important to get the culture for competition right, before moving on. One step at a time is better than two steps forward and one step back.

3. MERGERS AND ALLIANCES IN AIRLINE MARKETS

In the last decade airline markets have witnessed a flurry of corporate restructuring, horizontal and vertical integration and diversification through internal or external growth, and through consensual amalgamations and alliances. Some mergers have been approved by competition authorities, both within countries as well as in a regional setting, such as the recent Air France/KLM and Lufthansa/Swissair amalgamations. Some alliances have not been approved, at least consistently between jurisdictions, as in the attempt by Qantas and Air New Zealand to form a formal and comprehensive trans-Tasman alliance in 2003. Other alliances, for example between Qantas and British Airways on the so-called ‘kangaroo route’ from Australia to England have been approved (twice in this case, the most recent approval occurring in 2004) on public benefit grounds. In this case their combined market share was a much lower 40 percent (compared with the approximately 80 percent combined market share of Qantas and Air New Zealand across the Tasman), and the two airlines faced real competitive constraints from Singapore Airlines and Emirates, among others on the route.

There appears to be little doubt that such corporate activity has been privately beneficial. In an interview in *The Australian*, April 29, 2006, Patrick Alexandre, the executive vice-president of the international commercial division of Air France, made it quite clear that he saw consolidation as the inevitable future of the airline business. In Europe this was likely to be based around BA, Lufthansa and Air France-KLM, and was likely to occur within the three major existing alliances. It was pointed out that the Air France-KLM merger had been a success as the separate brands had been retained (but customers could combine fares from both), and because the two airlines had largely operated complementary networks.[11] Another executive, Bruno Matheu, argued that the success showed that mergers were not just a matter of cutting routes, but could lead to real synergies, and that the model of the future could be one bottom line with two brands and two networks, but with inter-operable networks.

Is there room for more than three alliances (Oneworld, Star and Skyteam) in the future? In the near term probably not, and the longer the current three grow (and consolidate within each other) the harder it will be for a fourth alliance to become established with enough critical mass (Wings, based around KLM and Northwest, was clearly too small an alliance to be viable). Where does the fast-growing Emirates fit into this? Is there likely to be any consolidating switch between alliances? Perhaps not, given the established technical and commercial links that exist within alliances. However, the revised 2006 proposal by Qantas and Air New Zealand to form their own trans-Tasman alliance, independently of their own current (and different) alliance memberships, may lead in this direction for one of the airlines.

In the presence of restrictions on foreign ownership and the bilateral regulatory system that governs international airline operations, which together give limited access to country-pair traffic rights, cross-border amalgamations such as those that have occurred in Europe are unlikely to feature strongly in the medium term. Brand franchising may occur, and alliances are another way to get some of the advantages of a merger. Code sharing can work too, in so far as brand presence is achieved on a route, or as in the operating alliance currently proposed by Qantas and Air New Zealand, whereby the two airlines will each be able to maintain a full network presence while eliminating some of the excess capacity (thereby gaining more efficient use of aircraft) that is currently a feature of the trans-Tasman market.[12]

Airline alliances were originally forged as a substitute for amalgamations, with the purpose being to increase revenue through the achievement of operational and customer synergies, joint purchasing of aircraft, countervailing power that could deal with the power of airport operators, as well as a little pricing tranquillity. Some of these goals have been achieved, such as in IT and in providing seamless ticketing. Others, like joint fleet purchases, have proved to be impractical, given the unique needs of each airline in terms of capacity and timing requirements.

But alliances (certainly parallel ones but also complementary ones) can also be used to choke competitive instincts. Any agreement to share carries with it a commitment to cooperate, and no matter how worthy the original goal, it is but a short step to go from an efficiency-enhancing informal arrangement to other kinds of joint action, tacit or overt, that are welfare reducing, certainly from the consumers' point of view.

Further consolidation may be hampered by the rigidities of the bilateral system of aviation agreements on which international airline services are based. This system perpetuates the worst features of highly restrictive trade agreements, and stands in the way of building efficient and dynamic airline networks. Alliances are a second-best response to changing market conditions, as these bilaterals preclude first-best solutions. Governments need to agree on a way to produce a multilateral approach to air transport rights between countries – and how to compensate those who will lose, at least in the short run, from this change – that will permit the achievement of greater static, allocative and dynamic efficiencies. There is clear evidence that the liberalisation of air services agreements will yield significant gains in jobs and in economic activity. For example, it was recently estimated that due to liberalisation on the trans-Tasman route, between 2002 and 2005 air traffic increased by 56 percent above what it would otherwise have been (an extra 1.7 million passenger movements a year).[13]

Merger activity and conduct relating to entry into, and strategies within, an alliance are at least to some extent substitutable events. Clearly, merger policy and enforcement, at least in relation to airline markets, should not be developed independently of corresponding developments in policy and enforcement with respect to agreements, arrangements or understandings between rivals in the form of alliances. While this in theory can be handled easily within any given country with a respectable competition policy regime, the trend is to airline-conjoining activities that are cross-border in nature. This means that airlines are different, and airline mergers and alliances, especially cross-border ones, should be assessed under a different regulatory framework.

There can be no doubt that competition is very strong between the major international airlines, at least on routes where bilaterals have not reserved monopoly profits for a small number of carriers from the two countries involved. We would expect that where amalgamations take place in highly competitive markets, the motive is less likely to be to develop market power (unless perhaps the mergers are of the creeping acquisition sort), but rather to secure improved managerial, scale and scope efficiencies that will enable the newly joined airlines to compete more effectively. But the desire to insulate itself from as much market constraint as possible is always latent in any organisation, and this applies to both horizontal as well as vertical amalgamations.

It must be understood that the integration of national markets through globalising processes at the same time both increases and reduces the scope for anti-competitive behaviour by firms. Previously protected domestic incumbents feel the chill winds of international competition for the first time. Cross-border mergers can lead to synergies and efficiencies that, if enough competitive pressure is present, will be passed through to customers. But with fewer players in the market, and with more exposure to each other in a number of markets, and with a now-smaller number of potential competitors, firms may lapse into mutual forbearance and pricing tranquillity. What this means is that it is difficult to make strong a priori generalisations about cross-border amalgamations – each one needs to be assessed on a case-by-case basis.

The nature of the rush to join airline alliances indicates that they are seen as an important part of airline marketing and development. As they grow in member numbers, diminishing returns to membership could well occur and administrative costs may increase. Research is needed into the optimum size and spread and internal distribution of routes of such alliances; what are the major determinants (operational, organisational, attitudinal) of alliance growth; whether top-down or bottom-up development is optimal; whether "poaching" may occur between the three major groups; the nature and extent of inter-alliance competition; and on whether (and how, and led by whom) new alliances may split off from the two leading alliances, with what marketing and synergistic effects.

In terms of progressing research, it is important to identify which countries have the most enlightened policy on cross-border amalgamations and alliances, and proceed from there in terms of developing a feasible and timely agenda, and also, as Evenett (2003) notes, to ascertain which countries have the greatest regulatory effect on the corporate restructuring that is taking place.

4. INTERSECTION OF REGIONAL AND DOMESTIC POLICIES: A TRANS-TASMAN CASE STUDY

As we have already highlighted, most international airlines pursue global strategies, but their regulation is still largely national. Local regulators control firms in their jurisdiction in a vacuum, not usually taking into account the firms' operations and their economic spillovers (good or bad) elsewhere. In reality it is not possible for one economy to successfully regulate a multinational airline, as decisions will likely be made in favour of local welfare, which may not correspond with either the firm's private optimum or with the international socially optimum outcome. Just as sector-specific competition policies within a given country can lead to regulatory inconsistencies and potential for capture, then also uncompromising country-specific competition policies may stand in the way of achieving regional or global consensus and the benefits that can follow from harmonised approaches to making markets work competitively. This is especially true when dealing with sectors exhibiting strong network effects.

Currently, with the exception of the EU, cross-border mergers between firms domiciled in different countries are independently assessed in their respective countries. Mergers are evaluated under each country's statutory provisions, which demand assessment in terms of national priorities and objectives. Even in geographically, commercially and culturally close countries like Australia and New Zealand that over the past decade have signed several MOUs on the harmonisation of trans-Tasman business laws,[14] the statutory objectives of enhancing national welfare are squarely national, not trans-Tasman. The competition authorities from the two countries meet frequently, undertake staff exchanges, use similar guidelines, and cooperate in investigations and coordinated enforcement where appropriate. Yet there are significant differences in analytical approaches, in attitudes to public consultation, in attempts to quantify anti-competitive detriments and public benefits, and in the welfare standards used to assess 'public' benefits. In addition, differing appeal procedures and decision making authority mean that complete business law harmony is far from being achieved.[15]

The problems of multiple merger jurisdictions are strikingly demonstrated by the competition regimes of Australia and New Zealand. Both countries prohibit mergers that have the purpose, effect or likely effect of substantially lessening competition. Agreements, arrangements or understandings between competitors are similarly proscribed. A somewhat unique feature of the *Trade Practices Act* in Australia and the *Commerce Act* in New Zealand is that both types of conduct can be administratively authorised (rendered immune from prosecution) if the parties can demonstrate ex-ante that any anti-competitive detriments arising from the conduct will be outweighed by any public benefits directly attributable to it. This process can be lengthy and cause significant commercial delays. If the parties are domiciled in separate countries, the authorisation process has to be undertaken in each one separately. Despite essentially the same law being applied to the same set of facts, different outcomes can result.

Nowhere has this been more starkly demonstrated than in the attempt that began in 2002 by Qantas and Air New Zealand to set up a trans-Tasman agreement whereby the two airlines would coordinate schedules and pricing for all flights within, originating from, and arriving into the two countries. Qantas also sought to acquire a 22 percent stake in the equity of Air New Zealand. The proposals were denied by the Australian Competition and Consumer Commission (ACCC) and by the Commerce Commission in New Zealand on largely structural grounds, based on a likely combined trans-Tasman market share of around 85-90 per cent (Air New Zealand did not fly domestic routes in Australia, and appeared unlikely ever to do so, and Qantas operated only very limited services within New Zealand, and appeared to have no wish to expand these).[16] Qantas and Air New Zealand appealed both decisions to the relevant appeal bodies, the Australian Competition Tribunal in Australia,[17] and the High Court in New Zealand. The appeal was denied in New Zealand, but was granted in Australia. The proposals were abandoned, however, as they needed approval in both jurisdictions.

Why was it that the two regulators agreed, but the appeal authorities produced quite different decisions? The problem lay in the differing nature of the appeal procedures. In Australia, the appeal was to the Tribunal, a body consisting of a judge of the Federal Court of Australia as President, and two lay members appointed for their expertise in commercial matters, economics or the law. For appeals on agreements and equity acquisition issues, the process is a de novo one (rather than a review on the papers that were before the ACCC) in which a complete rehearing occurs, with updated evidence, new witnesses, and new arguments and submissions being heard. For New Zealand, the appeal was before the High Court of New Zealand, in which a judge sat with one lay member, with only limited admission of new evidence, the purpose of the appeal being to determine whether the Commerce Commission had made error in its decision.

In a market which was highly dynamic, it came as no great surprise that the two appeal authorities handed down quite different decisions. In the intervening period between the regulators' decisions and the appeal hearings, the market for passenger flights between Australia and New Zealand had changed markedly. Significant new entry had occurred by Virgin Blue, an Australian carrier, and Emirates, a large international carrier that used its 'dead' turnaround time to fly a return leg across the Tasman. Both airlines offered much lower fares (and, in the case of Emirates, true international class service) than had previously been charged by Qantas and Air New Zealand, resulting in a steep drop in market share for the two established carriers.

Using a behavioural rather than a structural approach (in contrast to the ACCC at first instance, which focussed heavily on market shares), the Tribunal found that in the presence of such fierce competition, there could be little prospect of future anti-competitive detriment, as it would not be in the commercial interests of Qantas and Air New Zealand to raise their prices or significantly restrict their schedules,[18] in the face of these low priced entrants that appeared to be committed to the trans-Tasman market in the long term, and for whom there appeared to be no barriers to expansion.

In contrast, in New Zealand the High Court sought to find whether there was any error in the findings of the Commerce Commission, paying little regard to developments in the market, especially with respect to new entry. In authorisation matters, New Zealand has generally sought a greater level of quantification of anti-competitive detriments and public benefits than has been the case in Australia, and, while the Court did find some errors that worked to the airlines' advantage, they were not sufficient to lead to a reversal of the regulator's decision. A further appeal was open to the airlines, but they chose not to take this opportunity.[19]

Following their failure to get the arrangements approved, it appeared that each airline would go its own way, with Qantas in particular focussing on LCC operations in Asia. However, in April 2006 the two airlines submitted a new proposal to the ACCC for authorisation, in the form of a trans-Tasman code-sharing alliance that controlled capacity and prices. This application relied on the findings of the Tribunal, and effectively by-passed the Commerce Commission, as in New Zealand inter-country airline agreements (the new proposals contain no equity acquisition component) need only to get the approval of the Minister for Transport, who had supported the previous set of proposals as the relevant Minister (but who of course had no control over the independent Commerce Commission). On the assumption that such approval should now be a 'shoe-in',[20] the two airlines presumably decided that they could apply to the ACCC for authorisation, confident that even if the application were to be rejected, in the face of what is now a highly competitive trans-Tasman airline passenger (and freight) market, any appeal would likely still find favour with the Tribunal.[21]

The moral of the trans-Tasman position is clear. For internationally traded commodities like country-to-country airline services, within-country assessments of commercial activities may differ significantly from country to country, with the potential to disrupt or deny globally or regionally efficient strategies from coming into operation. Narrow self-interest, or an unduly restrictive statute, may enhance national welfare in the short run, but in the long run is likely to damage welfare, especially when dealing with industries where network effects are important, and where the firms subject to the vagaries of introspective regulation have the commercial opportunity to choose other locations in which to base their operations or to locate part of their commercial network.

Careful planning and consultation are needed to get national, regional and international policy right for the promotion of competition in markets which transcend national boundaries. The culture, commitment, goals, institutions, laws, enforcement mechanisms, penalties and review procedures all need to be fully debated and supported at a global level, at the same time providing for sensible intersections with regional and/or national operational necessities and political/economic sensitivities.

5. REGULATORY ERRORS AND MULTIPLE COMPETITION AUTHORITIES

As illustrated in the previous section, when firms located in two different jurisdictions seek to merge or engage in an alliance, two independent regulators will assess the conduct. In markets that are as interconnected as airline markets, decisions on the competitive process by one country will almost certainly affect competition in airline markets in other countries. Findlay and Round (2003) have observed that different decisions could emerge between countries on a merger, either for reasons of political economy, or because of differences in regulatory capacity or maturity or methodology or investigatory procedures, and because of different attitudes taken to the costs of decision errors. Regulators may also come to different conclusions because of differences in data provided to them (certainly this was the case in the Qantas-Air New Zealand alliance application). But most importantly for the purposes of this paper, each regulator will examine the impact of a proposed merger or alliance on the welfare of its own country's population and the firms domiciled in that country (or the share of profits accruing to its nationals if the firm is partly foreign owned). If benefits or costs accrue to foreign nationals, they will not normally be considered.

Under this scenario, for a proposal to go ahead it must be approved by both regulators. Under what circumstances could one regulator accept a merger application while the other rejects it? More to the point, could a proposed merger that reduces global welfare be accepted, or could one that improves global welfare be rejected due to its assessed impact in one country? Many academic papers have considered these kinds of issues. National authorities that concentrate on the effect of mergers on national welfare will usually overlook the possibility that such mergers could have an effect on producer surplus accruing to foreign firms, and could result in increased prices in international markets – external effects not within the country in question, but in other countries.[22]

Tay and Willmann (2005) model mergers as random events that yield asymmetric consequences in the two countries affected by them. They conclude that a first best global competition policy can only be achieved through a global competition authority that can internalise cross-border externalities, and point out that such an authority would free poorer countries from the expense of setting up their own independent competition authority. Haufler and Nielsen (2005) use a Cournot model also to show that under certain circumstances actions taken by national merger authorities towards national mergers will be too restrictive from the perspective of global efficiency. They argue (at p. 25) that there is an important asymmetry between national and cross-border mergers in markets where national players dominate. In these markets a national merger will indeed reduce the number of firms that actively supply the market, whereas an international merger will not… . …the conditions for an international merger to be in the interest of the participating firms are unambiguously stricter than in the case of a national merger, but when indeed proposed, international mergers will not be vetoed by neither [*sic*] national nor regional merger authorities.

Findlay and Round (2003) have assessed regulatory discordance in the context of two sources of conflict between regulators: differences in structures between the two economies and the resultant differing weights given by regulators to consumer and producer interests, and different approaches to the need to look forward in the assessments and how to handle the ensuing uncertainty that emerges in any assessment of dynamic market efficiency.

