



## When to invest in high speed rail - introduction

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## Outline



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- Motivation behind high speed rail investment
- Costs and benefits of high speed rail
- Examples of appraisals
- Conclusions

# Origins (new lines 250km per hour or more)



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1964 Tokaido Line

1981 Paris-Lyon

1981 Rome-Florence (1<sup>st</sup> section)

1988 Fulda-Wurzberg

1992 Madrid-Seville

2012 European total 6900km (Spain 2144; France 2036)

World 13000km (China 3426; Japan 2087)

Source: UIC



## Motivation for HSR

- Speed
- Capacity
- Reliability
- Economic Development
- Environment
- Supply industries
- Prestige
- Political integration



# Costs and Benefits

## COSTS

- Capital costs
- Net Operating costs
- Net External costs (environment, safety)

## BENEFITS

- Time savings and improved reliability
- Additional capacity
- Diversion from other modes (reducing congestion and environmental impact)
- Generated traffic
- Wider economic benefits

# Typical costs of HSR in Europe (m2004 euros)



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## Capital costs

Infrastructure

Construction (per km)

12-40

Operating costs depend mainly on rolling stock requirements, staff, energy, wear and tear – note very high utilisation of assets may offset high energy costs

## Values of time used in British rail appraisals

(£ per hour, 2010 prices and values)

Source: DfT (2013)



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Business	31.96
Commuting	6.81
Leisure	6.04



## Value of time - issues

- Should we have different values of leisure time by mode?
- How should time spent waiting and interchanging at airports be valued ?
- Is the business value of time lower if time spent travelling can be usefully employed?
- What if journeys start and finish out of normal working hours?
- Do savings in labour cost lead to equivalent increases in GDP?



## Capacity benefits



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- Increased traffic on hsr route
- Increased traffic on other routes
- Reduced overcrowding
- Improved reliability



## Benefits of diversion from car or air

- Reduced congestion
- Environmental pollution
- Accidents
- Release of airport capacity for long distance flights

Generated traffic  
(valued at half the benefits to existing traffic)



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- Leisure
- Commuting
- Business

Does this reflect relocation of business or net expansion?

# Wider economic benefits from generated traffic



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- Causes?
  - labour supply
  - agglomeration externalities
  - Imperfect competition

Agglomeration benefits solely from commuter journeys up to 75km on conventional rail and road

Longer journeys have little impact because of distance decay and small rail market share (but isn't rail important for precisely those journeys most likely to produce WEBs?)

# Ex post appraisal of French LGV



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	<b>Sud Est</b>	<b>Atlantique</b>	<b>Nord</b>	<b>Inter Connection</b>	<b>Alpes</b>	<b>Meditar anean</b>
<b>Passengers in first year (m)</b>	<b>15.8</b>	<b>26.7</b>	<b>19.2</b>	<b>16.6</b>	<b>18.6</b>	<b>19.2</b>
<b>Social return (%)</b>	<b>30</b>	<b>12</b>	<b>5</b>	<b>13.8</b>	<b>n.a.</b>	<b>n.a.</b>

# CBA of Madrid-Seville high-speed rail in Spain (billions of 2010 euros)



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<b>COSTS</b>	6.8
<b>BENEFITS</b>	4.5
Of which Time savings	1.6
Generated traffic	0.8
Costs saved on other modes	1.9
External costs saved	0.2
<b><i>Net present value of HST</i></b>	<b>-2.3</b>

Demand in 1993 2.8m trips

# CBA of Madrid-Barcelona high-speed rail in Spain (billions of 2010 euros)



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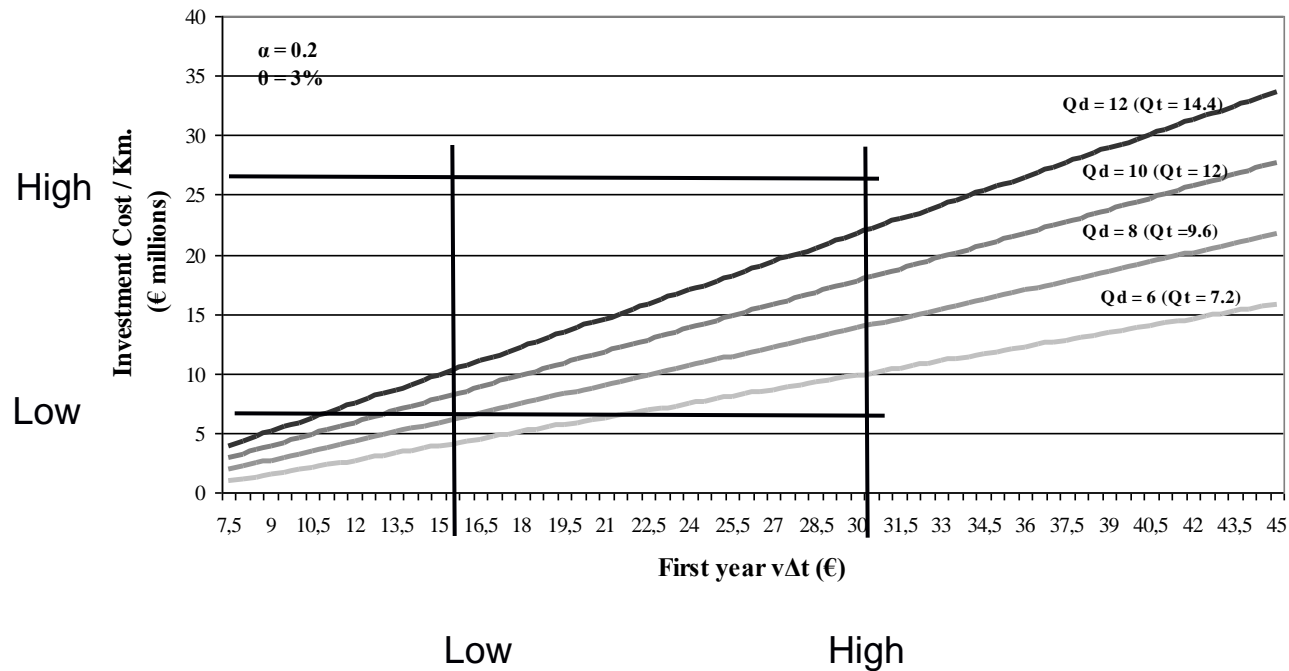
<b>COSTS</b>	12.4
<b>BENEFITS</b>	7.2
Of which Time savings	2.8
Generated traffic	1.1
Costs saved on other modes	2.9
External costs saved	0.4
<b><i>Net present value of HSR</i></b>	<b>-5.3</b>

Demand in 2009 5.5m trips

# First year demand required for breakeven ( $\alpha = 0.2$ $\theta = 3\%$ )



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# Conclusions



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HSR only justified when volumes high (construction cost also crucial)

Typically needs around 9m passengers per annum density on social cost benefit terms (much higher for commercial viability)

Can enhance a whole network when associated with upgraded conventional lines

But many uncertainties:

- Costs
- Demand forecasting
- Value of time
- Wider economic benefits