

National Issues in the USA in Economic Development, Mobility, and Income Inequality

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Abstract

This assessment of the present context for evolving socio-economic patterns and trends in the United States is intended to support consideration of prospects for gains in income shares among the lower income population, recognising that the United States is: a very large heterogeneous population; highly dispersed over a large geographic area; highly technologically developed; and with relatively high incomes by world standards. All of these factors conduce to the need to recognize the characteristics of individual nations as they move toward improved incomes for their populations. The key factor for the future in the US will be better utilisation of the underemployed population to abet the need for skilled workers to support a large aging dependent population, including better education, and greater mobility providing access to employment and to other social and economic opportunities. It is hoped that this assessment adds further dimension to the important challenges addressed here.

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Introduction

Today we live in a challenged and challenging world. In the career of this writer, it is the most difficult period we have ever faced in which to make sound forecasts or even to make general assessments of the future. It is difficult to do transportation forecasting, of course, but more particularly it is a great challenge to understand the key drivers that impact transportation. Planning and public policy operates today in a context of serious unknowns. Among these are:

- Dramatically changing demographic attributes of the population
- An erratic and unclear economic context
- Highly volatile resource costs for almost all key inputs and uses
- Shifting technologies of transportation and other sectors
- Shifting social patterns, attitudes and values

Moreover, the time constants that influence change have themselves changed. There appears to be greater volatility in almost all patterns. There are many degrees of freedom in almost all aspects of the present context – some factors contravening, others reinforcing expected patterns. Building scenarios of the future has to be multi-dimensional.

Part of this is the product of the very difficult period the world, particularly the developed world, has been through in this century. In America, and elsewhere, sharp declines in economic activity were registered in mid-decade with a severely prolonged recovery period reaching ten years, leading many to see fundamental change rather than simply retarded recovery in the patterns since 2008. We have to continually be asking ourselves are the patterns we are seeing the product of a slow return to “traditional patterns” or is this the harbinger of “a new normal”? Each day seems to confirm that the erratic state of the world economy is the real driver of so many of these trends. The weak economy explains much and new far-reaching technology changes add to the drama and the uncertainty.

Seeking then for a tangible and consistent thread of change therefore in this time is fraught with uncertainty. This paper will seek to differentiate those patterns that are clearest and that establish the context, the stage, on which the more uncertain patterns and speculative trends will play out.

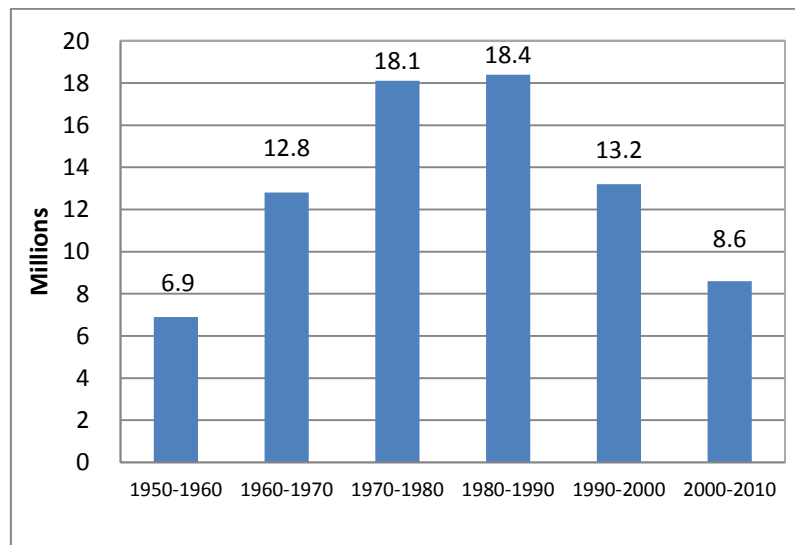
- First, demographic trends considered to be the most stable, including projected births; labour force and employment trends, and geographic distributions, recognizing the speculative nature of trend assessments,
- Consumer spending trends and their implications for transportation and housing and their linkage to workers,
- Racial, ethnic and gender patterns will be considered, establishing a firmer base for consideration of behavioural trends;

- New technologies and their influence will be assessed;
- Finally, some public policy actions will be assessed in the context of these patterns.

The demographic challenge

The central question in this period is where will the workers come from to replace the aging baby boomer generation now reaching retirement age, and how will we support that large aging population in the future? The figure below shows that the great period of expanding numbers of workers added to the economy each decade is now behind us. It actually peaked in the eighties and has been in a steady decline since. Part of the issue in the first decade of the new century could be attributed to poor economic environment as much as a decline of persons coming of working age.

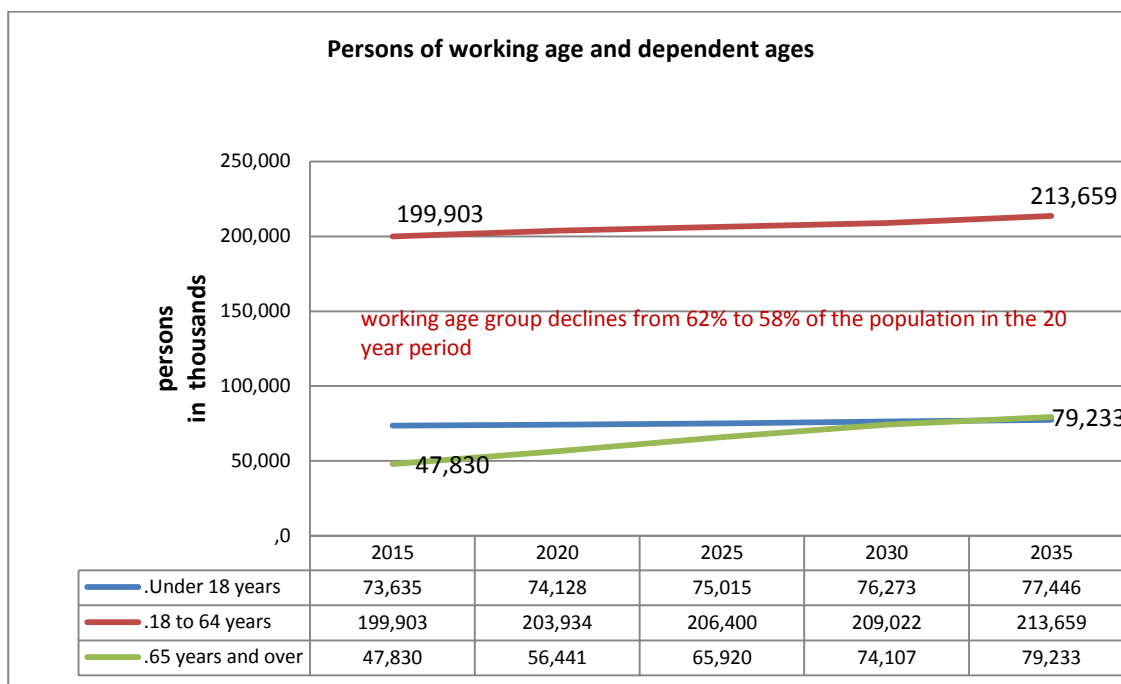
Figure 1. **Workers added in USA by decade.**



Source: *Commuting in America 2013*

But the future does not promise any brightening in these trends. The following projections of the US Census Bureau starkly depict the gaps in the work force age group in the coming years.