Differences in reactions by regulators to merger proposals can arise because of differences in the structures of their own economies. From a global perspective a merger proposal should be rejected if it reduces total welfare - that is, if the expected loss of consumer surplus exceeds the likely gain in producer surplus. But each regulator will make this assessment according to its own views on the appropriate measurement, and the relative distribution, of these surpluses. One country, for example, could account for a relatively high share of producer interests and a relatively low share of consumer interests and would discount the total cost to consumers and take into account a greater share of the impact of the proposal on producers. It is possible for such a country to approve a proposal which does not enhance global welfare as its large share of a relatively small gain to producers exceeds the cost to its consumers, and that when this happens, the other country (in a two country world) will reject the same proposal. If approval by both regulators is required, the merger would not go ahead, avoiding the risk that global welfare will be reduced. Additionally, a merger that increases global welfare could be rejected by one country if its loss in consumer welfare is relatively large compared to its share of producer gains.

Clearly, it is possible that one country could be worse off when a merger that reduces global welfare is rejected, but it is unlikely that a scheme could be set up to compensate that country. In contrast, if a country seeks to stop a merger that enhances global welfare, compensation may be feasible, although it would need to be checked that this country was not ‘gaming’ the situation. Establishing such a scheme would be costly, however, and the assessment of the appropriate compensation would not be easy, especially in view of the possible long-term incentive effects.

All regulatory decisions are subject to the possibility of error. Type 1 error occurs when a merger that will be welfare enhancing is rejected, while Type 2 error results from the approval of a socially undesirable merger. Here, it may be hard to undo the damage, as once the eggs have been scrambled it will rarely be possible to revert to the original position. However, if a Type 1 error is made the proposal can always be resubmitted, with no lasting social (or private) damage. Type 1 and Type 2 errors are inversely related; any regulatory scheme to reduce the probability of one occurring automatically increases the chance of the other taking place. Avoiding the risk of accepting a merger that will reduce welfare means that that there will occur a greater rejection rate of all mergers, good as well as bad. The trade-offs can be reflected in the threshold that is applied in the statute. For example, the higher the threshold for rejecting a merger (an easier regime), the greater the implied risk of making a Type 2 error. Findlay and Round (2003) note that in open economies with few entry barriers, Type 2 errors may correct themselves over time, as any excessive profits made as a result of the increased market power will encourage entry into the market. While Type 1 errors may only entail short run social costs, they will involve irretrievable losses to both consumers and the firms involved. To guard against this situation becoming a long run problem, firms must be able to re-apply, or appeal to an independent review body for a speedy rehearing of the case.

In airline markets, where entry possibilities are often closed off by other regulations, the consequences of making a Type 2 error could be damaging, and so regulators should investigate merger proposals in great detail, and may be more likely to reject mergers that increase competition. Depending on national goals and stages of development, and on the relative short-run and long-run costs of these errors (and on the costs of reducing them), different countries may evaluate the consequences of the two different errors in different ways. Such inter-country differences create major problems for cooperation on competition policy issues.

When two countries assess a merger independently and when agreement by both is required before a merger can go ahead, the country which is more concerned about a Type 2 error (and therefore will be more likely to reject an application) is likely to prevail and determine the final outcome. Such a country is likely to be at a later stage of development, or to have a stronger antipathy towards big business, or to have a longer established culture for competition, or to regard entry barriers as being relatively high.

If regulators follow different ideological approaches to assessing the competitive process further opportunities arise for different decisions. For example, one regulator might favour a structural approach and the other a dynamic approach that focuses on strategic behaviour by firms.[23] This situation might arise as between a relatively new regulator and an experienced one. A regulator following a strategic behaviour approach may approve more mergers than one following a structuralist approach. The gap could be expected to diminish over time, and consultation, cooperation and capacity building clearly will help produce a more coordinated regulatory vision, but, even so, discrepancies in the positions of the regulators could persist, to the detriment of firms that wish to merge and to society in general.

The message here is unequivocal – the 'right' answer on mergers and alliances, globally speaking, and assuming that the goal will always be to maximise total welfare, is more likely to happen when these kinds of conduct are assessed by a supranational authority. For this to occur, individual countries need to yield their legislative and decision-making power to a more widely-based constituency. More globally socially efficient decisions will then be likely, but problems relating to distributional equity between countries will be inevitable.

6. LESSONS FROM REGIONAL TRADE AGREEMENTS FOR A MULTILATERAL COMPETITION POLICY

Evenett (2005) has recently addressed the lessons to be derived from regional trade agreements (RTAs) that address competition issues, in developing multilateral policies on competition laws and their enforcement. He notes, at p. 5, that 'Diversity, it would seem, is the dominant attribute of RTA provisions on competition law and policy.' This does not bode well for the development of multilateral policies on competition, whether in a trade context or in a stand-alone format, especially when the needs (and objections) of developing countries are taken into account.

Perhaps the search for a universal framework and all its associated issues of coverage, non-discrimination, flexibility, cooperation, capacity building and so on cause difficulties at a higher plane than a more limited search for a multilateral approach to one specific sector or even type of transport service like airline services. While generally sector-specific regulation raises problems such as consistency, capture and transparency, if a sector is so unique or its behaviour is so fundamental (through network effects, spill-overs and the services it provides) to the efficient operation of other sectors or whole economies or regions, then going it alone, in terms of regulation, may well be the socially optimal approach. But different countries will have different views (that are possibly irreconcilable) on many important issues, including the costs of implementation and operation, expertise, relevance, impact on national champions and domestic industrial policy.

Evenett (2005) lists many issues that will arise in future attempts to produce a multilateral framework for competition policy generally. These are no less germane to the development of a specific framework for promoting competition in international airline markets:

- The more parties involved, the harder it is to achieve unanimity.
- Will the initiative work if special provisions are used to placate some countries?
- Does the agreement substitute for, weaken or strengthen RTAs, either current or mooted, between participating countries?
- Has the policy sequencing issue been carefully thought through?
- Does a successful provision in an RTA guarantee that it will work effectively in a multilateral agreement?
- There may be significant structural and behavioural features in RTAs that will not be relevant in a multilateral agreement?
- Should a multilateral agreement be drawn up in the context of international trade perspectives and institutions, or should it be developed independently?
- How will disputes be resolved, and through what appeal body, and how will this be constituted?

There is clearly no one magic recipe – there is, as Evenett puts it (at p. 10), ‘a wide range of logical possibilities’. He distils four broad themes that will be important in determining final outcomes:

- What is the rationale for a multilateral agreement?
- What is the likely impact of competition rules on non-signatories?
- What will determine the effectiveness of the provisions of the agreement?
- What political economy factors are involved in setting up the agreement?

Regional and international cooperation on trade issues has certainly been achieved, albeit slowly and far from optimally, and in principle there is no reason why a similar process on airline services competition adjudication cannot occur.[24] At first, a commitment to the principle should be sought. The detail will be much harder to get agreement on.[25]

Such cooperation, albeit limited, would be a vast improvement on the current situation of uncoordinated and unsystematic attempts to control mergers, especially cross-border amalgamations. Agreement would be needed on many issues – the type, focus, detail and coverage of the laws, as well as the degree of proscription and prescription; the nature of enforcement; and the penalties that could be incurred for breaches of the statute. As Round (2005, p. 239) has said in relation to the need for East Asian countries to develop a harmonised approach to competition law and policy:

The pursuit of a cooperative regional policy and enforcement stance requires the flexibility to handle economy-specific problems, and should promote a convergence to a broadly agreed set of goals, standards, prohibitions and methods that will provide a transparent regulatory framework and incentives for businesses and consumers to get the most out of market processes, thus enhancing private and social welfare. A harmonised approach would involve each economy taking account of what is happening in its neighbouring economies, and through consensus following a common path on as many issues as possible, including policy development, legislation, administration, education, enforcement, penalties and review. The keywords should be communication and convergence . . .

Much debate has occurred in recent years over the need to develop a viable multilateral competition policy to be administered through the WTO, and also to develop best practice guidelines for competition policy and enforcement through agencies like the OECD and the International Competition Network. The EC has shown the way in promoting international competitiveness.[26] It is now up to other regional groups to follow this lead, and for international bodies like the WTO to encourage the development of an international merger policy regime for the transport sector that promotes efficiency and competition.

Piecemeal competition-related provisions have been included in many WTO Agreements, including, for example, in various GATT Articles mainly related to anti-dumping provisions and state-owned enterprises; in GATS (General Agreement on Trade in Services) provisions with respect to monopoly and anti competitive behaviour, as well as domestic regulation; and in the TRIPs (Trade Related Aspects of Intellectual Property Rights) provisions against conduct that unreasonably restrains trade or affects adversely the transfer of technology. As well, Trade Policy Reviews frequently deal with issues related to competition. ICAO has drafted a model clause on competition safeguards which lists examples of conduct that may be anti-competitive in air transport markets. This clause also provides for consultations and for a dispute resolution mechanism with respect to those behaviours.[27] The clause could be combined with other material into a GATS Reference Paper on Air Transport Services, which could include the principles to be applied to domestic regulation as well as detail on desirable levels of international cooperation.

Competition law and enforcement philosophies and practices within economies will always reflect the local underlying political, economic, and legal culture and history of the country. Views will differ on reasons, content, objectives, processes, instruments and timetable.[28] Immediate or full agreement cannot be expected. But a timetable and a commitment to a process of convergence on principles and methods, a harmonising yet flexible process of developing a shared multinational approach, is essential in order to promote efficient airline markets. With such cooperation, experience and capacity can be shared, and the complete intersecting picture and all of its implications can be assessed. Such integration could begin simply with information exchanges and then expand into the more complex process of shared commitments, building policies and infrastructure (including an appeals mechanism), and educating the industry on its new regulatory environment. This is how trade liberalisation has developed as an international policy, albeit very slowly.[29] These gains, however, will not be free of adjustment problems, nor will they be symmetrical in their occurrence. But transition problems should not be used as an excuse for a lengthy delay in getting the system rolling.[30]

7. SUMMARY AND CONCLUSIONS

As pressures mount for airlines to become more efficient globally, proposals for mergers and alliances will increase. Different countries will face proposals that will simultaneously affect the competitive process in markets which lie within or overlap their jurisdictions, as well as in markets over which they have no regulatory mandate. When competition regulators act independently and where agreement is required before a merger can go ahead, a country that seeks to reduce the likelihood of approving a socially-damaging merger is more likely to reject merger applications. The deliberations and priors of that country on the trade-off between the two types of regulatory error therefore become dominant. However, while independent assessment may lead to the rejection of mergers or alliances that will enhance global welfare, the cost of that risk may be less than that of building a more complex set of institutions to avoid the problem.

If producer interests have a powerful influence over regulatory agencies (a likely situation in the early stages of the development of competition policy), there will be a higher probability that mergers which lower global welfare will be approved, although this outcome will be less likely if the countries and their regulators are at different stages in developing a culture for competition. It is also less likely when regulators are independent of any political influence.

Different countries will display differing attitudes to regulatory decision-making errors and their consequences. A relatively less developed country might approve mergers that will damage the competitive process on a wider scale, on the grounds that the costs of this error will be short-lived (although this is not necessarily the case) and that lowering the risk of making such an error would involve considerable regulatory effort (this is undoubtedly true, but carries with it a much greater and more geographically dispersed long-run social benefit). In contrast, a merger could be rejected under one regime even though on a more global evaluation the transaction could be welfare enhancing.

We believe that developed countries should be heavily involved in programs of capacity building to share their experience on methodologies, errors and outcomes with countries and institutions at earlier stages of development. The goal must be to deepen and shorten the learning period, and to bring together policy procedures and methodology, so that when cooperation or assessment of the same or similar factual situations is required, any differences of opinion will be minimised. Only then can we be confident that socially good mergers and alliances will be approved, and socially-damaging ones will be rejected. And, as appealing as this goal might be, it is still a second-best one: first-best would see a single international authority to consider the numerous competition issues that arise in international airline markets.[31]

Such a move has been discussed from time to time, but a truly global authority is far from being a reality, if for no reason other than we do not know what the objective functions of the respective national authorities are.[32] The gains from setting up such a body would in all likelihood not be distributed evenly, and would be especially likely to fall to countries which do not already enjoy extraterritorial powers.[33] In the absence of a mechanism for compensation or side payments, such a body will be difficult to establish with any sort of universal support. The benefits from embracing a competitive culture are likely to be so high that the winners could in theory compensate the losers (an equity argument rather than an efficiency one), and there would still be a credit balance left at the end of the process. In practice, of course, such processes do not happen, as there is no mechanism that can easily be used to bring about this redistribution.

Countries should of course be free to choose the competition policy they think is locally optimal – but they must be conscious of any spill-overs to other countries from their decisions. At the very least there should be some consistency in national laws on the worst anticompetitive practices, but different economies at different stages of economic development will always face different problems with respect to competition policy.

The idea of an international competition policy and a global 'super-regulator' for competition and consumer protection issues is not new.[34] Multi-purpose regulators are generally preferable to single-sector regulators as they present less opportunity for regulatory capture, and promise greater consistency in assessment of all types of conduct and all kinds of markets. From a cross-border perspective, a trade-off exists between having a single regulator, perhaps lacking detailed knowledge of each relevant economy, and the more specific expertise of single-country regulators. From this, one might conclude therefore that a trans-national, single-market authority dealing with airlines is subject to major organisational as well as operational difficulties – treating issues in an inconsistent way with other antitrust authorities, being subject to capture. Yet it offers the prospect of proper consideration of all the network-wide effects of airline behaviour, and of internal consistency in evaluating airline behaviour.

The horizontal and vertical alliances and mergers in the airline sector to date (whether voluntary or defensive) have been designed to protect the market positions of the participants. It may now be difficult, if not impossible, to unwind these at any geographical level. The situation is not unlike that of regulating a market faced with what are known as creeping acquisitions. Here, no single acquisition that adds incrementally to market share can be assessed as substantially lessening of competition, but a point is reached when the acquirer clearly has amassed significant market power and it is too late to rely on structural remedies – and behavioural remedies are much harder to implement and enforce. This point of no return must be carefully anticipated. Use of trigger mechanisms may help manage the problem, as can carefully developed merger guidelines that are revised through experience and changing market circumstances.

It is desirable that one country, or a group of countries, takes the lead in promoting common policy directions, statutory coverage and language, and also in encouraging regulatory capacity building and cooperation towards a harmonised approach to common issues. However, as Round (2002) has noted, the reality and speed of convergence of competition policies, removing differences in approach, ideology and method, depend on the development of a joint culture for competition and an appreciation of its contribution to efficiency and social welfare. History shows that convergence to common competition policies and enforcement procedures, let alone jurisprudence and precedent, rarely emerges quickly, as different countries' stakeholders respond to, and are driven by, different incentives, endowments, aspirations, and micro- and macro-economic environments. Despite these differences, regulatory authorities will have to interact if they are to come up with sensible answers.[35]

The way to start is to find a champion or two committed to the goal. Research into perceived problems could be undertaken, and detailed assessments could be made of what controls might be desirable, and whether current existing methods and precedents from single countries can be adopted, or whether a new regulatory method is called for. The question should not be whether a converged treatment of airline market competition will happen, but rather when will it occur, how it will occur, based on what model(s), with what efficiency and distributive goals, in what legislative manifestation, and with what agreed enforcement priorities and methods. What is now called for is the establishment of understandings on principles, sequencing, capacity building, methods, enforcement, remedies and review. Now that is a *real* policy challenge!

NOTES

1. Gaining a first mover advantage could lock away for many years a virtually unassailable position in terms of access to raw materials, appeal to customers, the ability to raise current and potential rivals' costs, and the development of good relationships with governments.

2. The further back in the chain where market failure occurs, the more likely it is that any distortions will be passed on and amplified as we move further down the functional chain towards final consumers.

3. If transport markets are not competitive, the gains to be had from increased trade liberalisation can easily be dissipated (or captured) through the market power held by transport operators. It then becomes a policy question of trade-offs – what degree of regulation is called for to ensure that the gains from more liberal trading regimes are not taken by transport operators, and how can the transport sector be best regulated for the promotion of competition.

4. Generally speaking, the lower the degree of competition in a market, the greater the likely gains arising from improved conditions that facilitate new entry or expansion by present small rivals. Francois and Wooton (2001) develop a simple theoretical model that illustrates this in relation to maritime services.

5. Notable exceptions include the EU and various MOUs between Australia and New Zealand on the harmonization of business laws.

6. Qantas also sought to take up an equity position in Air New Zealand. The proposal foundered after rejection by the competition authorities in both countries. A successful appeal was made in Australia, but the appeal was denied in New Zealand, effectively putting an end to the proposed alliance. In April 2006, however, a revised proposal was presented to the Australian Competition and Consumer Commission (given the revised form of the agreement, permission is not needed from the New Zealand Commerce Commission, but rather only from the Transport Minister) but without any equity acquisition proposal and with the cooperation on fares and scheduling restricted to trans-Tasman services only. The case is discussed in detail in a following section.

7. http://www.iata.org/pressroom/pr/2003/2003-03-22-06.htm (accessed 16 July 2006). Findlay and Round (2006) consider the challenges for air transport reforms that are posed by these three pillars.

8. Descriptions of the system are provided by the Productivity Commission (1998) and WTO (2000 and 2001a).

9. Cooperative arrangements between carriers are reviewed in WTO (2001b). Oum, Park and Zhang (2000) provide an analysis of alliances.

10. http://www.iata.org/pressroom/speeches/2003/2003-03-22-01.htm (accessed 17 July 2006).

11. The Air France/KLM amalgamation aimed for cost savings from many sources, including combining local and regional management teams, joint ticket counters, joint airport handling contracts, shared airport lounges, and renegotiated catering contracts.

12. Their LCC subsidiaries appear not to be included in the code-sharing proposals, but will abide by some form of agreement that would eliminate fierce competition. If the proposal is authorised by the Australian Competition and Consumer Commission, the airlines will coordinate pricing and marketing initiatives as well, in the process eliminating losses that have emerged in this sector due to too much capacity and heavy discounting by new entrants. It was estimated in April 2006 that there were 3120 vacant seats every day on trans-Tasman flights. See Rod Myer, 'Qantas, Air NZ try to mop up spare Tasman seats', Sydney Morning Herald, 21 April 2006.

13. Adrian Rollins, 'Fly the unfriendly skies', The Australian Financial Review, 21 June 2006, p. 69.

14. See Round et al. (2005) for details on these MOUs. For example, a company with a substantial degree of power in a trans-Tasman market (one with a geographic dimension of either within Australia, or New Zealand, or both) must not take advantage of that power for one of three proscribed anti-competitive purposes in any market in either Australia or New Zealand. A misuse of market power in any market in the two countries can be attacked by the competition agency of either country in its own court system.

15. In a press release dated 23 July 2006, the Australian Competition and Consumer Commission and the New Zealand Commerce Commission announced an in-principle agreement to a protocol to enhance their cooperation in dealing with trans-Tasman mergers, including the sharing of information, assistance with merger reviews and the synchronization of their timing, and the gathering of information on behalf of each other.
    See http://www.accc.gov.au/content/index.phtml/itemId/754797/fromItemId/142, accessed July 23 2006.

16. It is the normal practice of the ACCC not to oppose mergers, even if they will result in a duopoly, if there is evidence of sustained and sustainable levels of import competition.

17. David Round is a Member of the Australian Competition Tribunal, and was one of the three Members who sat on the appeal. Nothing that is said in this paper, in general or specifically in relation to this appeal, should be ascribed to the Tribunal, but rather should be read as his personal views.

18. Some readjustment of schedules had been proposed by the airlines in order to eliminate wasteful wingtip flying and to introduce aircraft of optimum capacity for each flight, rather than continue with the inefficient scheduling of parallel flights and large aircraft resulting in excess capacity.

19. It is worth noting that New Zealand appeal authorities have always been reluctant to find against the Commerce Commission, on the grounds that it is a specialist regulatory body with the knowledge and ability to investigate and analyse commercial matters.

20. Warren Truss, the New Zealand Minister for Transport, was reported in The Australian on June 15 2006 as saying that the proposed new agreement between Qantas and Air New Zealand would help both airlines bring about needed capacity rationalisation, helping them to survive in a very competitive market in which they had been losing market share.

21. At the time of writing in late July 2006, the ACCC had not reached a decision on the application. The decision is expected to be made before the date of the meeting in Berlin, and will be discussed (insofar as it is relevant to this paper) during the presentation of the paper.

22. There is a considerable literature now on these external effects. See, for example, Farrell and Shapiro (1990), Barros and Cabral (1994), and Head and Ries (1997).

23. As was the case in the evaluation of the Qantas-Air New Zealand alliance in Australia, where the ACCC took largely a structural approach, and the Australian Competition Tribunal on appeal favoured an analytical method based on the examination of strategic behaviour in the relevant markets.

24. Plurilateral agreements are already used in air transport markets, for example in Europe and among groups of APEC members. A plurilateral agreement could emerge from negotiations on air transport market access between Europe and the US (see 'Open skies hits turbulence', Australian Financial Review, 14 February 2004, where it is suggested that sticking points are the American position on 49% foreign ownership cap for US airlines, and limits on foreign carriers' access to domestic routes). However, plurilateral structures do not necessarily lead to global free trade, either because their architecture makes intersection difficult or because they create new interests that preclude further extensions to their membership. See Andriamananjara (2002, 2003).

25. If broad agreement on the joint treatment of airline competition issues could be established by a small number of countries, this could induce other governments to pursue similar policies, if only because domestic firms not used to competitive pressures may find it much harder to compete in regional markets where competition policies have been effective and where buyers are better informed and more demanding that their requirements be met by firms, whether domestic or foreign.

26. Neelie Kroes (2006), the European Commissioner for Competition Policy, has observed that cross-border mergers, especially in sectors where large national incumbents have been present, tend to be more favourable in terms of competitive outcomes than amalgamations between national players in the same sectors. As Kroes points out, the single market rules of the EU, and Article 21 of the EC Merger Regulation, forbid national governments from using unjustified steps to prevent the consummation of cross-border mergers that have a European dimension (and hence the approval given to the Air France-KLM merger).

27. See http://www.icao.int/icao/en/atb/atconf5/docs/ATConf5_conclusions_en.pdf (accessed 17 July 2006).

28. Or, in other words, the economist's Magnificent Seven list of questions: what, who, where, how, how much, for whom, and when.

29. In developing economies industrial policy goals often will take precedence over competition issues, and so in the short run allowance might have to be made for this. However few would deny that a vigorous domestic competitive environment equips local firms to survive in regional or global markets.

30. The Closer Economic Relations Trade Agreement between Australia and New Zealand has shown that harmonisation is possible in the enforcement of competition laws, especially in the context of predatory behaviour. A company with a substantial degree of power within Australia or New Zealand, or both, must not take advantage of that power for one of three proscribed anticompetitive purposes. A misuse of market power in any market in the two countries can be attacked by the competition agency of either economy. See Round et al. (2006) for further details of this Agreement.

31. The situation is complicated by the reality that some airline issues will be strictly of a domestic nature. A way must be found to treat these in a national manner that is strictly consistent with the principles and practice of handling the international issues in a supranational body.

32. Many issues need to be agreed on before such an authority can be successfully established. For example, should it be bureaucratic, administrative or judicial? Should it operate under a current international body or start afresh? What will be the national composition of the authority? Will membership (and will it be legal, other professions, or business people, and in what proportions) rotate, and if so, how often? How will the chair of the authority be selected, and what tenure will this person have? To what superior authority or institution will the group report? What will be the nature (legal or administrative) of the review/appeal stage of the process, and on what grounds will appeals be heard? Should its procedures be inquisitorial or adversarial? Agreement is also needed on whether the objective should be efficiency in airline markets – allocative, productive and dynamic, or whether equity issues should be given much weight. As western countries with a long experience of competition policy have not in the past necessarily agreed on these objectives (Europe, for example, has tended to favour the latter while the US has generally emphasised the former), it is unlikely that ready multinational agreement will occur on these goals.

33. For an interesting early assessment of the need for competition policies for an integrated world economy, and a proposal for international competition policy instruments that would seek to promote competition while at the same time having a low impact on national sovereignty, see Scherer (1994). It is interesting to note Scherer's final sentence in his book: "It is important to emphasize that extraterritorial application of domestic antitrust law must be a solution of last resort so as to place a priority on promoting cohesive and converging competition policies in an increasingly international market."

34. See Scherer (1994).

35. The recently proposed merger consideration protocol between the Australian and New Zealand competition authorities (outlined in footnote 15 above) may, in time, provide a useful model for consideration by other, wider groups of countries.

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Terrorism and Travel to the United States

by

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SUMMARY

Paris and Rennes, October 2006

INTRODUCTION

The attacks of September 11, 2001 (New York), March 11, 2004 (Madrid), July 7, 2005 (London) and August 10, 2006 (London)[1] are several of many examples of terrorist events in recent years that have directly affected the transport sector. Because of their psychological impact in the short term, terrorist events targeting the transport sector inevitably have an impact on transport activity.

However, *persistent* terrorist events and the associated counter-terrorism policies implemented by governments may have also a long-term impact on the transport industry. In addition, actions by terrorists that do not directly involve the transport sector may still have an impact on this sector. For example, the fact that a US journalist or businessman is taken hostage in a developing country might affect travel to that country by other journalists or businessmen. Because of the uncertainty about the economic returns of business transactions and the atmosphere of insecurity that they generate both for businessmen and tourists, terrorist acts are likely to lead to reductions in demand and shifts in the patterns of demand for international transport.

Furthermore, if these kinds of acts persist, government officials in the country targeted may take security measures to counter terrorism that will in turn affect travel into to that country. In our example, the US – the country of residence of the journalist or businessman – might then introduce costly inspections and require tighter security at its airports and seaports, steps which tend to increase the costs of travel, especially when time is factored in as a cost[2].

The literature that assesses the impact of terrorism on transport flows and international tourism has mainly focused on its effect within the country where terrorist incidents have occurred. Put differently, the impact of terrorism occurring in a country has been assessed on *incoming* tourism or travel to that country. Frey, Luechinger and Stutzer (2004) survey this literature nicely[3].

However, most of the work has dealt with tourist travel rather than the air transport industry as a whole. Ito and Lee (2005) is one study with which we are familiar that actually assesses the impact of 9/11 on US domestic demand for travel. The authors focus on evaluating the transitory and permanent effects of 9/11 on US domestic demand for air travel. One of their findings, based on the use of monthly time series data, is that 9/11 caused Revenue Passenger Miles to fall by more than 30% immediately after the attack and led to a permanent downward shift of approximately 10%.

However, a specific feature of the ongoing terrorism against the US is that in recent years nearly 90% of the incidents against US interests have actually taken place outside the US. This paper will focus mainly on the impact that terrorist events have had on *outbound* airline travel to the US. In particular, we wish to measure whether the higher risks faced by private agents and the more stringent security measures introduced because of terrorism are uniformly affecting all travel flows to the US. In fact, if the security measures are multilateral and the risk perception by potential private travellers is the same across countries, then one would expect the impact to be the same for all departures to the US. If, on the other hand, the security measures are taken on bilateral basis against the country of the first nationality of terrorists (i.e. reduction in the number of visas for this country, longer waiting times for its nationals at US borders, etc.), then the impact should be even higher on these countries of 'origin'.

Secondly, we wish to investigate whether the events of 9/11 have exacerbated these effects. In particular, we would like to determine whether security measures at borders have been becoming more multilateral after 9/11 than was previously the case.

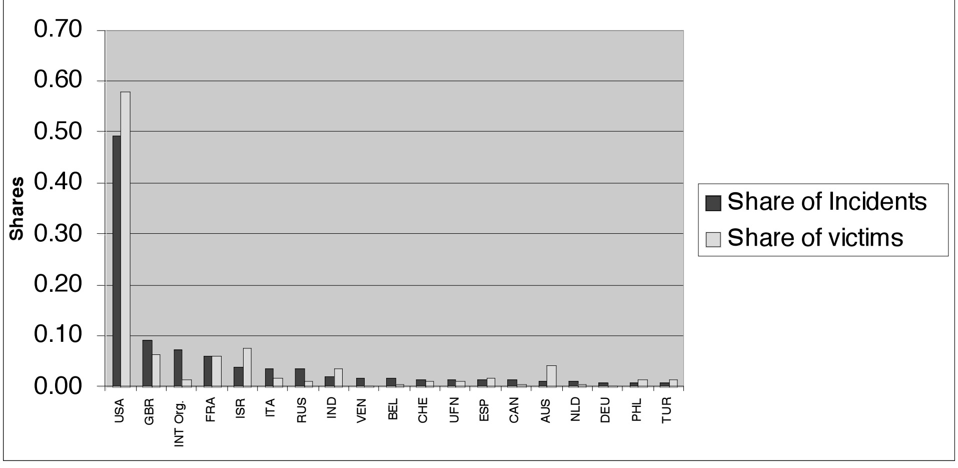
Section 1 outlines some stylized facts. Section 2 presents our analytical framework and the induced empirical specification. Section 3 presents the results. Section 4 presents some robustness checks and section 5 tests the exacerbating role of 9/11.

1. STYLIZED FACTS

1.1. Terrorism between the late nineties and the beginning of our decade

We have extracted terrorism variables from the ITERATE dataset provided by Mickolus and Sandler (2004). For more details on this dataset and a comparison with other datasets, see Verdier and Mirza (2006) or Krueger and Laitin (2003). ITERATE (**I**nternational **Ter**rorism: **A**ttributes of **T**errorists **E**vents) defines terrorism acts as *"the use, or threat of use, of anxiety-inducing, extra-normal violence for political purposes by any individual or group, whether acting for or in opposition to established governmental authority, when such action is intended to influence the attitudes and behavior of a target group wider than the immediate victims and when, through the nationality or foreign ties of its perpetrators, its location, the nature of its institutional or human victims, or the mechanics of its resolution, its ramifications transcend national boundaries"*. ITERATE provides information on the country of location of each incident. In addition, we have coded as the country of origin of the terrorism the country of the first nationality of terrorist groups reported in the data. We have also coded the target country as that of the first nationality of the victims.

Figure 1: Distribution of incidents and victims, by Target country (averages over period 1995-2003)



Note: calculations made by the authors using ITERATE database. Only the first 20 target countries are shown.

What do the facts show during the most recent period (1995-2003)? Figure 1 traces the distribution of the share of incidents and victims by target country. The US is by far the country most affected worldwide by transnational incidents. On average over the period, more than 50% of the victims were Americans and approximately 50% of total incidents worldwide were directed towards the United States. It is followed by the United Kingdom (GBR), International Organizations, France and Israel, each of which were the target of 7 to 8% of incidents, with the same proportion of victims.

The disproportionate share of incidents and victims sustained by the US, however, makes it a very interesting country to study, even without considering the September 11 tragedy. In fact, we still obtain similar figures for the share of incidents against the US (49%) even if we do not take the events of 9/11 into account, although the share of total victims does drop to 47%[4].

The next question that is naturally raised concerns the national identity of the terrorists who target US interests and nationals. Figure 2 shows the distribution of the first 25 countries of origin involved. Colombia (COL) ranks first, accounting for more than 35% of incidents, followed by Palestine and Other Arab groups[5] (PAL), Pakistan (PAK), Saudi Arabia (SAU)[6] and the Philippines (around 8 to 10%). It should be noted, however, that Saudi Arabia is the country that accounts for the highest share of victims, partly because of 9/11. That said, even if 9/11 is excluded, it should be pointed out that terrorism from Saudi Arabia still ranks first, accounting for more than 30% of the total victims.