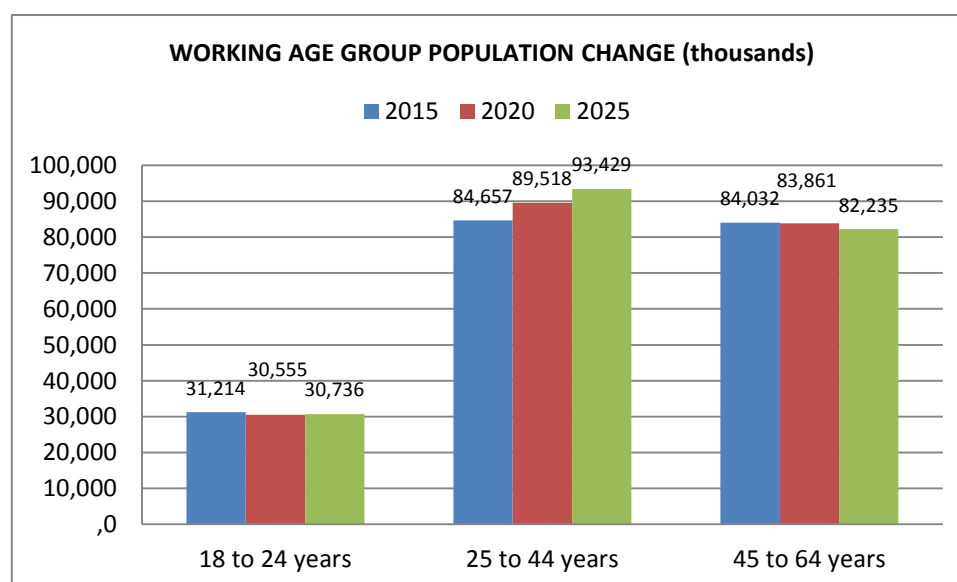
Figure 2. Persons of working age and dependent ages



Source: US Bureau of the Census Projections 2014

Examining the 18 to 64 working age group in greater detail shows that both the elder work force, those from 45 to 64 in age, and the younger work force, those in the age range of 18 to 24 actually decline in the ten year period. Whatever growth in working age population occurs is in the mid-level age group of 25 to 44.

Figure 3. Working age group detail



Source: US Bureau of the Census Projections 2014

The challenges and implications are clear.

- The working age population increases by only 13.7 million and thus falls as a share of population from 62% in 2015 to 58% by 2035. This means greater numbers of dependents in the society to be supported by the working age group.
- There is an explosion in those over 65 adding over 31 million in the period, gaining 64% of the population growth arriving at over 21% of the persons in the population up from under 15% today. One effect, that is already happening, is that the over 65 population will have to continue to work.
 - In part because the economy’s weaknesses have forced some to postpone retirement
 - In part because the elder population are healthier than past generations and the nature of present work is amenable to their skills.
 - Working at home is a supporting inducement
- Only 4 million persons under 18 are added in 20 years, which means very few coming of working or driving age.

It is important to recognize that these projections were made as the nation was coming out of the recession and may be projecting the lackluster experience of the early part of the century. However, as an example the numbers of people coming of working age in the next 10 years are already here. These projections do include expected immigration to the USA in the period. That is perhaps the number with the greatest potential for change. The table below summarizes some of the attributes of the new century. The VMT values had been in decline since 2008 and have only returned to 2008 levels in the past year.

Table 1. A new century – with limited growth

USA	2000	2015	Change	% chg
Population (millions)	281.4	321.4	40	14.2%
Vehicles (millions)	221.4	260.4	39	17.6%
Road System miles* (millions)	3.936	4.177	0.241	6.1%
Lane Miles (millions)*	8.224	8.766	0.542	6.6%
Vehicle Miles of Travel (VMT) (trillions)	2.764	3.148	0.384	13.9%
VMT/ lane mile (thousands)	336	359	23	6.8%
Average Travel Time to Work (minutes)	25.5	26.0	.5	2.0%

Source: US Census Bureau; Federal Highway Administration US DOT

More of concern, income levels in the United States as of 2014 were still well behind earlier years on an inflation-adjusted basis. The figure shows that median incomes in 2014 were below 2009 levels and all the previous years of the century. Early indications for 2015 suggest that we are close to a return to previous levels, but these data say nothing about the income distribution.

Figure 4. Median household income in current and inflation-adjusted dollars



Source: BLS income statistics

Counties in America

While these reduced levels of worker growth and weak incomes would seem to suggest that travel demand will weaken, or even decline, with a negative effect on infrastructure requirements, great care must be taken in assessing these trends. A large part of the question is geographic in nature with stark contrasts across the nation. The county system in the USA is utile in this assessment.

The sub-unit of government below the state in the United States is the county (some states give them different names). For statistical purposes, the Census Bureau uses counties or county equivalents as one of the basic units of statistical observation and presentation. One reason for this is that counties are highly stable and their boundaries rarely change. Beyond that geographic stability, counties are tremendously variable in size, population and economic activity. There are 3 142 counties in the United States. Some of the counties, particularly in the West, are immense in size. San Bernardino county California, the largest in the country, is larger than some states, others may be the size of small villages. The island of Manhattan is a county. Half of the population of the country lives in 146 of the counties.

Metropolitan statistical areas are aggregates of counties and therefore may contain built areas and areas that are still quite rural in character. In a recent study of national population trends¹ the stark variations by county were revealed. Broadly, between 2000 and 2010 about one third of counties lost population, just over a loss of two million; another third gained much of the national population change, just over 27 million for the decade; and the last third, all rural counties, were quite stable gaining only limited population. Therefore, many questions of economic development and sustainable population and development have very sharp variations and very different starting points in various parts of the country. Planning and policy must be sensitive to these variations and vary with the trends and changes occurring in each area.

A sample county

Fairfax County Virginia is a close-in suburb of Washington DC. It is large as counties go with a population in excess of one million and a land area of about 400 square miles, (roughly 1 000 square km) and a population of about 1 000 per square km, typical of US suburbs. It varies from very metropolitan (Tysons Corners midway between Washington DC and Dulles airport, has multiple 20 story buildings and is a greater job centre than many well-known large cities) and still there is extensive farmland in the county.

One useful way to define a suburb, which will help us understand Fairfax, is that a suburb is typically a place with more workers than jobs for them and therefore it must export workers each day. A city then can be defined as a place with more jobs than workers which must import workers each day.