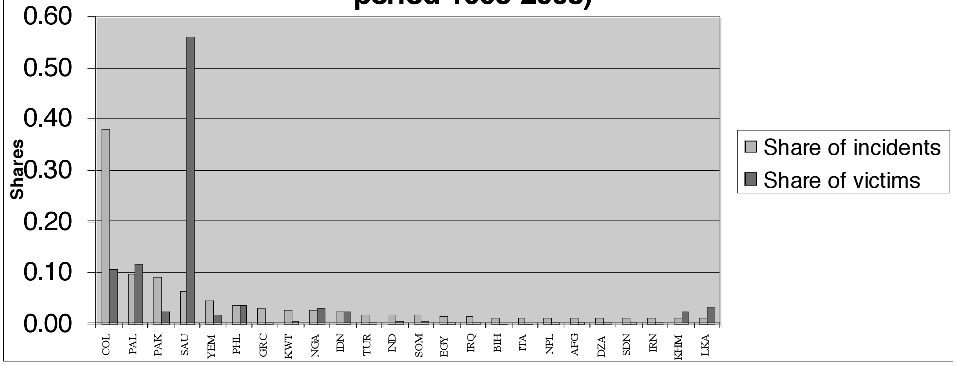
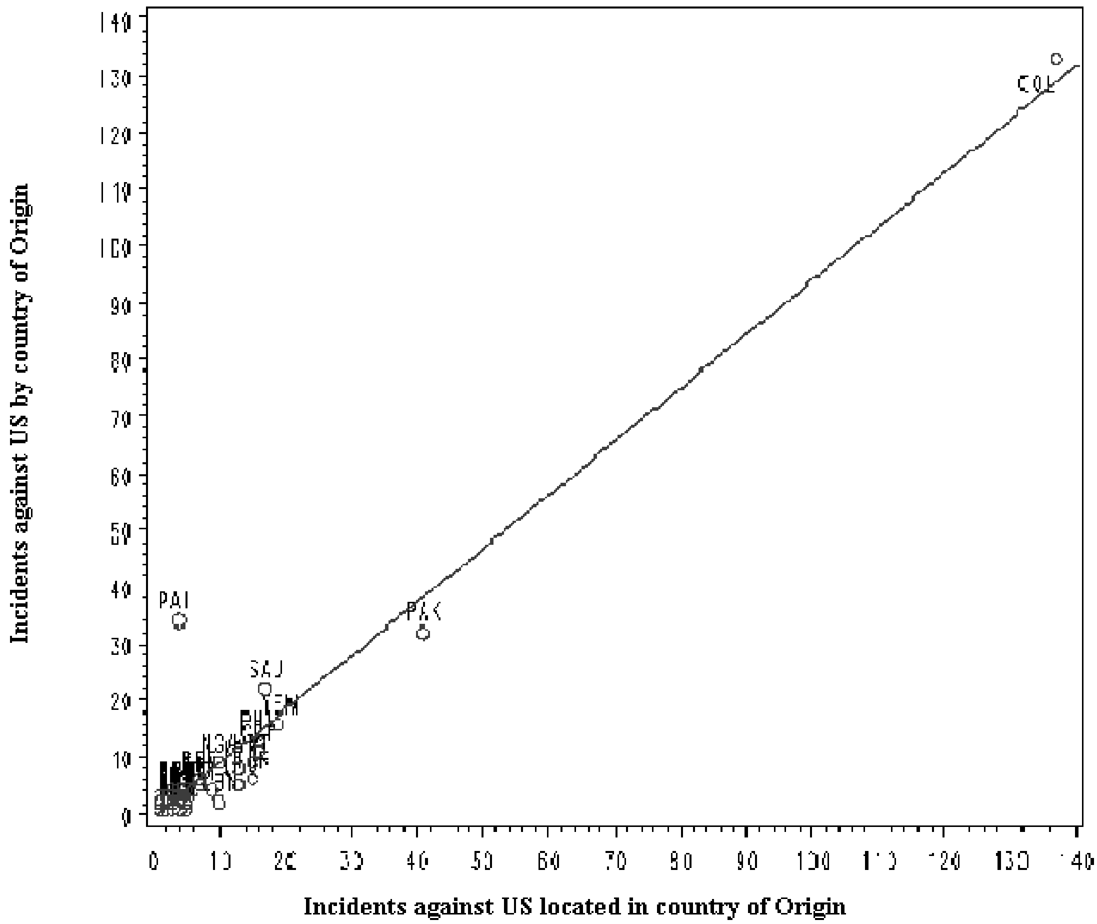


Figure 2: Distribution of incidents and victims made by country of Origin, against the US, (averages over period 1995-2003)

Note: Calculations made by the authors using ITERATE database. Only the first 25 countries of origin are shown.

Interestingly, when we look at the country of location of the incidents perpetrated against the US, we find that most of the incidents occurred within the country of origin of these incidents (see Figure 3). In other words, those who attack the US do so within their own country. The very high correlation between the countries of origin and the countries of location of the incidents in recent years has already been documented by Krueger and Laitin (2003) using the US Department of State dataset, and Verdier and Mirza (2006) using ITERATE. Consequently, it becomes quite interesting to find out the impact that these incidents have on travel to the United States. Specifically, we shall investigate here whether incidents perpetrated locally against the US have an impact on travel to the US.

Figure 3: Co-evolution of incidents targeting US, by country of origin and located in that country of origin



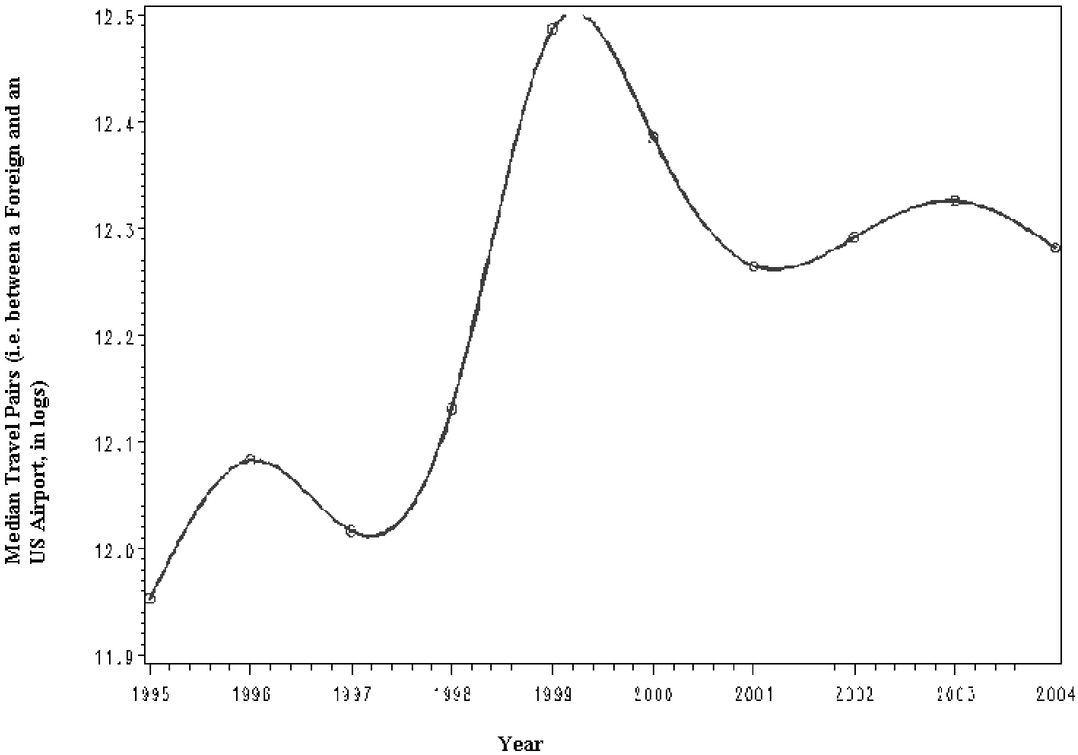
Note: Figure prepared by authors using ITERATE database

1.2. Travel to the US during this period

During this period (1995-2004), the air transport sector experienced 9/11. Much has been already said about the impact of these events on the world air industry. We shall focus here on international flights to the US. We have used the On-Flight Origin and Destination (OFOD) dataset provided by the International Civil Aviation Organization (ICAO) to extract the number of transport passengers between pairs of airports. Only outbound flights from any *reported* airport to the US have been considered. We are not interested here in very short-term psychological effects, but in the longer term effects of terrorism. This is why we have chosen to focus on annual rather than quarterly data over the 1995-2004 period[7].

Figure 4 shows the changes in the median number of passengers to the US (i.e. airport to airport) over the period, computed in Logs. The median number of passengers reaches a peak in 1999 and then decreases by more than 18% in 2001[8], presumably because of the September events. It should be noted, however, that the impact seems to have persisted until 2004, as the difference with the peak year still remained approximately 15%.

**Figure 4: Bilateral travel to the US,
Median over time**



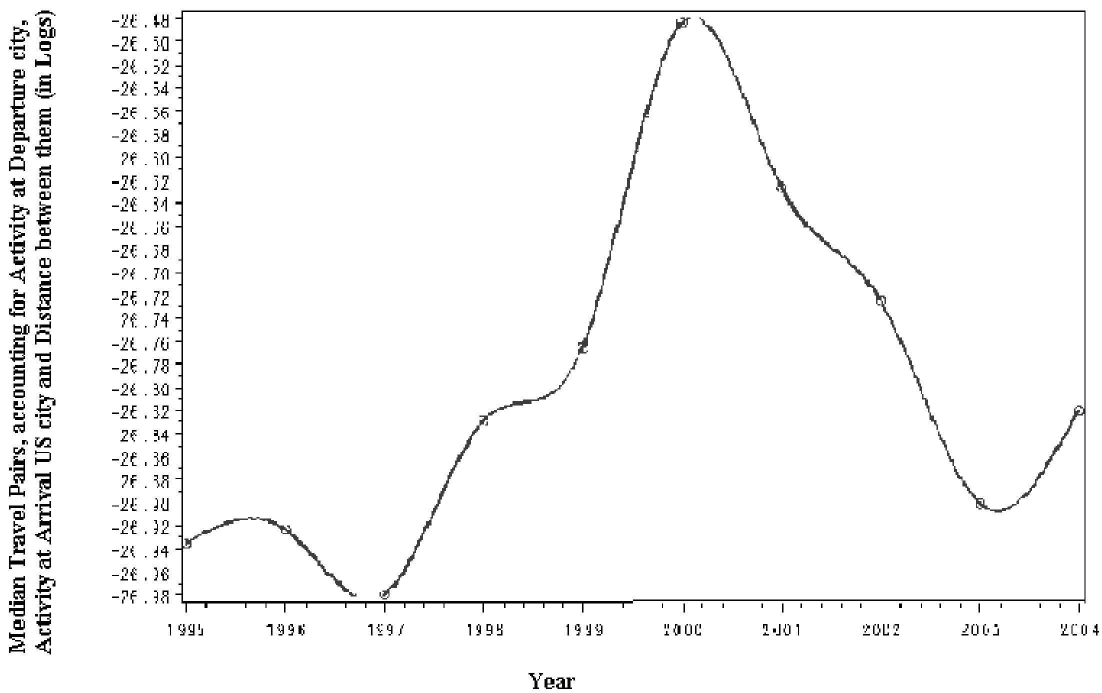
Now, in order to capture more accurately the impact of September 11, we must condition out some of the structural factors that affect bilateral transport, independently of those events. Hence, September 11 must have had an effect on that share of transport that is not governed by those factors. In other words, it is possible that by the time the shock of 9/11 affected travel to the US, other forces such as the degree of activity in cities of departure or US arrival were driving up demand for travel to the US. Consequently, not accounting for these forces would bias downward the figures on the true impact of 9/11. One way to control for some structural forces of bilateral travel is to imagine that bilateral transport is governed by the activity at the point of departure (*d*), the activity at the point of arrival (*a*) and the route distance between the two points. Here, we are drawing a parallel with the very popular gravity equations in the bilateral trade literature.

We then normalize the number of 'bilateral' passengers $Trav_{ad}$ through a measurement of US market access which is a combination of the three forces listed above: MA=(Pop_d * Pop_a) *Dis* tan *ce*, where Pop_d gives the population of the city of Departure (*d*), Pop_a is the population in the US state of arrival (*a*) and Distance is the route distance in Km between the two airports. The higher the amount of activity at the point of Departure (resp. Arrival), captured by a Population variable, the greater the amount of travel between the two localities. Conversely, geographical distance approximating transport costs must affect bilateral travel negatively.

Figure 5 then shows the changes in the median ratio ($Trav_{ad}/MA_{ad}$) (i.e. changes in the median number of passengers, accounting for changes in the US market access variable). It turns out that the decrease in travel was almost monotonic from 2001 to 2003, down 13% from the peak in 2001, 21% in

2002 and 33% in 2003, before slightly recovering again in 2004 (still deviating approximately 28% from the peak year). Hence, the impact of 9/11 on bilateral travel to the US might have been even higher than what Figure 4 suggested.

Figure 5: Bilateral travel ratios to the US (accounting for activity and distance), Median over time



Note: $Trav.\,Ratio = Bil.Travels \,/\, \left(Pop^{US} * POP_d \,/\, Dist\right)$

1.3. In search of the relationship between travel to the US and transnational terrorism during this period

Nevertheless, as we have already mentioned, our main focus in this paper is to assess the impact of terrorism targeting the US anywhere in the world, and not only the impact of 9/11. One way to see whether terrorism constitutes an impediment to travel, most likely by increasing transaction costs, is to compare the observed travel between two countries to the potential for travel governed by the structural factors mentioned above and to see if the difference between the two can be related to terrorism activities.

Figure 6: Terrorism incidents and the difference between observed and potential travel

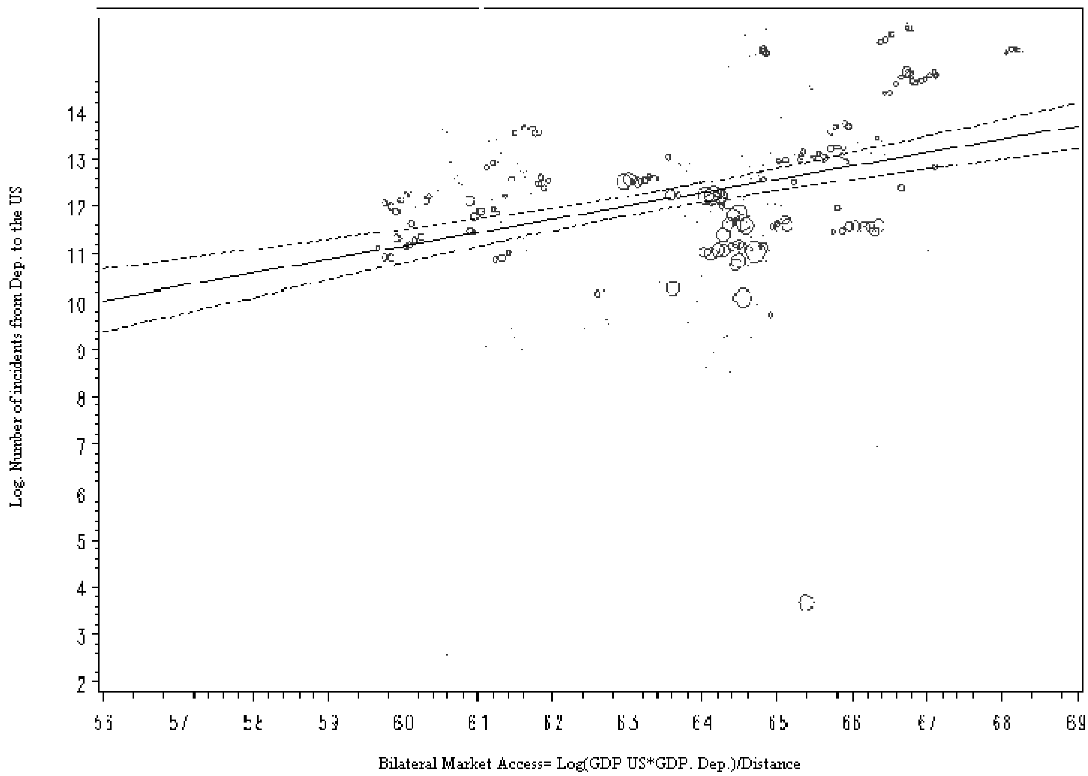
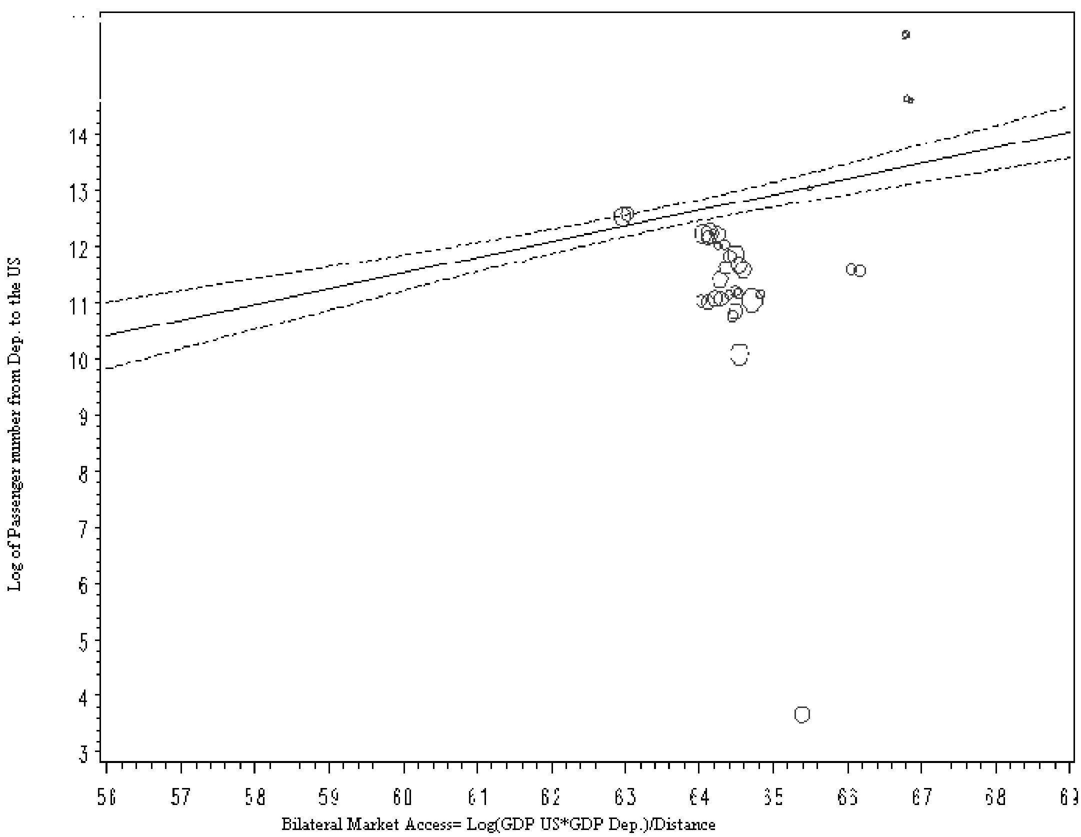


Figure 6 plots that relationship using data from ICAO and ITERATE over the 1995-2003 period. For each given year, each foreign city of departure and US city of arrival, the coordinates are represented by bubbles the size of which varies with the total number of incidents against the US originating from each partner over the previous 5 years of observations. Where the number of incidents tends to zero, the bubbles shrink to a dot on the figure. We make a stock rather than a flow measurement of incidents here in order to eliminate some possible cyclical behavior regarding terrorism incidents. This also helps to remove partly the possible endogeneity over time that might exist between terrorism activity and travel (see Verdier and Mirza, 2006). Finally, the difference between observed and potential travel is measured by the deviation of each of the bubbles from the slope. Together with the slope, we also show confidence interval curves. According to the figure, large bubbles seem to be located mainly below the slope. That is to say that the countries from which most of the incidents originate are also countries from which fewer people are travelling to the US than should be the case (i.e. travel potential). This is consistent with a transaction cost effect of terrorism. It should be noted, however, that many countries that are not a source of terrorism still have amounts of travel that are below the slope (see the dots below the slope on the figure). Conversely, many countries from which some terrorists acts have originated, although in a small proportion, still have cities of departure that are above their potential. This suggests that being below or above the slope might not only be due to terrorism but to the many other forces that are also affecting bilateral travel.