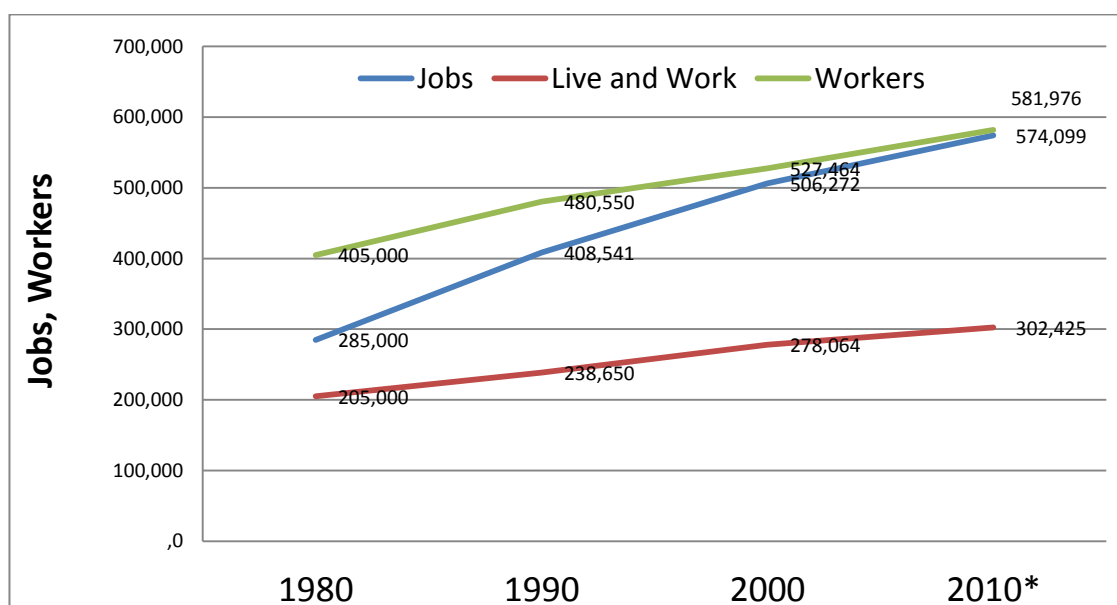
In 1980, Fairfax County was a classic case of a “bedroom suburb”. There were roughly 70 jobs for every resident worker. Most of the jobs were the kinds of jobs that follow households – grocery stores, department stores, car services, schools and medical services. By 2010, 30 years later, the ratio had risen to 99 jobs for every 100 workers – effectively a job worker ratio of 1. Therefore, if all the 582 000 workers filled the 574 000 jobs in the county, only 8 000 workers would need to be exported each day. This, of course did not happen, only 52% of resident workers remained to work in their home county. (This is actually a rather good ratio compared to many others.) The effect was 280 000 workers were exported each day to other jobs around the region and 272 000 workers were imported to fill the remaining jobs in the county. Therefore, 552 000 workers crossed the county boundaries each day, instead of the idealized notion of 8 000. This is really what commuting and worker access is all about.

So the concept of a balance of jobs and workers, an ideal ratio of one job per worker, answers few of the questions of connecting jobs and workers. It would be true certainly that the potential rises for some to live near work, to walk or bike to work, but modern economic structures are not necessarily that neat. It is important to examine why. But it is far more significant to understand that it is the skills mix of the jobs to be filled and those that the resident workers can provide that matters more than just simple numeric balances of jobs and workers.

- Perhaps the key reality of work – home relationships in America and other countries, as well, is that about two-thirds of workers live in a household where there are multiple workers. The question then, if living near work is a goal, whose job will they live near? It is possible, but not likely, that they will both, or all, find local work that matches their disparate skills, economic needs and career objectives.
- When one person in the household changes jobs (especially among young workers – job changes occur every two or three years), will they uproot and move each time, especially when the prospect of moving again soon is clear? There is a clear expense and mental dislocation associated with moving – doctors, favourite stores, friends, etc.
- One of the reasons that large metro areas are attractive to workers, and employers, is the array of choices of jobs (or workers), say, within a half-hours travel there. Particularly, recognizing the growing specialization of skills in job requirements or in workers the catchment areas for persons with the requisite skills must expand to assure adequate choices of skilled workers.
- Growing specialization in skills seems to be an assured complement of changing work force requirements now and into the future. Employers reaching out farther and farther to find the skills they require will be a natural outcome of this trend.

- Moreover, we must recognize that optimizing the commute trip is not necessarily very high on many household's preferences. Often a considerable commute distance is a price people willingly pay to retain a preferred environment for their families – schools, amenities – which makes the commute an acceptable trade-off. The basis for changing homes is a complex one discussed more fully later.

Figure 5. Fairfax County Virginia – 1980-2010



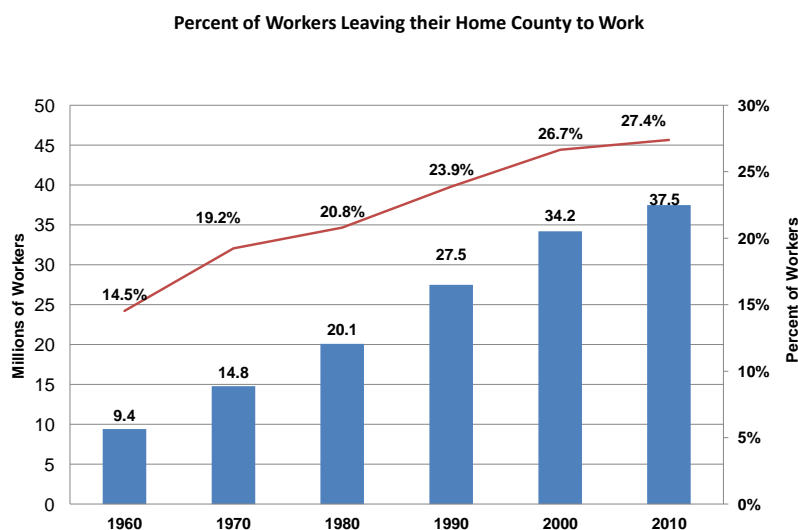
Source: *Commuting in America 2013*

Finally, it is to be observed that by 2013 our case study area, Fairfax County Virginia, actually had reached a stage where it had more jobs than workers, a job/worker ratio of 1.04, completing the transmutation from a bedroom community to a job centre. In that three years from the census of 2010 there was an increase in 30 000 residents who both lived and worked in the county with the percentage rising to 54% contrasted to 52% in 2010, and still there were now 571 000 workers, both exports and imports, crossing the borders of the county each day.

This is a trend that can be perceived around the country as suburban residence communities gain jobs and central cities gain residents so that both types of areas are moving closer to job/worker ratios of 1 from opposite directions but still generating extensive travel between areas. The impacts on the less skilled workers need to be carefully assessed. In some areas as employers move to be near the skilled workers they need, the effect is to raise costs in neighbourhoods and push the lower income workers farther away from some job sites. In the end, it may be the lower income workers with the greater commuting requirements. The dominant commuting pattern today in the USA is from suburb to suburb rather than focused on the centre creating very mixed patterns of flow.

A key statistic, that presents this trend in its national scope, is that since 1960 the number of workers working in a county different from their residence county has grown astoundingly, as both housing and jobs have relocated. The number of workers traveling outside their home county quadrupled from 9.4 million in 1960 to 37.5 million in 2010, a shift from 14.5% to 27.4% of all commuters. By 2014, that number had risen to over 40 million workers. Thus, the Fairfax county Virginia story is being told repeatedly throughout America.

Figure 6. **Percent of workers leaving their home county to work**



Source: *Commuting in America 2013*

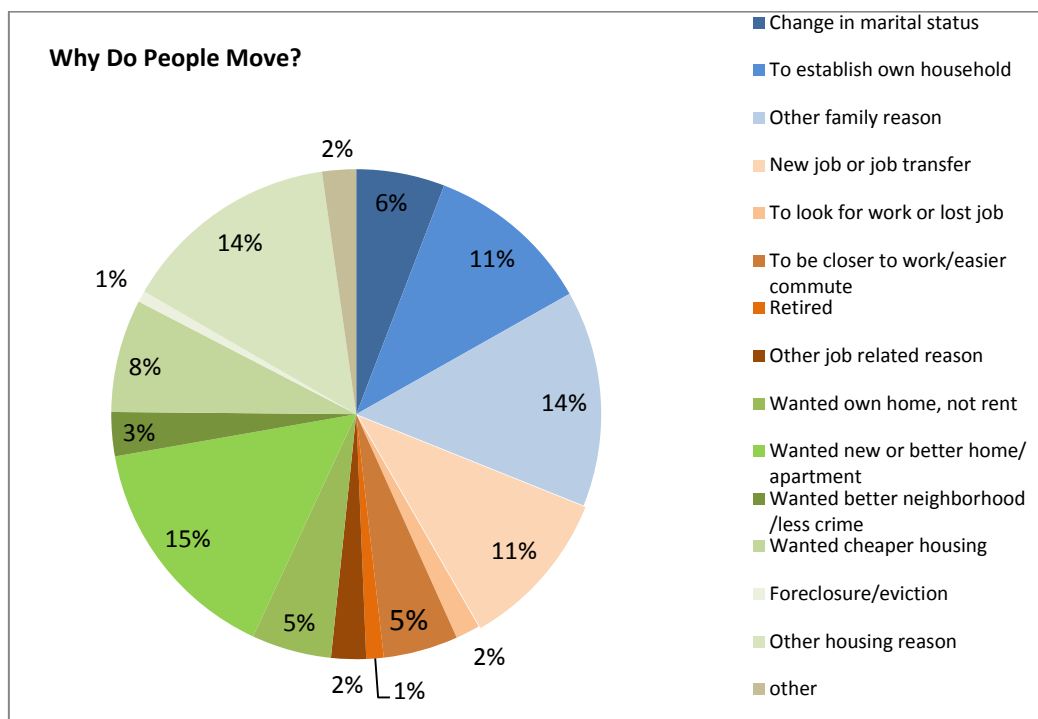
Of interest is that the share of transit users rises sharply with shifts away from the residence county. Among the 7.6 million transit users in 2014 only 4.4 million, about 58%, used transit to travel to work within their residence county, meaning that 42% of all transit users leave their home county to work, and while transit users represent only 5.2% of all commuters they represent almost 8% of workers crossing county boundaries. Thus, while transit is often seen as the complement to a compact city the lengths of transit lines often support extensive population dispersion and long distance job connections to workers, even including inter-metropolitan workflows.

Redistribution of population and workers

Of the 312 million people in the US in the period of study, fewer than 12% moved between 2014 and 2015, and of these the great majority simply moved elsewhere within their residence county, generally for reasons related to housing preferences. Only about 4% of the population moved to a new county, most often to a different county within the same state. A slightly larger share of movers is unemployed, and they tend to be willing to move farther presumably in job searches. So worker mobility seems strong where job search is concerned, particularly among the younger population.

There are three broad categories of why people move: the first is changes in family structure, marriage or other changes, 31%; changes in job situations, 21%; and changes in the housing itself, 46%.

Figure 7. Why do people move?



Source: Census table 17-1 Geographic Mobility 2014-2015

One of the effects of the prolonged recession recovery was that it suppressed moving as persons could not afford new housing or could not sell their present homes, or perhaps were afraid to leave jobs for fear of lack of alternatives. It is in the nature of an economic recession that it locks people into their homes and jobs if only due to the uncertainty generated by trends. Current data indicate the beginnings of a return to more normal levels of geographic mobility. One of the great strengths of America has been a totally open market for jobs so that workers from any state can respond to job opportunities anywhere in the country. The recent shifts of oil field workers to remote areas such as North Dakota and West Texas are a good example of that flexibility. There are few language barriers or other social or governmental barriers to impede worker flows across states and counties. This is a strong positive in national workforce balances for both skilled and unskilled labour. Among the strongest growth in occupations will be in the health related fields, serving, in many cases, the elderly population. Both skilled professionals and less skilled technicians and support personnel will move to where the elder populations choose to locate.

As can be seen from the chart, about 20-21% of movers give work-related reasons for their move including job transfers, looking for work or retirements. Overall, only about 5% of movers identify wanting to improve their commute situation as a reason for moving. It can be assumed, however, that many others would be delighted to see their travel to work be less time consuming, less expensive and less stressful, but accept it at the present time as the trade they make between the job and housing they want. Comparatively, US commute times and congestion issues are relatively benign by world standards.

Consumer expenditures and the housing/transportation nexus

The Consumer Expenditure Survey, CEX, managed by the US Bureau of Labour Statistics, BLS, is the source of the national measures of the cost of living index. It carefully records all outlays by “consumer units”² relatively close in definition to the typical sense of a household. The power of this survey is that it details expenditures for a complete array of categories and a comprehensive set of demographic attributes. The HBS, Household Budget Survey of Eurostat is similar in function. A limited set of these tables, focused on quintiles of income and geography, will be employed here.

Table 2. 2014 Consumer Expenditure Survey Demography

Average number in consumer unit:	All consumer units	Lowest 20 percent	Second 20 percent	Third 20 percent	Fourth 20 percent	Highest 20 percent
People	2.5	1.7	2.2	2.5	2.8	3.2
Children under 18	.6	.4	.5	.6	.7	.8
Adults 65 and older	.4	.4	.5	.4	.3	.2
Earners	1.3	.5	.8	1.3	1.7	2.1
Vehicles	1.9	.9	1.4	1.9	2.3	2.8
Annual Expenditures	\$53,495	\$23,713	\$33,546	\$45,395	\$60,417	\$104,363

Source: Consumer Expenditure Survey BLS 2014

Table 3. 2000 Consumer Expenditure Survey Demography

Average number in consumer unit:	All consumer units	Lowest 20 percent	Second 20 percent	Third 20 percent	Fourth 20 percent	Highest 20 percent
People	2.5	1.8	2.3	2.5	2.8	3.2
Children under 18	0.7	0.4	0.6	0.7	0.8	0.9
Adults 65 and older	0.3	0.4	0.5	0.3	0.2	0.1
Earners	1.4	0.7	1	1.4	1.7	2.1
Vehicles	1.9	1	1.5	1.9	2.4	2.9
Annual Expenditures	\$38,045	\$17,940	\$26,550	\$34,716	\$46,794	\$75,102

Source: Consumer Expenditure Survey BLS 2014

There were about 25 million consumer units per quintile in 2014, and about 16.3 million in 2000. Rather than examine spending against CU incomes, it is more effective to scale them against quintile expenditures, particularly because in lower income groups older and younger people spend above their

incomes as a result of other sources of spending such as savings among older persons or family support in the case of young students.

Comparing 2000 and 2014

The differences are surprisingly slight between two periods 15 years apart. The key differences are:

- People: the two lower income quintiles have grown slightly smaller, others are the same
- Children under 18: in each quintile, except the lowest, there were more children in 2000
- Adults over 65: there are more persons over 65 particularly in the higher income quintiles in 2014
- Earners: there are fewer earners in the three lowest quintiles; the number is constant in the top two
- Vehicles: vehicle ownership was slightly higher in almost all quintiles

To assess income inequality trends the ratios of highest to lowest quintile for each period is as follows:

Table 4. **Ratio of highest to lowest quintile elements**

	2000	2014
People	1.8	1.9
Children under 18	2.3	2.0
Adults 65 and older	0.3	0.5
Earners	3.0	4.2
Vehicles	2.9	3.1
Annual expenditures	4.2	4.4