One way to capture indirectly part of these unobserved forces independently from terrorism is to draw a slope of trade potential for those countries related to groups that had never attacked the United States during the previous 5 years. This would give the potential for travel to the US for what we shall call 'safe' countries. We then introduce into the picture all of the remaining observations corresponding to ‘risky’ partners (i.e. those that attacked the US over the preceding 5 years). Here, we wish to know what would have been the volume of travel from those countries if they had not been the source of incidents. Figure 7 shows a very clear pattern: travel from cities in those countries from which the incidents originate is in the vast majority of cases lower than what their potential would be if they were ‘safe’ countries. Now, there are many other alternative explanations for this finding: countries that are risky in terms of their terrorism activity are also likely to be risky in absolute terms (i.e. possible civil war, other political and armed conflicts with the US, etc.). In the econometric study, we try to condition out many of these effects that may alter the relationship between travel and terrorism activities.

Figure 7: Terrorist incidents and the difference in travel in comparison with the potential of ‘safe’ countries



2. THE ANALYTICAL FRAMEWORK AND EMPIRICAL SPECIFICATION

In this section of the paper, we shall evaluate the impact of terrorism on travel to the US. One can show formally, using a Spence-Diwit-Stiglitz Utility function on the Demand side, that bilateral travel between cities is governed by the same forces as those governing bilateral trade flows. That is to say, the volume of activity in either city should have a positive impact on travel. What is more, since GDP per capita can capture to a certain degree the extent of purchasing power in the country of departure, it should also reflect increases in travel from that country. On the other hand, transaction costs should affect travel between cities negatively. Transaction costs could take several forms. They are usually linked to route distance between airports. Travel should also be related to higher regulations at airports (airport taxes, number of slots, etc.) (see Nicoletti and Gonenc, OECD, 2000). More interestingly, however, some trade costs could be related to terrorist acts.

Terrorism can lead to two types of trade costs. The first type is directly related to terrorism, and has a substantial subjective component, while the second type is indirectly related to terror, and represents all the counter-terrorism policies implemented to protect human lives and assets (see Verdier and Mirza, 2006).

The ‘subjective’ type costs arise as terrorism generates anxiety and risks which are likely to induce reductions or shifts in investment and demand. These can be of two types: **the first concerns place-based transaction costs (PT)**. Where the incidents take place, these should have severe effects on travel into the corresponding country. However, conversely, transaction costs in ‘unsure’ countries increase the relative attractiveness of safe countries. Hence, depending on the direction of the travel (i.e. towards unsafe or safe countries), the place-based costs of terror can be either negative or positive. For instance, a series of acts in Indonesia should be detrimental to travel to Indonesia but might increase, at the same rate, travel from Indonesia to other safer countries. **The second ‘subjective’ type of costs is target-based (TT)**. It should directly affect travel into the country that has been a target of terrorist acts. We know, for instance, that US interests and residents have been the main target of as many as half of the overall incidents perpetrated worldwide over the past few years. Although the majority of the incidents took place in the country of origin of the terrorist organizations, this might still affect business with (and tourism to) the US. The reason for this is that an explosion against, say, a US embassy in a given country may lead travellers to the US to expect further terrorist acts that might take place in the US homeland or on a plane heading towards the US, and thus decide not to make their planned trip.

The second type of costs of terrorism are indirect and concern counter-terrorism policies **(CT)**. Costly inspections and monitoring and tighter security at airports and seaports increase the costs of travel for both tourists and businessmen and the costs associated with shipping goods, especially when time is factored in as a cost. Now counter-terrorist policies can be either bilateral or multilateral. One would expect, for instance, the US to implement security measures that are tighter for countries that they believe to be linked to a higher probability of incidents. On the other hand, if the US believes that terrorism can come from anywhere in a more globalized world, they might implement security measures that are more multilateral.

Hence, ideally one would like to test an equation of bilateral travel in which all sources of transaction costs from terrorism (**PT, TT and CT**) would be included. Thus, the theoretical equation that could be estimated is:

$$\begin{aligned} l(Trav^{US}_{i,d,a}) &= a_1 l(pop^{US}_a) + a_2 l(pop_{i,d}) + a_3 l(GDPcap_i) + a_4 l(APT\_Dist_{i,d,a}) \\ &\quad + a_4 PT_i - a_5 TT^{US} + a_6 CT^{US}_i + \mathrm{Reg}_{i,d} + \mathrm{Reg}^{US}_a \end{aligned} \tag{1}$$

where l(.) is a log operator, *Trav* mentions the number of passengers travelling from the airport of departure (*d*) in country (*i*) to the airport of arrival (*a*) in the US, at time *t*. The *pop* variables refer to the population in the city of departure (*d)* and arrival *(a)* respectively. GDPcap represents GDP per capita while *APT_Dist* is the distance between the two airports of *d* and *a.*

Now, we do not directly observe the different types of costs of terrorism. They are approached here through different measurements of incidents. Let *N* represent the total number of terrorist acts in the world in a given year *t*. Let n_i, n^{US} and n_i^{US} also designate respectively the number of incidents associated with a country of location *i,* the total number of incidents against US interests and the number of incidents perpetrated by groups from *i* against the US. First, the **place-based** cost of terrorism (**PT**) can be proxied by the share of total incidents located in the source country of departure *i*, $\left(F_i = \dfrac{n_i}{N}\right)$. A country whichis a host to a high number of incidents becomes unsafe to live and do business in, which might lead to an increase in outward travel to safer countries. Hence, the corresponding coefficient is expected to be positive for travel to a safer country, such as the US.

However, if the targets of terrorism are US assets or US residents, then terrorism should lead to **target-type** transactions costs (**TT**). These should be captured by the share of incidents perpetrated against US interests anywhere in the world:

$$\left(F^{US} = \frac{n^{US}}{N}\right).$$

The higher the number of incidents against US interest, the lower the expected travel to the US will be.

Furthermore, we do not directly observe **counter-terrorism** measures (**CT**). As already mentioned, these can be either bilateral or multilateral (i.e. CT_i^{US} or CT^{US}). If they are of the bilateral type (CT_i^{US}), then one could capture them through the fraction of incidents against the US perpetrated by terrorist groups from

$$i\left(F_i^{US} = \frac{n_i^{US}}{N}\right).$$

But if they are multilateral (CT^{US}), then they should again be captured by F^{US}. **Hence, unless one assumes that security measures are perfectly bilateral, one cannot a priori identify separately TT costs and CT costs**. By adding a time subscript, replacing regulation variables at airports by airport fixed effects and capturing the impact of other non-observed variables by time and country effects, the empirical counterpart of equation (1) then becomes:

$$l(Trav^{US}_{i,d,a,t}) = a_1 l(pop^{US}_{a,t}) + a_2 l(pop_{i,d,t}) + a_3 l(GDPcap_{i,t}) + a_4 l(APT\_Dist_{i,d,a}) \qquad (2)$$
$$+ a_4 F_{i,t} - a_5 F^{US}_t + a_6 F^{US}_{i,t} + f_i + f_a + f_d + f_t + u_{i,d,a,t}$$

We shall investigate the results based on this type of equation in the following section, but first we shall present the data.

3. DATA AND RESULTS

As already mentioned in the stylized facts section, we have used the On-Flight Origin and Destination (OFOD) dataset provided by the International Civil Aviation Organization (ICAO) to extract the number of transport passengers between pairs of airports between 1995-2003.

We have also used the ITERATE dataset to extract terrorism incident variables for the same period. We have then constructed the three variables of frequency of incidents mentioned above: $\left(F_i = \frac{n_i}{N}\right)$, $\left(F^{US} = \frac{n^{US}}{N}\right)$ and $\left(F^{US}_i = \frac{n^{US}_i}{N}\right)$.

The data on flight route distance are extracted from the www.landings.com site. Because of the lack of GDP data at sub-national levels (regions, provinces, cities), we have approximated them by using the population at the corresponding levels. For the population related to the US arrival airport, we have extracted from the US Census Bureau data the population at the State level in which the international airport operates. This has been downloaded from: http://censtats.census.gouv. Population data at departure points has been gathered from Thomas Brinkhoff's www.citypopulation.de/cities.html. The author assembles population data at the province, locality and agglomeration levels mainly from national statistics offices and Yearbooks, the UN Statistics Division and the CIA World Fact book[9]. However, the data are usually available for a typical year in the 90s and a typical year in the year 2000s. We have therefore extrapolated the observations to missing years between the two representative dates by using average annual growth rates. Finally, GDP per capita has been extracted from World Bank data.

Table A shows the initial results. We first present a baseline regression (C1) to examine the performance of the gravity equation on travel between city pairs, without introducing terrorism variables. In C1, only partner countries' effects and time effects are included. C1 shows that gravity variables work well for bilateral travel: Population from countries of departure and arrival are positively related to travel, and distance comes with a negative and significant coefficient that is close in magnitude to those obtained by the trade literature (see Disdier and Head, 2006). GDP per capita is positive and statistically significant. More interestingly, however, it should be noted that the time dummies expressed in deviations from 1995 begin to become negative and statistically significant from the year 2001 onwards. The coefficients on these dummies can be interpreted further: they express the deviation of travel, in logs, from the travel potential[10]. Some simple calculations suggest then that in 2001, the number of trips deviates negatively about 25% from the potential. In 2003, the deviation from the potential reaches around 40%.

The second column (C2) adds to (C1) two series of fixed effects related to the cities of departure and arrival. The population variables are, however, multicollinear to some of the newly introduced variables (the related variation inflation factor reaches figures as large as 500). This is why they 'appear' to be either non significant (i.e. departing population) or with a 'very high' coefficient (i.e. arriving population). More importantly though, the VIF statistic shows that the time effects are not concerned by multicollinearity (i.e. VIF lower than 3) and thus can be interpreted. These time effects show the same trend: they are insignificant before 2001 but highly significant and negative after that date, with a value of coefficients that is now even higher than in C1. In order to avoid collinearity problems, we mainly present the results with the country fixed effects and where necessary extend our results so as to include all fixed effects. All the results are available from the authors upon request.

The third column (C3) presents alternative results by replacing time fixed effects by two time trends: the first one ends in 2000, while the second begins in 2001. Again, the results are fairly similar to the previous specifications. The first sub-period effect is statistically insignificant while the second is highly significant and negative. After some minor calculations, one can observe that the deviation from the travel potential is approximately 15% in 2001, roughly 30% in 2002, reaching 45% in 2003.

We wish to determine in what follows whether a part of this trend is due to terrorist acts against the US. One might easily assume that the events of 9/11 should affect the time trend by increasing the trend of security measures at the US borders or by affecting the preferences of travellers, who attempt to avoid US destinations. As mentioned above, one way to capture these changes in preferences and/or security measures at the borders would be to introduce a measure of the frequency of incidents against the US into the equation. Column C4 presents the same regression as that of C3, to which we add the corresponding variable. The effect appears to be negative but statistically insignificant and the coefficient on the time trends does not change much.

That said, one might expect security measures and the frequency of incidents to be endogenous, i.e. stricter security measures undertaken by US authorities might reduce incidents directed against the US during the same period. One way to remove this endogeneity is to lag this frequency of incidents or express it over the previous few years (see Mirza and Verdier, 2006). We have chosen here to present the results for a frequency of incidents against the US perpetrated over the previous 5 years. We ask then what is the impact of past incidents on today's travel, assuming that past incidents should affect today's security measures. Column C5 presents the results. An increase in the frequency of incidents against the US during the previous 5 years does indeed reduce travel significantly. The coefficient of -1 is a semi-elasticity. One way to interpret the magnitude of the effect is to look at Figure 8, and then compare the average frequency of incidents in the second half of the 90s with that prevailing after 2001. One observes that the frequency of incidents then increased by about 25 percentage points (from 25 to 50%). This corresponds therefore to a decrease of about 25% in travel between the two sub-periods.

Interestingly, the inclusion of the frequency of incidents against the US drives the coefficient on the second sub-period trend down, in absolute values, causing it to lose its statistical significance. Hence, our incidents' frequency seems to be capturing what previously was captured by the time trend in the second sub-period. This suggests that what was driving the time decrease in travel after 2001 is an increase in security measures, captured here by the past frequency of incidents against the US.

Figure 8: Changes in the frequency of incidents over the previous 5 years against the US during the 1995-2003 period

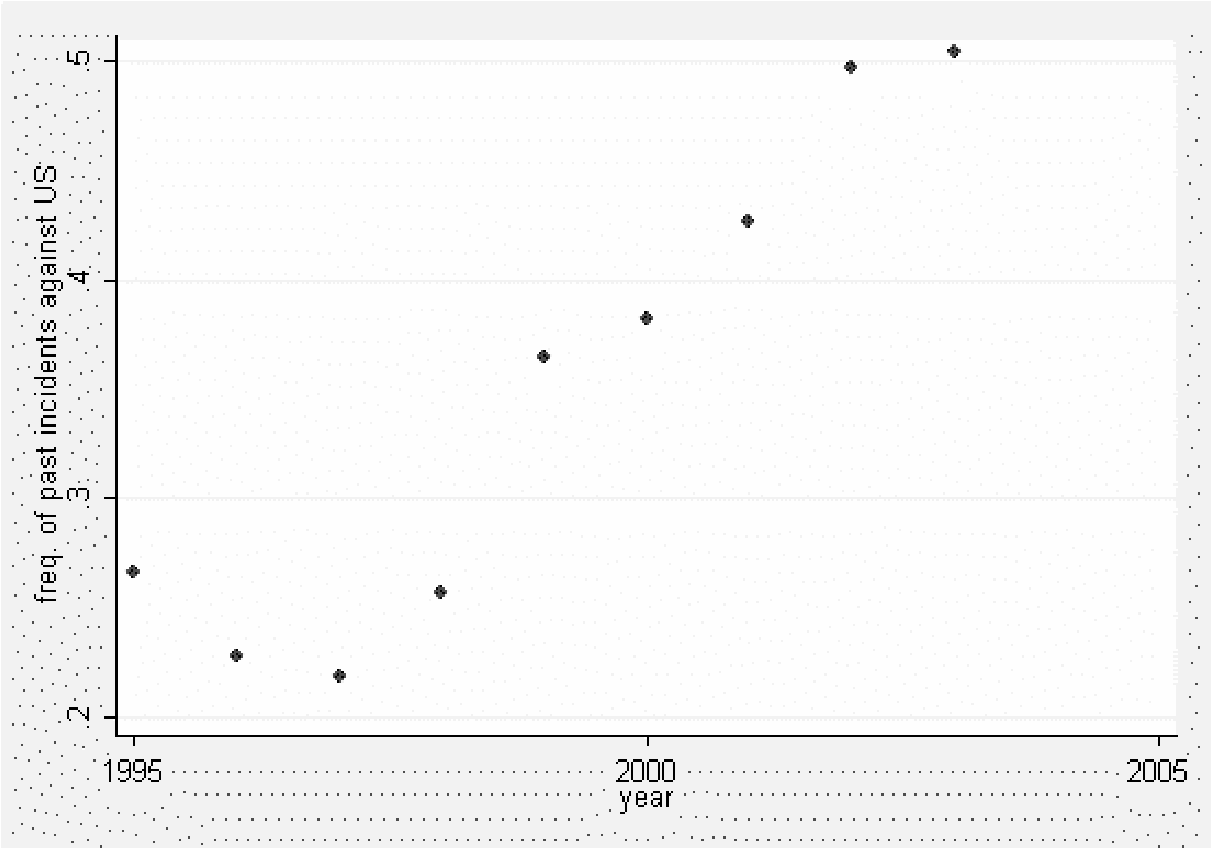


Figure 8 shows in fact an upward trend of this frequency after 1999. Our conjecture of such an effect on travel is that after 9/11 the authorities began to increase security measures at borders in a proportion that is close to the increase in the frequency of past incidents observed by the authorities. This consequently reduced travel to the US. But this conjecture on the role of security still has to be investigated further.

In column 6, we introduce the two remaining variables of incidents discussed earlier,

$$\left(F_i = \frac{n_i}{N}\right) \text{, and } \left(F_i^{US} = \frac{n_i^{US}}{N}\right).$$

The first is aimed at controlling for the place-based costs of terrorism while the second is intended to account for specific bilateral security measures at US borders. Specification C6 show results that are very consistent with our analytical framework, i.e. the frequency of incidents taking places in a country i (F_i), has a positive effect on flying to the US. Although it is a target of terrorism, the US may remain a relatively safe destination for people.

In addition, the 'bilateral' frequency of incidents appears with a negative and statistically significant effect. That is to say that given F^{US}, a measurement that already accounts for the 'multilateral' part of security in the equation, the inclusion of F_i^{US} has further negative effects on travel to the US. Hence, the country of origin of incidents seems to matter for US border security. The last column C7 reports the results where we have added city departure and arrival fixed effects[11]. Again, the coefficients are very close to those of C6. Because they vary according to the year and country of departure, the interpretation of the coefficients related to the newly added terrorism variables F_i and F_i^{US} is not straightforward, however. It must be borne in mind that that the coefficient is a semi-elasticity. This being the case, an increase of F_i^{US} by one standard deviation (i.e. σ=0.017) reduces travel by approximately 7% (i.e. 4.5*0.017). But the effect is highly non-linear. The highest value of the frequency of incidents against the US involves Colombia (around 16%). Consequently, an increase in the average incident frequency of approximately16 percentage points would cause departures from Columbia to drop by nearly 60% in comparison with those from other countries.[12]

4. ROBUSTNESS OF THE RESULTS

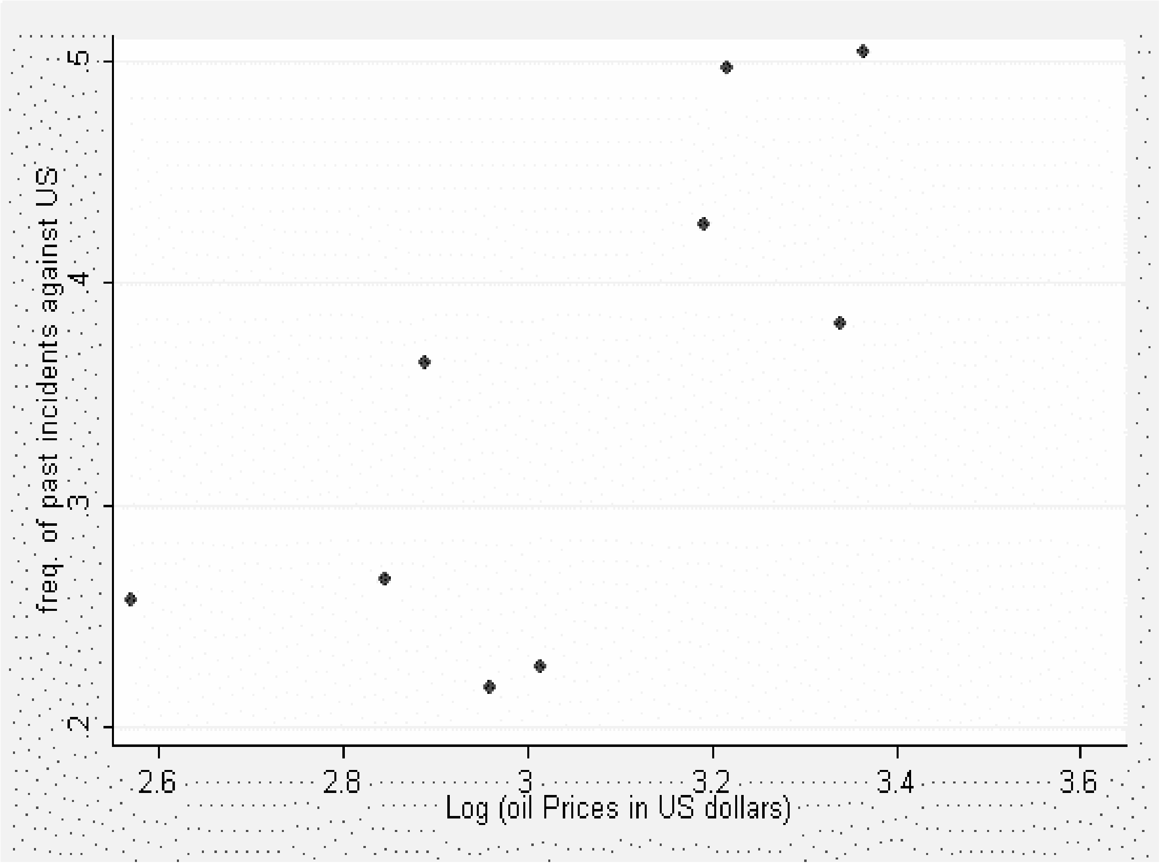
We wish to investigate here whether we are really capturing a terrorism-specific effect on travel to the US. In fact, one can assume that the incident frequency effect is being translated through some other variables that are related to travel but not yet accounted for in our regression. We therefore wish to control for some of these variables in our regression.

The first candidate variable is the price of oil. In fact, we know that during the period, oil prices experienced an upward trend from approximately 17 dollars in 1995 to 37 dollars per barrel in 2003, although some variations were noticeable around this trend. This might have been affecting the prices of transport tickets and thus travel. One can assume that this increase in oil prices was the result of an increase in political and war risks observed in the Middle East and Asia, which in turn could be partly related to terrorism perpetrated in or originating from these countries. We have obtained some data on these prices from Datastream. Consequently, we wish to investigate here how the coefficient on the frequency of incidents behaves when we introduce petrol prices into the equation. In particular, we wish to see whether the coefficient on the frequency of incidents against the US (F^{US}), an only time-varying variable, is still robust to the inclusion of oil prices. In fact, the two variables F^{US} and oil prices do seem to be positively correlated (see Figure 9). Column C8 in Table B shows the results. Although the impact of oil prices on travel should be investigated further, the fact remains that the oil price does not seem to affect travel in our specification, leaving all the coefficients on the frequencies of incidents unaffected.

We have further included other control variables such as a dummy for civil war in the country of departure and a dummy indicating whether or not the country is a New State taken from Barbara Walter's civil war resolution dataset. A civil war or a new state could be associated with an increase of instability inside a country, which would tend to increase travel transaction costs with countries like the US on the one hand, while being associated with the frequency of incidents on the other.

In addition, because of the instability that they can create, ethnic and religious factions can also be associated with both a reduction in travel and an increase in terrorist acts. We were able to download these two variables from Romain Wacziarg's website[13]. Including these controls alternatively (i.e. C9 to C12 in table B) or introducing them all together (i.e. C13 and C14) does not change the picture greatly. The sign and magnitude of the impact of the frequency of incidents remain mostly unaffected. It should be noted in passing that the effect of most of these controls becomes negative and statistically significant when we account for cities' fixed effects in our regression.

Figure 9: Co-evolution of the frequency of incidents over the previous 5 years against the US and oil prices during 1995-2003



5. TESTING THE EXACERBATING IMPACT OF 9/11

The question that we are raising here is whether the events of 9/11 have increased the sensitivity of travel to terrorism. Because of the major shock induced by 9/11 and due to the persistent series of attacks against US interests and residents, in particular outside the US, the relevant authorities might have changed their behavior by setting more stringent regulations for entering the United States. Here, we wish to test for a possible structural break before and after 9/11. In our specification, we can do so by interacting our incident frequencies with a dummy mentioning whether the years of observation are before 2001 or not. Table C presents the results. In columns C15 and C16 we interact the dummy respectively, firstly with the frequency of incidents against the US (F^{US}), and secondly with the frequency of 'bilateral' incidents F_i^{US}. The results in C15 show that after 2001, terrorism attacks against the US, expressed by F^{US}, have increased the impact on travel (in absolute value) by roughly 30% (i.e. the coefficients on that variable are approximately -1.3 before and -1.8 after 2001). A simple F-test, however, does not reject the equality of the coefficients between the interaction variables expressed before and after 2001. This would tend to suggest that multilateral security at the borders may not have been significantly strengthened before and after 2001.

On the other hand, column 16 shows that 'bilateral' incidents (i.e. identified with a particular country of origin), tended not to affect 'bilateral' travel before 2001, but have significantly affected it after 2001. In other words, in the aftermath of September 11, the authorities may not have changed their multilateral security policy regarding the US borders, but may have taken specific security measures targeting nationals from countries that have been the source of attacks against the US over the past few years. Column 17 reproduces similar results while introducing all the interaction variables together into the equation. Mirza and Verdier (2006) obtain similar results for the impact of terrorism on bilateral visa issuance by the United States. Using data on a similar period, they find that terrorism originating from one country is affecting the number of visas issued to that country. To the extent that the visa issuance policy covers a significant aspect of counter-security measures, this suggests that the counter-security impact of terrorism is still highly bilateral.

6. CONCLUSION

In this paper we have focused on evaluating the impact of terrorism on bilateral travel to the US in recent years. The US case is very interesting to study not only because of the events of September 11, but primarily because the US has been the main target of terrorism throughout the world, accounting for approximately 50% of the incidents and some 50% of the victims of terrorism (even when 9/11 is not taken into consideration). The second important fact that makes the US case very interesting is that the vast majority of terrorist events targeting the US (90%) actually take place outside the US.

More specifically, we have asked what impact terrorist events (real acts but also terrorist plots reported by the media and included in the ITERATE dataset) targeting US nationals and assets anywhere in the world have on *outbound travel* to the US.

We began by establishing an analytical framework that describes the three sources of transaction costs generated by terrorism. The first concerns the place-based costs. Terrorism at a location should increase uncertainty, hence affecting the costs of living and doing business in that country. As a result, terrorism in a country would reduce travel to that country while increasing the attractiveness of other safer countries.

The second source of costs generated by terrorism is target-based. An act of terrorism against a country, wherever it is perpetrated, may lead travellers to that country to expect further terrorist acts that might take place at any time in the targeted country or on aircraft bound for that country, and thus to decide not to carry out their travel plans.

Thirdly, the targeted country might, in response to the incidents, introduce counter-security measures that would further increase the impact of terrorism on travel. These measures could be either multilateral or bilateral, depending on the security policy implemented at the port of entry.

We have tested this framework for travel to the US during the 1995-2003 period. We have found results that are consistent with the three types of costs listed above. Most importantly, an increase in the frequency of incidents in a country of location would, *ceteris paribus*, increase the amount of travel outside that country, a proportion of which would be heading to the United States. However, an increase in the number of incidents targeting the US, wherever they are located, has a negative impact on travel to the US. Specifically, a 10 percentage point increase in the frequency of incidents perpetrated against US nationals or assets worldwide will lead to a ten percent decrease in bilateral travel to the US.

In addition, we have also found that an incident targeting the US originating in an identified country will affect travel from that country to a US city even more negatively. This effect tends to show that the counter-security measures implemented at borders tend to have a bilateral component.

We have also tested whether travel to the US has become more sensitive to an increase in terrorist incidents against the US after the events of 9/11. We have found mixed results for the impact of total incidents against the US, but it does appear that ‘bilateral’ type incidents (i.e. incidents against the US for which we could identify a country of origin) have been affecting travel to the US mainly since September 11. We have concluded that this result is consistent with counter-security measures at US borders that since 9/11 seem to be more targeted towards ‘risky’ countries.

NOTES

1. Date of the terrorist plot in the UK against several airlines serving the US foiled by the UK authorities.

2. In addition, because of the hub-and-spoke system, security at one airport can have negative externalities on other airports, further increasing transport costs (Coughlin, Cohen and Khan, 2002).

3. Drakos and Kutan (2003) are an exception, however. These authors focus on studying the effects of terrorism in one country on tourism in other countries. They therefore test whether terrorism taking place in Israel, Greece or Turkey is affecting each other's tourist industries. They find that there are indeed contagion effects (i.e. negative for the industry within this group of countries) and substitution effects (i.e. positive within this group). However, almost 90% of the externalities seem to be due to contagion effects.

4. We do not report the corresponding distribution when we do not take 9/11 into account, but this is available from the authors.

5. This is how the "first nationality of terrorists" is coded in ITERATE.

6. We have coded Al Qaeda's country of origin as Saudi Arabia. If we had coded it as another country, such as Pakistan or Afghanistan, our econometric results would not have changed at all.

7. Only data up to 2003 were used in the econometric work in order to match the observations on the terrorist incidents to which we had access.

8. The 18% figure is obtained by computing the growth rate between 2000 and 2001. Using our Figure 4, it can be computed as: exp(12.3)-exp(12.5)/ exp(12.5), where 12.3 and 12.5 are logs of the number of passengers.

9. For more on this, see www.citypopulation.de/references.html

10. The 'travel potential' is the potential for travel explained by the gravity variables and the country fixed effect in the regression. Trade potential is an indication of the number of trips between city pairs that should be estimated if one accounts for gravity variables. In the C1 specification, the gravity variables are the populations at both end points of the transaction, the distance between these end points, GDP per capita and a country fixed effect.

11. We removed the population variables here because they were multicollinear to some of these fixed effects.

12. The distribution of frequencies of incidents () is highly skewed. While the average frequency is approximately 0.002 (2 per thousand), only one per cent of the distribution is associated with a frequency higher than 10 per cent.