Source: calculation by author from BLS data in tables 2 and 3 above

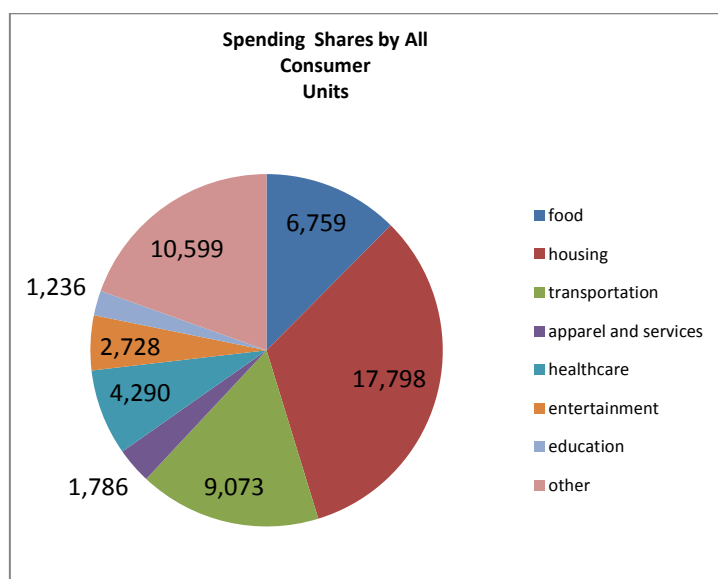
There are significant changes here. The ratio of populations is up slightly; children under 18 shows a sharp decline; adults over 65 increased substantially; but most significant is that the earner ratio jumped sharply, entirely as a function of the decline in workers in the lowest quintile. Both vehicle ratios and spending ratios increased.

In assessing the population in the lowest quintile of income and their expenditures in 2014, there are many suggestive factors to consider. Some are soundly based in statistics, others more speculative. Overall, they do not permit a definitive picture to emerge. The first statistic to consider is that the average expenditures of just under USD 24 000 in the lowest quintile are more than double the reported mean income for the group of USD 10 750. Note that only 0.5 workers per household are reported, indicating the presence of either high unemployment, high levels of retired persons, or possibly college students in the group. With a relatively high share of persons over 65 and with over 60% of respondents being women, a sense can emerge of a high proportion of this quintile's population consisting of retirees, particularly women, whose spending may be distinct from their incomes. At the same time the group registers 50% college graduates, 39% homeownership and 63% with at least one vehicle, and at 1.8 the

highest ratio of vehicles per worker of all quintiles. It is possible that other members of this cohort can be college students functioning as consumer units, registering limited incomes but with support from parents or others. Finally, a third group is suggested by the fact that while African-Americans comprise only 13% of the US population they constitute 21% of this quintile. Clearly, the statistical picture of this quintile transmits a very mixed image.

The trends are important here; both percent home ownership and possession of at least one vehicle declined from 2000 to 2014: from 43% to 39% for home ownership; and from 66% to 63% with at least one vehicle. What did rise was college degrees; from 39% in 2000 to 50% in 2014. There also was a significant rise in the African-American share from 17% to 21%.

Figure 8. Spending shares by all consumer units



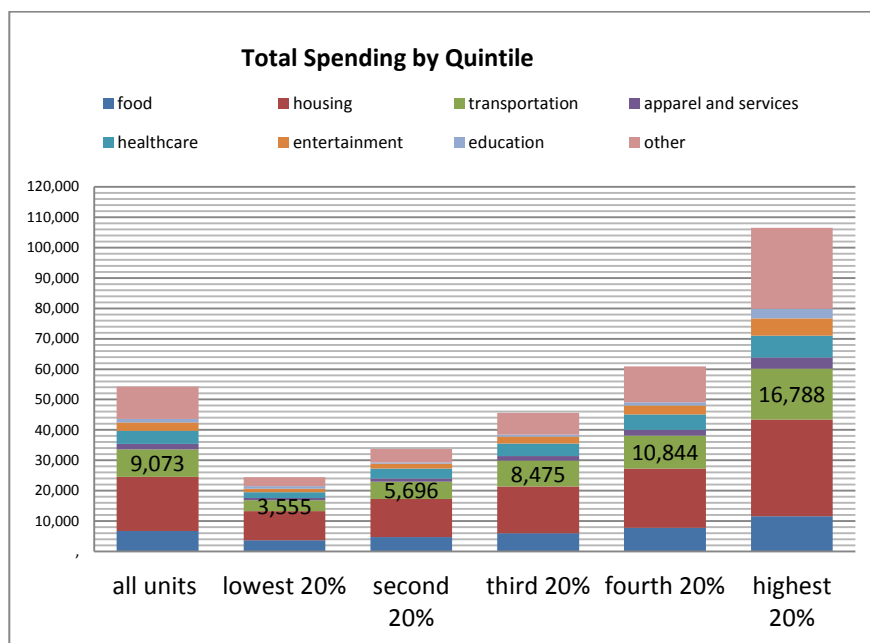
Source: Consumer Expenditure Survey BLS 2014

Aside from their incomes there are important quintile attributes revealed in the ranges from lowest to highest quintile in the 2014 summary descriptive table:

- The number of persons in the CU's rises with income from 1.7 to 3.2.
- The number of children doubles from 0.4 to 0.8 per CU.
- The number of elders halves from 0.4 to 0.2.
- The number of vehicles owned triples from 0.9 to 2.8.
- Most significantly, the number of earners per CU more than quadruples from 0.5 to 2.1.
- The ratio of earners is roughly in proportion to the ratio of expenditures.

These attributes go far in explaining the significant differences in expenditures, where stage in the life cycle as demonstrated here, may be as pertinent as incomes.

Figure 9. Total spending by quintile.



Note: Other is largely contributions to insurance, pensions and social security

Source: Consumer Expenditure Survey BLS 2014

Overall spending in 2014 by all units is above USD 53 000; the lowest quintile's spending is at USD 23 700 and the highest at USD 104 000 for a ratio of highest to lowest of 4.4. The following table identifies the highest/lowest ratios for the main expenditure categories in 2014 and, for comparison, for the year 2000 also. The overall expenditure ratio has risen from 4.19, at the turn of the century, to 4.40 in 2014 indicating a growing disparity in spending between quintiles. Of greater pertinence is that transportation is the only basic expenditure where the ratio increased between the periods, in all other basics the ratios declined. The category of "Other" also showed an increase; this category largely consists of savings, insurance, payments to pensions and social security. We can note that health trends showed a large rise; this is largely a product of changes in the data collection design regarding health care that shifted some categories and obtained improved information.

Table 5. Spending in Major Categories by Highest and Lowest Quintiles

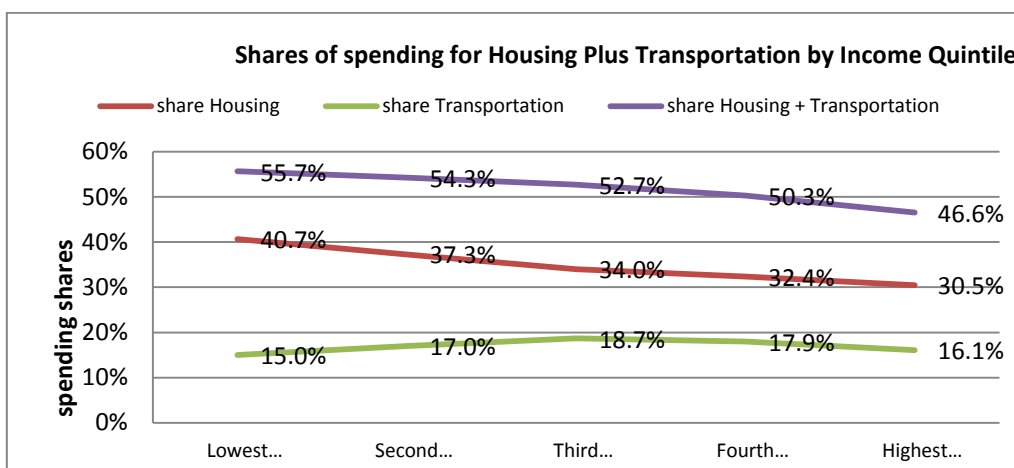
Main Expenditure	2000			2014		
	Lowest Quintile	Highest Quintile	Ratio	Lowest Quintile	Highest Quintile	Ratio
Food	2,673	8,679	3.25	3,667	11,595	3.16
Housing	6,509	22,611	3.47	9,643	31,812	3.30
Apparel	844	3,989	4.73	786	3,625	4.61
Transportation	3,212	13,315	4.15	3,555	16,788	4.72
Health	1,470	2,864	1.95	1,868	7,219	3.86
Entertainment	837	3,866	4.62	1,108	5,629	5.08
Other	2,395	19,778	8.26	2,909	26,646	9.16
Total	17,940	75,102	4.19	23,713	104,363	4.40

Source: Consumer Expenditure Survey, BLS 2000 and 2014

The transportation-housing trade-off

In the housing-transportation expenditure combination there is a real trade-off at work. In the lower income quintiles, the sum of transportation and housing is above 50%. As incomes increase, the shares decline to below 50%. In this trend housing declines as a share of spending while transportation rises slowly with income and then tapers off in percentage terms at the highest levels. This is reflected as well in city vs rural trade-offs and some other factors. Transportation is the only one of the major expenditure categories where spending shares rise as incomes rise indicating that there is real value in transportation that consumers pursue greatly as incomes rise. As noted above the decline in transportation spending as a share of total expenditures does not suggest that transportation spending does not rise. It jumps dramatically, as the figure above shows, reaching spending levels of almost USD 17 000 in the highest quintile. Much of this expansion is related to purchases of new vehicles and expanded air travel.

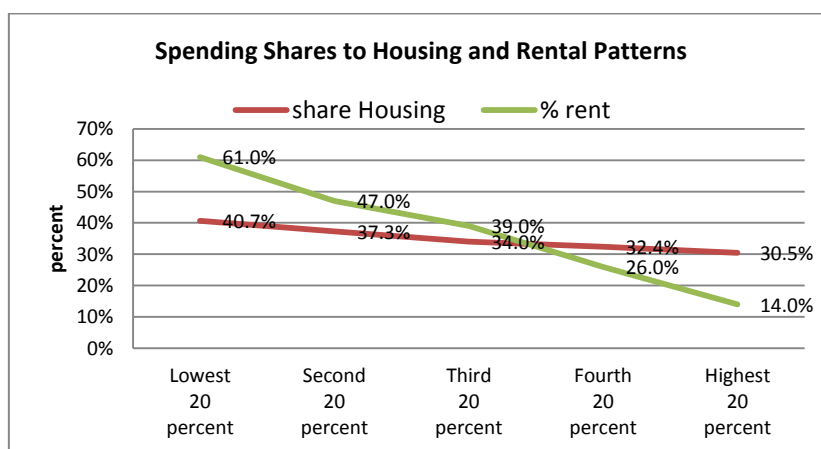
Figure 10. Shares of spending for housing plus transportation by income quintile



Source: Consumer Expenditure Survey BLS 2014

One of the key factors is the own vs rent trade-off. The figure below shows that rentals decline sharply with rising incomes while at the same time spending shares for housing also decline. This trade-off will be addressed further below.

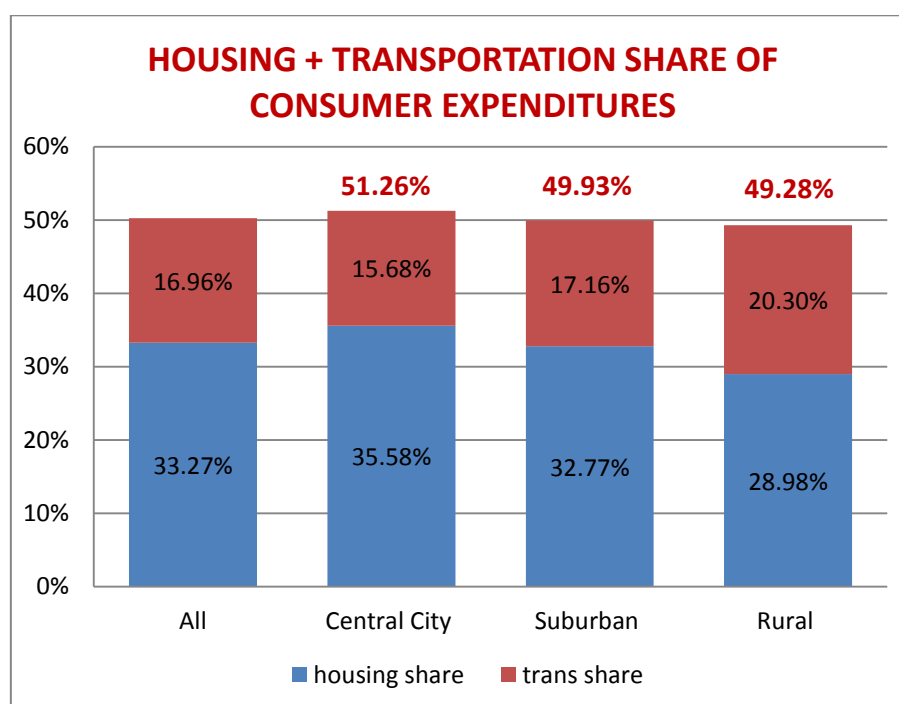
Figure 11. Spending shares to housing and rental patterns



Source: Consumer Expenditure Survey BLS 2014

Rather than focusing on quintile trade-offs based on incomes, the best mechanism to understand the inherent housing-transportation trade-off is in geographic structure. The figure below shows that transportation rises as a share of spending in rural areas vs central cities, even exhibiting greater absolute spending in rural areas, despite the fact that incomes are considerably lower than centre city incomes. But the greater spending on transportation is more than compensated for by declines in housing costs with the result that rural total spending per CU is below 50% whereas central city spending with its much lower transportation spending cannot overcome higher housing costs so total spending is well above 51%. Suburban spending is at the average of almost exactly 50%. The percentage differences are modest but have tended to be stable over time.

Figure 12. **Housing plus transport share of consumer expenditures.**



Source: *Consumer Expenditure Survey BLS 2014*

Perhaps the key point here is that home ownership rises as shares of spending declines. Urban residents, despite spending almost 36% of their expenditures on housing, have home ownership levels of only 47%, which rises to 68% in suburbs and 79% in rural areas, both with significantly lower shares of spending.