13. For more details on these data, see Alesina, Devleeschauwer, Easterly, Kurlat and Wacziarg (2003).

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Table A: Log of Travel to US

Variables	C1	C2	C3	C4	C5	C6	C7
Log Population in city of Dep	0.351***	0.024	0.350***	0.344***	0.344***	0.344***	
	[0.071]	[0.292]	[0.071]	[0.070]	[0.069]	[0.069]	
Log Population in US city of Arrival	0.497***	3.273*	0.496***	0.465***	0.466***	0.466***	
	[0.095]	[1.732]	[0.094]	[0.096]	[0.096]	[0.096]	
Log Distance between Airports	-1.185***	-1.812***	-1.184***	-1.164***	-1.164***	-1.164***	-1.841***
	[0.387]	[0.414]	[0.386]	[0.399]	[0.400]	[0.398]	[0.430]
Log GDP/cap in country of Dep	2.533***	2.506***	2.088***	2.686***	2.944***	3.106***	3.016***
	[0.812]	[0.726]	[0.640]	[0.590]	[0.715]	[0.781]	[0.619]
Freq. of incidents against US				-0.31			
				[0.186]			
Freq. of incidents against US (previous 5 yrs)					-1.081**	-1.973***	-1.298***
					[0.523]	[0.600]	[0.414]
Freq. of incidents against US and originating from partner (previous 5 years)						-4.838***	-4.141***
						[1.452]	[1.181]
Freq. of incidents located in Dep. country (previous 3 years)						5.888***	4.841***
						[0.732]	[0.824]
Year dummies (expressed in deviations from 1995)							
Dummy 1996	-0.01	-0.006					
	[0.134]	[0.105]					
Dummy 1997	0.039	-0.068					
	[0.152]	[0.143]					
Dummy 1998	-0.069	-0.149					
	[0.138]	[0.134]					
Dummy 1999	-0.07	-0.145					
	[0.128]	[0.143]					
Dummy 2000	-0.053	-0.171					
	[0.138]	[0.185]					
Dummy 2001	-0.283*	-0.387*					
	[0.167]	[0.222]					
Dummy 2002	-0.521*	-0.646**					
	[0.263]	[0.301]					
Dummy 2003	-0.544***	-0.674**					
	[0.203]	[0.290]					
trend1			0.005	-0.005	0.005		
			[0.013]	[0.012]	[0.013]		
trend2			-0.175***	-0.170***	-0.098		
			[0.062]	[0.060]	[0.065]		
Constant	-18.940**	-60.885*	-14.302*	-20.000***	-22.611**	-24.066**	-2.103
	[9.249]	[35.286]	[7.730]	[7.130]	[8.723]	[9.402]	[7.460]
Departure country effects	yes	yes	yes	yes	yes	yes	yes
Cities of departure and arrival effects	no	yes	no	no	no	no	yes
Observations	3225	3225	3225	3056	3056	3056	3106
Adjusted R-squared	0.28	0.54	0.28	0.28	0.28	0.28	0.55

Robust standard errors in brackets. Standard errors account for clusters of observations within partner countries

* significant at 10%; ** significant at 5%; *** significant at 1%

Table B: Log of Travel to US cities (with control variables)

Variables	C8	C9	C10	C11	C12	C13	C14
Log Population in city of Dep	0.345***	0.344***	0.344***	0.344***	0.344***	0.345***	
	[0.069]	[0.069]	[0.069]	[0.069]	[0.069]	[0.069]	
Log Population in US city of Arrival	0.466***	0.466***	0.466***	0.466***	0.466***	0.466***	
	[0.096]	[0.096]	[0.096]	[0.096]	[0.096]	[0.096]	
Log Distance between Airports	-1.164***	-1.164***	-1.164***	-1.164***	-1.164***	-1.164***	-1.840***
	[0.398]	[0.398]	[0.398]	[0.398]	[0.398]	[0.398]	[0.430]
Log GDP/cap in country of Dep	3.098***	3.111***	3.118***	3.106***	3.106***	3.116***	3.031***
	[0.776]	[0.782]	[0.781]	[0.781]	[0.781]	[0.778]	[0.620]
Freq. of incidents against US (previous 5 years)	-2.233***	-1.981***	-1.979***	-1.973***	-1.973***	-2.248***	-1.562***
	[0.681]	[0.605]	[0.600]	[0.600]	[0.600]	[0.688]	[0.477]
Freq. of incidents against US and originating from partner (previous 5 years)	-4.866***	-4.826***	-4.824***	-4.838***	-4.838***	-4.838***	-4.121***
	[1.440]	[1.460]	[1.453]	[1.452]	[1.452]	[1.449]	[1.187]
Freq. of incidents located in Dep. country (previous 3	5.886***	5.896***	5.887***	5.888***	5.888***	5.894***	4.860***
	[0.734]	[0.725]	[0.732]	[0.732]	[0.732]	[0.726]	[0.809]
Log (oil Prices in US dollars)	0.155					0.155	0.142
	[0.129]					[0.130]	[0.120]
Civil war in country of Dep.		-0.116				-0.14	-0.339***
		[0.114]				[0.123]	[0.103]
Country of Dep. is a 'new			-4.407***			-4.814***	-3.632***
			[0.572]			[1.746]	[0.705]
Log of Ethnic Fractions				-0.115		_	_
				[0.183]			
Log of Religion Fractions					-1.120***	-0.009	-0.579***
					[0.078]	[0.068]	[0.101]
Constant	-24.334**	-24.126**	-10.723*	-24.139**	-21.366***	-11.103**	-3.047
	[9.356]	[9.411]	[5.560]	[9.516]	[7.279]	[5.525]	[7.565]
Departure country effects	yes	yes	yes	yes	yes	yes	yes
Cities of departure and arrival effects	no	no	no	no	no	no	yes
Observations	3056	3056	3051	3056	3056	3051	3101
Adjusted R-squared	0.28	0.28	0.27	0.28	0.28	0.27	0.55

Robust standard errors in brackets. Standard errors account for clusters of observations within partner countries

* significant at 10%; ** significant at 5%; *** significant at 1%

Table C: Log of Travel to US
(impact of terrorism before and after 2001)

variables	C15	C16	C17
Log Population in city of Dep	0.345***	0.345***	0.345***
	[0.069]	[0.069]	[0.069]
Log Population in US city of Arrival			
	0.465***	0.466***	0.465***
	[0.096]	[0.096]	[0.096]
Log Distance between Airports	-1.163***	-1.164***	-1.163***
	[0.397]	[0.398]	[0.398]
Log GDP/cap in country of Dep	2.974***	3.117***	2.975***
	[0.770]	[0.774]	[0.770]
Freq. of incidents against US (previous 5 years)		-2.222***	
		[0.686]	
_ before 2001	-1.282**		-1.292**
	[0.615]		[0.624]
_from 2001	-1.776***		-1.771***
	[0.612]		[0.614]
Freq. of incidents against US and originating from partner (previous 5 years)	-4.817***		
	[1.471]		
_ before 2001		0.59	2.173
		[5.892]	[11.685]
_from 2001		-4.018**	-4.989**
		[1.835]	[2.082]
Freq. of incidents located in Dep. (previous 3 years)	5.567***	3.953	
	[0.769]	[2.483]	
_ before 2001			2.331
			[6.296]
_from 2001			4.491**
			[2.201]
Log (oil prices in US dollars)	0.159	0.151	0.154
	[0.130]	[0.130]	[0.130]
Civil war in country of Dep.	-0.09	-0.129	-0.077
	[0.115]	[0.123]	[0.117]
Country of Dep. is a 'new state'	-4.549**	-4.809***	-4.546**
	[1.740]	[1.737]	[1.739]
Log of Religion Fractions	-0.006	-0.009	-0.005
	[0.068]	[0.068]	[0.068]
Constant	-10.479*	-11.104**	-10.475*
	[5.491]	[5.499]	[5.491]
Departure country fixed effects	yes	yes	yes
Cities of departure and arrival effects	no	no	no
Observations	3051	3051	3051
Adjusted R-squared	0.27	0.27	0.27

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Robust standard errors in brackets. Standard errors account for clusters of
* significant at 10%; ** significant at 5%; *** significant at 1%

Summary of Discussions

SUMMARY

SUMMARY OF DISCUSSIONS

The OECD/ECMT Joint Transport Research Centre held the 17th International Symposium on "Theory and Practice in Transport Economics and Policy" in Berlin on 25 to 27 October 2006, the latest in a series of such events first launched by the ECMT. The central theme of this Symposium, attended by over 300 people, was "Benefiting from globalisation: transport sector contribution and policy challenges". Some twenty introductory papers were presented, prompting a wide-ranging debate among transport and globalisation experts and the floor. While the issues addressed covered a vast domain – ranging from the data available and discernible trends to the problems of infrastructure decision-making in a globalising world and the influence of globalisation on regional and national policies — this summary of discussions will focus on two major themes, namely:

— the role of transport in the globalisation process;

— the challenges for transport policy and the response of policy-makers.

Each of these themes is itself structured around a few points which are intended to highlight key concepts. Using these as the basis for discussions, the Symposium provided an opportunity to take stock of the research topics which the OECD/ECMT Research Centre has worked on during the first few years following its creation in 2004.

1. THE ROLE OF TRANSPORT IN THE GLOBALISATION PROCESS

1.1. Transport and economic productivity

As well as being a determining factor in the level of productivity of our economies and societies, transport also helps to shape their spatial structure in that, by increasing the geographical size of market areas, it allows production units to specialise. Without transport, it would be impossible for a company located in Spain to supply customers in Germany and equally impossible to maintain the current transformation of China into a workshop supplying the world with an increasing number of primary consumer goods.

More specifically, enlargement of a firm's coverage area enables it to increase its productivity both in terms of learning and in terms of economies of scale or scope each time that it increases production to serve new markets. Transport is responsible for the increased specialisation of firms, which is itself responsible for gains in productivity and gains from technical progress. Classical economic thinkers, such as Adam Smith and David Ricardo, demonstrated that productivity gains from activity specialisation acted as a driver, and it was transport that enabled such large-scale specialisation. It goes without saying that because goods are produced in areas offering the best economic conditions for their production, the world economy is prospering. Accordingly, as a result of the proliferation of flows and the opening-up to world trade that transport has made possible, we are currently seeing an increase in wealth in those economies which have been able to integrate themselves into that world trade.

Transport is therefore a factor in economic and social change and plays a key role in the process of urbanisation by making it possible to deliver food and goods to the heart of densely populated areas such as large conurbations and by allowing people to move around in, and have access to, these urban areas in order to establish the contacts that drive the prosperity of large cities and that are a necessary condition for achieving economies of agglomeration. This brings us to the fact that not all of the changes brought by transport are necessarily positive: for instance, the infrastructure congestion encountered in urban areas together with increasing sprawl, both of which cause considerable environmental nuisance. It is also clear that by allowing activities in different geographical areas which do not necessarily have comparable economic and social conditions to compete with each other, transport is also a factor in social change which can lead to the destruction of the traditional economic fabric as industry and businesses in new areas of the world gain in strength. Transport is a vector which exports an economy's industrial and innovation capacity to distant places, while at the same time importing and creating competition with that same capacity from other economies. This is the reason why some societies dispute the benefits of globalisation. If the economy as a whole stands to gain, provided that the price paid for resources used is at all commensurate with their scarcity, then some sectors of the population may well be hit hard by the process of change. Clearly, if the economy as a whole is a winner, compensation mechanisms should be set up for those who lose out.

One particular consequence of the impact of transport on economic productivity and more generally of its impact in terms of changing economic and social conditions, is that it is difficult to grasp all of the effects that new infrastructure may have. With a new infrastructure project, the challenge is to identify all of the effects and, above all, to take into account transport's dynamic influence on economic conditions. The challenge for the research community would be to come up with methods of improving classic cost-benefit analyses in order to restore to transport its role of transforming the productivity of the economic system and shaping production processes over the long term. This challenge was given special emphasis at the Symposium.

1.2. Transport time as a barrier to trade

In industrial economics, the price of transport is generally considered to be a determining factor, for instance, in modal choice. In actual fact, closer analysis of the reasons for the choice of transport by industry and business show that qualitative factors and the quality aspects of a transport option are at least as important as price. This underscores the findings of an innovative area of research in international trade: the importance of time as an explanatory variable in a country's export performance. For instance, in landlocked areas of Sub-Saharan Africa, the journey from factory to ship takes over two months, which in itself reduces export capacity to practically zero given the very high cost of setting up a continuous export flow capable of absorbing a two-month lag under such conditions. In addition, end consumers — the majority of whom are in developed countries — have become impatient and consider the rapid availability of goods ordered to be very important, hence the need for fast production and delivery procedures. A further point is that goods are subject to changing fashions and advances in technology which often render some of them — and their number of rising – rapidly obsolete. In addition, both the unit value of goods and the amount of know-how they incorporate are rising, driving the cost of their unavailability during transport even higher. The end result of this is that the time taken by transport operations, for example, can become a barrier to trade that is even more of a deterrent than taxes or customs duties. That, at any rate, is what the latest research on export performance in selected countries presented at the Symposium shows. Then there is the issue of relative performance, since transport time in one economic area compared with transport time for similar goods in another will be a decisive factor. The development of air freight transport bears this out. While admittedly prices have fallen in relative terms, air freight transport is currently experiencing major growth: in the United States over 40 per cent (in value) of foreign trade is carried by this mode of transport. Among other things, air transport offers a way of testing new export markets: it has the speed and flexibility to respond to any success on new markets, always remembering that, with the exception of world famous brands, export successes are almost always short-lived, hence the importance of a speedy response.

In order to grasp how important transport time can be for export trade performance, it is worth considering that a large share of the imports to small countries which do not have a fully developed industrial base consists of goods used as inputs for products that are subsequently processed and re-exported, with the result that time can cause friction either way and is equally important for imports and exports.

1.3. From transport to logistics

Logistics, which can take a wide variety of forms, acts as the interface between transport and trade, particularly international trade. As a result of transport firms extending their activities to include warehousing, packaging, customs clearance, processing, etc., all managed by very sophisticated information technologies, goods are no longer produced for stock but in direct response to orders placed by the end customer.

One of the consequences of this trend is that industrial and commercial firms are hiving off certain operations to firms able to offer logistics services as part of a process of outsourcing anything that is not their core business. As international trade flows proliferate – in the European Union, for instance, international transport is expanding at twice the rate of internal transport — organising transport becomes more difficult, making the turnkey services offered by logistics providers more attractive. These services are fully customised solutions which ensure a seamless transport and processing chain with no loss of time and high reliability.

While within Europe, logistics chains rely essentially on the speed, responsiveness, adaptability and flexibility of road freight transport, at global level we are seeing steady growth in air freight and maritime transport, particularly container transport. At this level, it appears that major carriers are attempting to control the entire logistics chain through mergers – or the acquisition of firms – resulting in the elimination of intermediaries and a redefinition of the role of port authorities and their room for manoeuvre faced with this concentration of actors in the logistics chain. It is also clear that, with regard to the choice of industrial sites on an international scale, ports have a stake in the ongoing competition between logistics chains. This is where port hinterland services play a key role, which only serves to show that transport modes are complementary and heightens the need for transport actors, particularly public authorities, to think in terms of logistics requirements and not modal development in isolation. With this aim in view, it would be useful to achieve co-operation between ports at European level in order to avoid chronic overcapacity and, more specifically, the subsidisation of that overcapacity by public authorities at a time when port authorities are losing power as players in the logistics chain are increasingly concentrated in the hands of a few extremely powerful transport groups which have managed to acquire quite substantial market power.

It is nonetheless foreseeable that, with rising energy prices and the fact that the preferred transport modes, although fastest in terms of avoiding lost time, are also the heaviest energy consumers and indeed the ones most affected by rising infrastructure congestion, we will see these logistics organisations reconfigure. This is because the possibility that we are at the end of the process of decreasing transport prices cannot be ruled out and any increase would mean a new trade off between transport time and transport cost. At intra-European level this may work to the advantage of inland waterways, for instance, or the highways of the sea, while at intercontinental level, maritime transport could see speeds decrease in order to reduce fuel consumption by ships and the unprecedented growth in air transport could come to an end. Environmental constraints, of course, only make it more likely that existing logistics systems will reach a turning point, say, when transport is included in emissions under pollution rights systems. In the longer term, the spatial distribution of activities could be affected when this negative impact of transport on climate change and energy consumption is taken into account.

On this point, the Symposium pointed out the desirability of so-called "*freight villages*" which centralise all the operators in the transport chain in one location, thereby facilitating, at least potentially, intermodal solutions. It is essential in this respect that each mode of transport comes up to a reliability standard that enables the synchronisation of each stage in the production and distribution process. Indeed, it could be said that reliability as a requirement counts just as much as the speed of transport. Often when this point is raised, just-in-time logistics organisations – in the automobile sector, for instance — are mentioned, to show how responsive the latter are to time-sensitive delivery of components when production is split between several different countries.

2. TRANSPORT POLICY CHALLENGES AND RESPONSES

2.1. Globalisation and transport infrastructure

The first point that springs to mind when considering the challenges that politicians have to face when taking transport policy decisions is one that was already mentioned in the first part of this summary of discussions at the Symposium, namely the absolute necessity of properly assessing the effects of new infrastructure. The discussions at the Symposium showed that it is precisely this issue of infrastructure investment that is fundamental to any discussion on economic globalisation.

The Symposium demonstrated that although international trade routes had historically remained unchanged — sometimes for over a thousand years (the Silk Road, for example, or the part played by maritime currents in the Mediterranean) — we were currently witnessing the emergence of a new pattern of international routes in response, for example to Eastern Asia's role in world trade, the trade induced by the NAFTA in North America or the single market and its single currency in Europe. Basically, what we are seeing is an acceleration in the processes of global economic change, which has led to an unprecedented degree of mobility in transport hubs and networks. In addition to these issues relating specifically to trade in goods, other factors such as the part played by population migration and, even more significantly the exponential increase in contacts between people of different nationalities triggered by economic globalisation and made possible by air transport, all give some idea of the new country-to-country connectivity that is emerging.

One of the indisputable consequences of the above phenomena is that investment in transport infrastructure is a necessity. However, the aim is not to support mega-projects by completing the Trans-European Networks — most of which had been only projects on a national scale to meet specifically national needs — which came in for some criticism at the Symposium, but to focus on missing or inadequate links from the perspective of the new geography of trade being mapped out before our very eyes. In purely practical terms, this consists in planning airport extensions, promoting the motorways of the sea, seeking to increase the capacity of ports to handle container traffic and to adapt this capacity to ship size, improving the quality of port hinterland services for increased activity in ports, promoting information technologies as a determining factor in improving the performance and operation of transport systems and investing in equipment that could appreciably cut waiting times at certain borders or enable rail interoperability.

Even though international trade is growing rapidly, borders still matter. Most companies still serve only domestic markets, distance plays a major role in the composition and direction of trade, national borders seem to have a negative impact on trade and, most importantly, planning still takes place mostly inside national borders. Evidence from the papers presented at the Symposium would suggest that there are major institutional barriers for improving international trade. Development of trade in the NAFTA area, for example, is still held up by trade barriers for international freight transport.

Furthermore, some of the papers presented during the Symposium clearly suggest that a more coherent investment policy would indeed be needed. Both the provision and financing of infrastructure should involve much more regional and international co-operation among policy-makers. There is a strong need for either unilateral or bi-lateral solutions to infrastructure investment at borders. The impacts of targeted intra-regional investment would bring obvious benefits for other countries in the same region as well. However, borders seem to matter especially in decision-making, as many of the investments also need to fulfill political needs. It should perhaps be a task for international co-operation to overcome this and to oversee that decisions on infrastructure investments take a look at the intra-border impacts of investments as well.

Finally, the growing importance of the air industry and airports in overcoming the border issue seems quite obvious. Air transport is highly flexible in the range of spatial services that it can offer, overcoming physical border problems encountered by other modes. Air transport's comparative advantage lies in situations where long-distance, fast and reliable transport is required for the movement of people and relatively low bulk commodities. However, at the same time, the important policy and research dimension of international trade should relate to the externalities, particularly in air transport.

The role of investment in infrastructure as such was confirmed by research work presented throughout the Symposium, which tended to demonstrate that the long-run rate of social and economic return from investment in transport infrastructure was higher than it appeared to be in the short run, but also higher than most private investment because of its dynamic effects and, in particular, spillovers from one country to another in the case of international infrastructure. In fact, a country which had little infrastructure might, perhaps, consider investment in international infrastructure to be a sub-optimal option, since building the infrastructure would be a substantial drain on its resources in the short term and any benefits would only be apparent in the long term, long after the end of the term of office of the politicians who had supported the investment. For countries which were better off in infrastructure terms, the dynamic effects and spillovers beyond the strictly national framework unquestionably call for international co-ordination: spillover effects could bring benefits to countries other than the one which actually bore the costs of a project to remove barriers to international transport.

While these assertions were on occasion challenged at the Symposium, the conclusion it finally reached was that it was crucial to focus, not on the total figures allocated to infrastructure investment, but on whether it was the right investment i.e., the right kind of investment at the right time and in the right place. This therefore brings us back to the issue of using international investment to support the process of economic globalisation. It was proposed, for example, that international financial support should be reserved exclusively for projects that furthered this process, in which case the importance of transit infrastructure was an additional factor that should allow them to be eligible for such finance. Managing to involve the private sector in partnerships seemed, in many respects, to be a solution to the scarcity of public funds and also appeared to offer a further guarantee of the relevance of the choices made or, more simply, of project cost control. However, the main point to emerge from the discussions at the Symposium was the need for a stable paradigm for government involvement and policy so that international investors could evaluate the suitability of projects and gauge the risks.

As an illustration of the specific characteristics of international transport, the Symposium heard, for instance, that in the Rhône valley in France, the elasticity of international road traffic was greater than 1 while the elasticity of transit traffic was even higher, at over 2 with respect to economic growth. This clearly showed the need for new infrastructure to keep up with the increase in international flows and raised the issue of policy, in this case European policy, capable of meeting those needs. While it was true that, at European level, limited possibilities of international public finance, in the strict sense of the term, had brought about a shift from taxpayer funding to user funding — which made total sense economically speaking, particularly the Eurovignette which, although it was not perfect, had been a positive step in this direction –- we also needed standardised, co-ordinated methods for evaluating infrastructure projects for compatibility and for ranking them in order of priority.

Lastly, the example of work conducted for the World Bank showed, in this case for road infrastructure, that quality itself has an impact on a country's capacity to participate in international trade. The gains from road infrastructure improvements are reported to be higher than those that could be expected from a reduction in customs duties or an improvement in customs procedures. Even though the available statistics apparatus dictates that some caution should be exercised and needs more work before these findings for the easternmost countries of Europe can be regarded as totally reliable, the participants at the Symposium did not question the strategic role that infrastructure and upgrades to meet needs can play in the development of trade. For less developed countries, as shown by the example of the North-East Asia region featured in other work presented at the Symposium, the flexibility and versatility of road infrastructure allowed it to play a far more important role than that of any rail alternative.

2.2. National regulation and international transport

Work presented at the Symposium tended to prove that a sector such as transport, which serves as both vector and intermediary in international trade, must be perfectly competitive if we specifically want to avoid that sector absorbing all of the benefits of international trade. The issue here was the impact on international trade of deregulation of an intermediate service industry. The studies presented showed that the structure of the transport sector was important and above all carried the risk that international trade gains would be reduced and not fairly distributed unless international transport was competitive through competitive structuring of the sector. Thus the volume of trade between any two countries is inversely related to the concentration of the transport services sector. The structure of the transport sector influences the volume of trade and who benefits from it, with the risk that transport actors will capture the producer's rent. If institutional trade barriers are weak, the role of transport is even more pronounced. Hence, transport can become an even more serious problem after the removal of trade barriers and the less economically developed the countries concerned, the greater the impact of transport. An imperfectly competitive transport sector can actually have the same impact as strong trade barriers.

The above analysis shows how important it is to have a competitively organised freight transport sector at a time when we are seeing large international groups formed through mergers and acquisitions appearing on the international scene with their tendency to incorporate the different aspects of the logistics chain, giving it an oligopolistic structure. This is therefore a question that touches on the regulation of a sector such as transport which has a strong international dimension.

Another area where the public authorities need to be particularly vigilant with regard to the transport sector relates to the role and importance of state-owned enterprises. In certain economic areas – ASEAN, which was mentioned at the Symposium, is a case in point – it is almost impossible to achieve the competitive structure referred to above in the transport sector, given the role and importance of state-owned enterprises. To a certain extent, the role of sector regulator has been captured by these companies which take their own interests to be the interests of the sector itself. They have advantages that their commercial competitors do not, such as automatic coverage of any losses they make, investment financed out of public funds, income from public service provision, the benefit of cross-subsidies which may enable them to crowd out the competition in certain markets, government guarantees on loans, exemptions from certain regulations and obligations, etc. In short, the presence of these companies can end up by distorting competition, providing a real-life example of the analysis above, which aims to demonstrate that a transport sector in which competition is poor could affect the volume of trade and exactly who benefits from it.

Here, the issue raised is indeed the operation of a sector in which state-owned enterprises and private enterprises exist alongside each other and whose development must work towards regulation by market mechanisms in order to avoid being a barrier to trade and to provide services at the least cost. In practice, rushing the deregulation of a sector in which state-owned enterprises receive preferential treatment is more likely to strengthen their position than it is to create a workable competitive structure.

A further point to note is that regulations are needed to ensure that the market thereby obtained operates on a competitive basis matched as closely as possible to the ideal theoretical model. In addition to instituting regulations on safety, working conditions and other statutory functions for which governments are responsible and have a duty to issue regulations that apply to all enterprises, there are three guidelines that should give states some insight into how to make the transport sector competitive:

– the institution of a code of practice and guidelines on corporate governance, applicable primarily to state-owned enterprises so as to halt the capture of regulatory power by those subject to the law;

– the establishment of regulations so that, for instance, loss-making public services are provided by the lowest bidder, thus making the process transparent, and not systematically to the historical state-owned operator, as well as the establishment of competition regulations in order to avoid abuse of dominant position or cartels between firms, for instance;

– clear definition of the role, organisation and powers of the regulatory authorities in the sector.

As regards regulatory authorities in the sector, in an area such as transport where enterprises of different nationalities are competing on an international market (air transport is one case that comes to mind) one issue that was raised was the need for supranational authorities. Clearly, the aim in the air sector, for instance, is the efficient operation of transport. Yet, from this standpoint, there may be a conflict between what appears to be the optimum at national level and what the optimum at international level requires. The example given at the Symposium was the case of a merger between companies in two different countries which had been approved by the regulatory authorities of both countries but which, despite the fact that it was in order from an economic standpoint, was later rejected by one country, not on grounds to do with the merger itself but because of procedural differences in the processing of the economic documentation for the merger, which was in the air transport sector as it happens. What this example did, primarily, was to introduce the idea that what was best at national level was not necessarily best at international level and that while in Europe, for instance, the high degree of economic integration made a case for having a European regulatory agency for certain transport sectors, it was nevertheless true that national interests could be harmed to a certain extent and that compensation mechanisms should therefore be explicitly considered so that such a development would one day be possible. A first step in this direction — one which, furthermore is already seen as essential — is the exchange of experience and analyses among regulators of different countries working in the same field or even neighbouring fields.

A simpler example of the type of question raised at the Symposium concerns road haulage in Europe. Some countries are currently concerned about the deterioration of their market share in international transport, and their hauliers tend to fall back on the domestic market. The question one might ask was whether the nationality of the haulier was more relevant than ensuring, independently of nationality, that hauliers comply with all of the regulations — on the environment, safety and working conditions – thereby ensuring that transport services are provided at least cost, which inevitably benefits the economy as a whole.

On another level, the example of the North American Free Trade Agreement which was given at the Symposium – an agreement that does not explicitly cover maritime cabotage — shows that in order for this type of transport to measure up to our expectations, changes to customs, regulatory, fiscal, technological and administrative provisions are needed and these are only possible within the framework of agreements that have not excluded transport from negotiations. One may arguably conclude that transport must not be excluded from negotiations that touch on the terms of international trade.

Lastly, the issue of security in transport, of course, requires an evaluation of the costs and benefits of the measures under consideration but it also requires a harmonised framework across transport modes, whether passenger or freight. From this standpoint, it also raises questions such as the financing of measures and non-discrimination between countries and firms, all of which are important for a multilateral framework in which the exchange of experience is of the utmost importance.

2.3. International transport and environmental pressures

There can be no discussion on transport and globalisation without examining one of the major challenges for civilisation, climate change caused by greenhouse gases. Allowing for the potential economic growth of our economies to the year 2050, the target of stabilising atmospheric CO_2 emissions at a level lower than 450 particles per million will require a 75 per cent reduction in emissions per unit of GDP.

Nevertheless, it is important to note that the transport industry accounts for approximately 20 per cent of greenhouse gas emissions worldwide. By the same token, this means that 80 per cent are generated outside the transport sector. This said, transport emissions are on the increase owing to the growth in air transport and to emerging countries, such as China and to a lesser extent India, entering the automobile age as a result of higher standards of living.

However, the experts at the Symposium were at pains to point out that international transport accounted for a very minor share of total transport movements: more than 80 per cent of transport was over short and medium distances, which also explained why road transport had assumed such proportions as it was particularly suited to this pattern of transport needs. International transport in and of itself was therefore not the major contributor to greenhouse gas emissions.

Thinking that the challenge facing society was to use transport to reap the benefits of globalisation and international trade on an economic level, while taking care to contain CO_2 emissions, was therefore not misguided. The challenge therefore was not to drastically restrict transport activity, particularly international transport. The priority was to increase the “efficiency” of the transport system. The overall change would be to move from a policy that up to now has been more of transport supply policy to a proper demand management policy.

This could be achieved by efficient pricing of the resources used by transport, be it through infrastructure user charges or fuel taxes reflecting the non-renewability of this form of energy. Pricing should also reflect potential damage from transport’s contribution to greenhouse gases, just as for any emission-producing economic activity. Here, the question raised was the possible inclusion of transport — for instance, air transport — in the tradeable emissions market.

It is very tempting to say that environmental problems should be approached through rational analysis: why, for instance, should transport taxes be any higher than the costs of the likely damage from climate change that the activity generates? As the market in tradeable emission permits now stands in the EU, the cost per tonne of CO_2 emitted works out at EUR 10 to 20. This figure, converted into centimes per litre of fuel used for road transport is much lower than the usual level of tax in Europe for oil-based fuels. Road transport is therefore paying more than is necessary to ensure the avoidance of damage at the level set in international commitments. In actual fact, the mechanism which set up emission permits is not based on the evaluation of damage but on a price for avoiding such damage through the gradual rationing of emission rights. On the other hand, it is quite possible, though not proven, that the harmful effects of greenhouse gases may carry a very high cost for society, chiefly because the changes it induces will be irreversible. These figures should therefore be viewed with extreme caution and, in any case, simply paying for damage does not make that damage acceptable. From a theoretical standpoint, the approach which holds that the costs of damage, particularly the costs of avoiding it, must be covered cannot be disputed. However, we still need to take a close look at the relevance of the figures for evaluating potential damage, for example, and the emission targets that need to be achieved to avoid causing precisely that damage. On that basis, there is no doubt that the transport sector should come under the scope of application of emissions permits in the long run inasmuch as these permits would appear to be the most appropriate way, compared with a carbon tax, say, of reaching the targets set in international agreements. From infrastructure user charging to the prospect of emissions permit trading, these are the very principles of efficient resource use which must be implemented.

Independently of its current share in the global pollution process, the fact that transport is growing strongly — particularly modes with the highest greenhouse gas emissions — is also very clear. On this issue, the opinions of the experts at the Symposium were somewhat mixed. There is vast scope, particularly in the freight sector, for increasing transport productivity by reducing part loads or consolidating transport supply, not to mention the fact that the freight transported was changing too. For example, Finland is exporting much less timber, which has been replaced by exports of mobile telephones, a particularly light product. For the same level of trade in market value, very different transport solutions are being put in place. What all of this comes down to is that an increase in trade does not necessarily mean a very sharp increase in international transport. However, what it does seem to mean is that the international division of labour looks set to continue – for some experts, we are only at the very start of the process – and that international trade is therefore going to increase. The prediction that transport will grow to the same proportion on that basis alone is by no means certain.

Another essential approach to cutting greenhouse gas emissions is the contribution that advances in technology can make in eliminating environmental problems. In actual fact, substantial progress has been made by manufacturers of both industrial vehicles and cars in reducing the level of emissions – primarily as a result of standards imposed by government. Progress in this same direction has also been made within the framework of the ECMT, which linked an increase in its multilateral licence quota for road freight transport to the use of clean vehicles. A whole host of incentives, both fiscal and regulatory, can be considered with a view to setting transport firmly on the road to significant environmental progress, even though at the present time some commitments given by vehicle manufacturers, for example, will probably not be met in their entirety or within the set timeframe.

There is one field in which it is proving difficult to promote progress and that is spatial planning: transport, particularly road transport which the majority of the population can afford, has led to the spatial dispersal of activity at a time when current pressures tend to confirm that what is needed is for spatial distribution that makes economical use of transport. While some participants at the Symposium thought that transport prices that reflect the costs generated by transport were enough to work towards in this direction, this was a view not shared by all. The difficulty of formulating spatial policies that are in line with sustainability and affect territorial governance, is all too obvious.

3. CONCLUSIONS

The Berlin Symposium provided a wide-ranging overview of themes relating to the implications of the globalisation process at work throughout the world. While there is no doubt about the fact that participating in world trade in goods and services can be a source of wealth for a country, it is equally true that social structures will have to adjust so that those left behind by the process do not polarise the debate and obscure the benefits, quite apart from the human problems to which it is only right to seek acceptable solutions.

Issues relating to the regulation of the transport sector were also raised and it will be important for public authorities not to confine themselves to a domestic perspective on these policies but to grasp the implications at a higher level, for example, a Europe-wide level. There remains the issue of the environment and therefore that of keeping at least the international commitments that have been made in this respect: some of those attending the Symposium pointed out that this issue would have warranted a full session on its own. That would be to forget that there is no challenge that specifically relates to international transport as regards environmental constraints since although international transport is growing, it accounts for nowhere near the major share of transport. Moreover, the environmental issue had been raised in many of the papers presented at the Symposium and could be the basis for drawing a series of conclusions, which have informed part 2.3. ("International transport and environmental constraints") of this summary. Right now, it was quite legitimate to see the main issue as being how to reap the potential economic benefits of globalisation while still ensuring the rational use of an intermediate sector such as transport, particularly in the light of the major challenges that the world will have to meet.

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Benefiting from globalisation

Transport sector contribution and policy challenges




Transport is at the heart of globalisation, indeed the term would be meaningless without the ability to move goods and people around the planet. The opportunities for individuals and businesses to benefit from globalisation are increased by efficient, cost-effective transport networks. A competitive, responsive, well-organised transport sector facilitates trade, but creating the conditions for this poses policy challenges that must be tackled if transport is to contribute fully to globalisation.

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