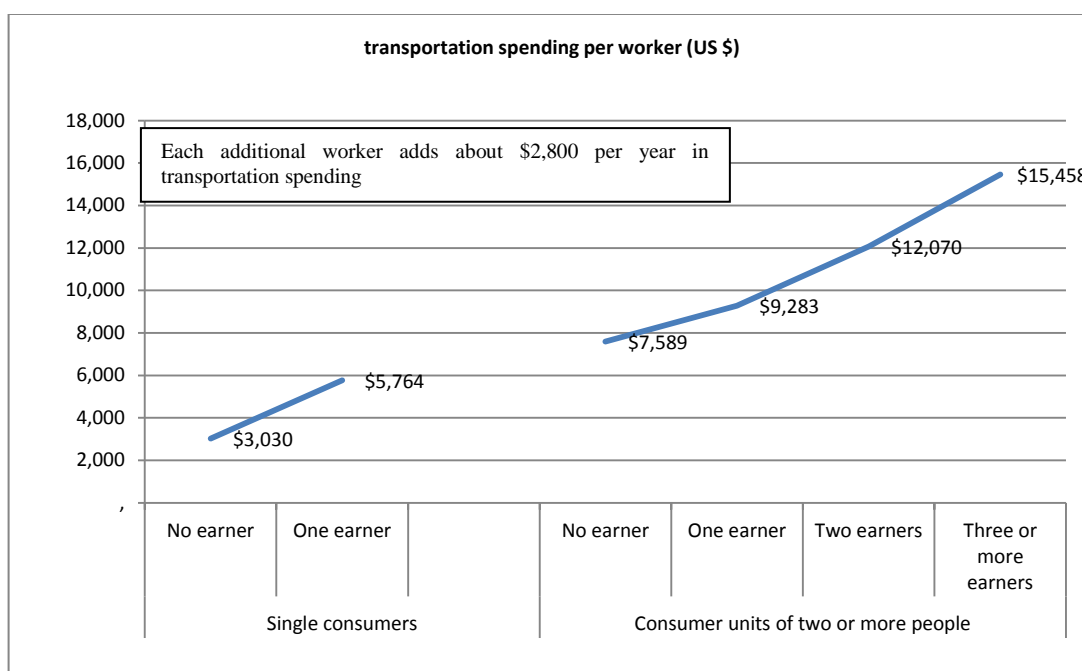
Thus, the rural resident's payment of higher shares of expenditure for transportation is compensated by more than equivalent declines in housing cost shares and with rising home ownership. And despite their lower incomes, rural residents have an average ownership of 2.4 vehicles contrasted to the centre city level of 1.4. In rural areas, many of those vehicles may have work functions. Interestingly both segments of the population have the same average number of 1.2 workers per CU but central city earners have incomes after taxes of almost USD 52 000 well above the USD 46 500 in rural areas.

In short then, it may devolve into a life-style question where preferences for renting vs owning, large lots versus smaller space, preferences for greater access to walking opportunities vs. longer commute times are worked out.

Transportation spending and the worker linkage

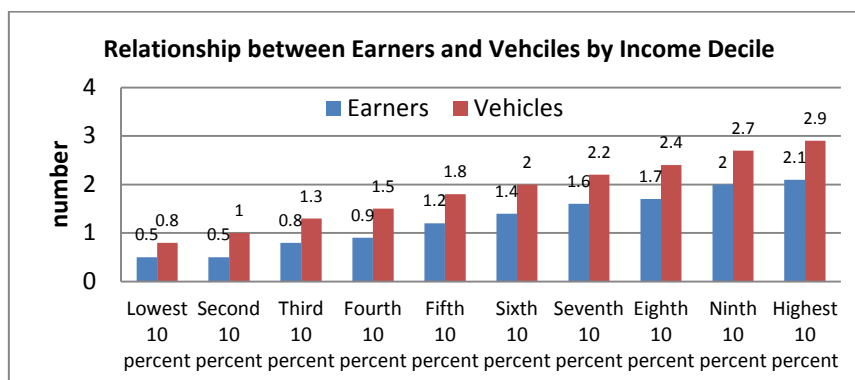
One of the keys to understanding transportation spending in the US is through study of workers. The figure explains the relationships. It shows that single consumers, where the consumer does not work, spend about USD 3 000 a year for transportation; if that single consumer works it rises to about USD 5 800. If the consumer unit has multiple members with no workers they spend about USD 7 600 per year on transportation, about proportional to the single non-worker, on a per person basis. This value has risen lately with increases in CU's with multi-person retirees. But transportation spending increases with each additional worker. In both the single consumer and multiple consumer units the increase per additional worker is about USD 2 800 per year reaching household spending of USD 15 500 per year in households with three or more workers. It is only in the category of three or more earners that vehicles owned do not exceed the number of workers.

Figure 13. Transportation spending per worker (USD)



Source: Consumer Expenditure Survey BLS 2014

Figure 14. Relationship between earners and vehicles by income decile



Source: Consumer Expenditure Survey BLS 2014

A major point here is that at almost every level vehicles exceed the number of workers in households. The foregoing figure for the complete set of income deciles illustrates that point. The historical worker-vehicle linkage is changing, largely because of the rapid retirement trends today.

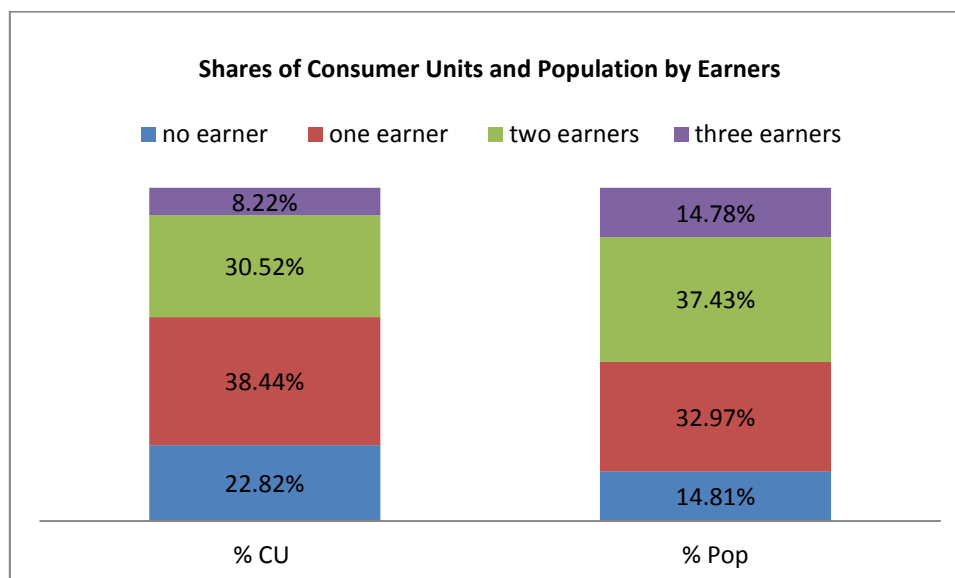
An important characteristic of the new American demography is that there are already 29 million CU's with no workers in them, 46 million people, largely thru retirement but also job displacement, indicating sharp declines in transportation spending. The historical national range for transportation spending as a share of spending is about 18%. Note that in the multiple person CU's that home ownership, vehicle ownership and persons over 65 are all higher than those of single person CU's.

Table 6. Consumer Units without workers

	Single person CU	Multi-person CU
Consumer Units (000's)	15 880	13 107
persons/CU	1	2.3
persons (000's)	15 880	30,146
One or more Vehicles	65%	86%
Persons > 65	0.6	1.3
% female	61%	53%
% homeowners	57%	75%
Trans. spending	USD 3 030	USD 7 589
All spending	USD 25 565	USD 43 418
Trans. share	11.9%	17.5%

Source: Consumer Expenditure Survey BLS 2014

Figure 15. Shares of Consumer Units and population by earners

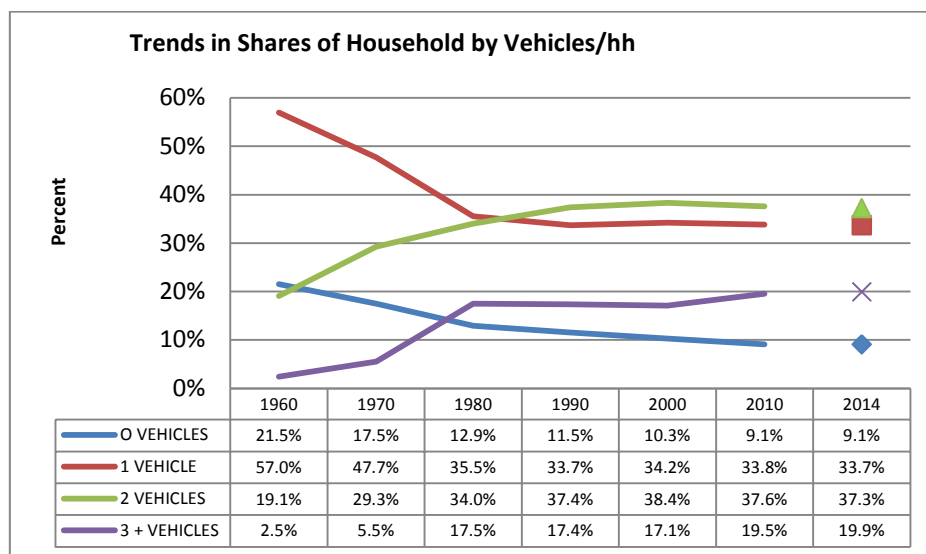


Source: Consumer Expenditure Survey BLS 2014

Vehicle ownership patterns and social equity

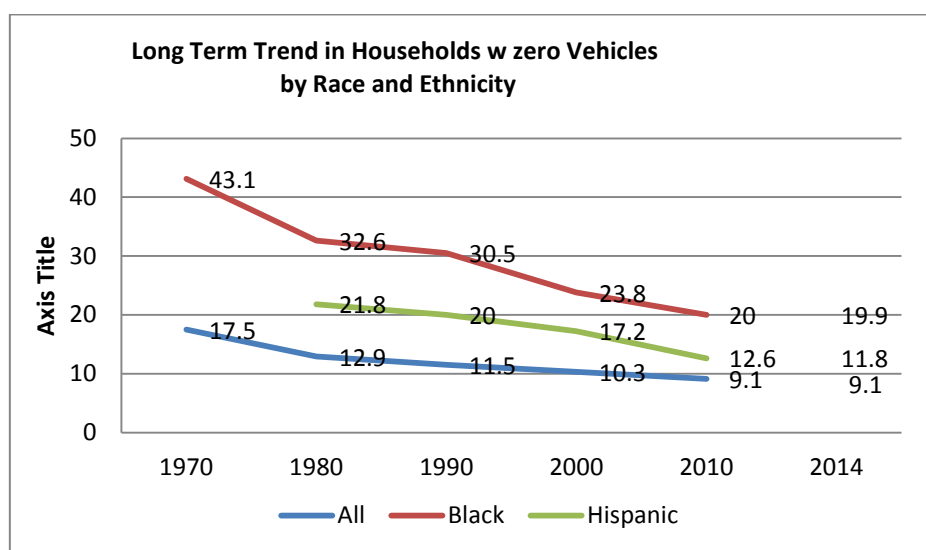
The figure below depicts the shares of households by the number of vehicles owned. Most notable is that the trend has been relatively stable since the 1980's, with only small shifts in shares over the 30+ year trend. This can be labelled close to vehicle saturation. Perhaps most significant is that households without vehicles has reached about a 10%-9% share since 1990. The actual number of households without vehicles has varied only slightly in a range of from 11 to 10 million over more than a 50-year period, but declining sharply in share as the number of households expanded. Moreover, the majority of those zero vehicle households are households without workers, either retired or young unemployed. Only 4.5% of workers live in households without vehicles indicating the vast majority of workers have access to a vehicle for work travel.

Figure 16. Trends in shares of households by vehicle/hh



Source: US decennial Census and American Community Survey 2014

Figure 17. Long term trend in households with zero vehicles by race and ethnicity



Source: US decennial Census and American Community Survey 2014

Growing homogeneity in travel behavior

The above figure makes an important contribution to the relevance of a growing homogeneity in many aspects of travel in the US. The most remarkable attribute of the figure is that African-American household vehicle ownership has changed dramatically in the period. In 1970, 43% of black households

had no vehicles; today that level has reached below 20%. A parallel pattern is exhibited by Hispanics; from just below 22% in 1980 to under 12% today. While this is a broadly positive trend two factors are clear: there is still a distance to go, especially for African-American households to reach comparability in household attributes; and the recession has slowed but not stopped the trend.

Mode choice trends, at least in the work trip, have also become more homogeneous.

Table 7. Trends in mode to work by race and ethnicity

Drive alone	2000	2010
Hispanic	60.60%	67.80%
African-American	67%	72%
Total Pop.	75.70%	76.50%
Carpool		
Hispanic	22.70%	16%
African-American	16%	10%
Total Pop.	12.20%	9.70%
Transit		
Hispanic	8.60%	7.80%
African-American	12%	10.90%
Total Pop.	4.60%	4.90%

Source: Commuting in America 2013

The table demonstrates a closing of gaps between the national patterns and those of African-Americans and Hispanics. The African-American population has long been the highest users of transit, and Hispanics, while also using transit more than average, were most notable as mainstays of car-pooling, owing to the nature of work often among the Hispanic population.

It is important, therefore, to see that car-pooling in both Hispanic and African-American population is shifting sharply toward the national norm. A similar pattern is visible in transit usage. The effect of this is to increase the shares in both groups of driving alone to work- the percentage changes were dramatic. These data, generated by the Census Bureau, only cover work travel. The new National Household Travel Survey, last conducted by US DOT in 2009, and now in the field collecting new data will tell us more about whether these shifting trends extend to other trip purposes as well, when available in 2017-2018.

In a somewhat parallel fashion, gender differences are becoming more homogeneous as well based on work travel data. Historically, women's work travel patterns were significantly different from men's; in trip distance, in time of travel and mode choice. Many of these factors were consistent with the gender roles of the time. Fewer drivers' licenses, less access to vehicles, jobs closer to home, etc. were part of the pattern. As women's work roles became more like men's so has their travel behavior. The female/male ratios in most travel were sharply skewed. Today, all differences are closing in just about every mode of travel. Most surprising is that Driving Alone to work is now a predominantly female pattern. In 1990, women's driving alone was in a ratio of 97% of men's. It has now surpassed men at 101%. All other modes similarly have moved in the direction of homogeneity. Carpooling and transit use ratios have moved closer to 1:1. Previously women walked to work more than men did; now it is less. The only areas where strong differences remain are in long distance commuter rail travel, bicycling, and motorcycling, but even there the vast differences are closing somewhat.

Table 8. Modal shares to work by gender

	Male	Female	F/M ratio
Car, truck, or van:	86.07%	86.47%	100.5
Drove alone	76.19%	77.00%	101.1
Carpooled:	9.88%	9.47%	95.9
In 2-person carpool	7.51%	7.52%	100.2
In 3-person carpool	1.32%	1.21%	91.9
In 4-or-more-person carpool	1.05%	0.74%	70.3
Public transportation	4.63%	5.29%	114.4
Bus or trolley bus	2.34%	2.95%	126.4
Streetcar or trolley car	0.06%	0.07%	120.1
Subway or elevated	1.62%	1.78%	109.6
Railroad	0.58%	0.47%	80.8
Ferryboat	0.03%	0.02%	72.8
Bicycle	0.75%	0.30%	39.7
Walked	2.85%	2.68%	94.1
Taxicab, motorcycle, other	1.44%	0.86%	59.4
Worked at home	4.26%	4.40%	103.1

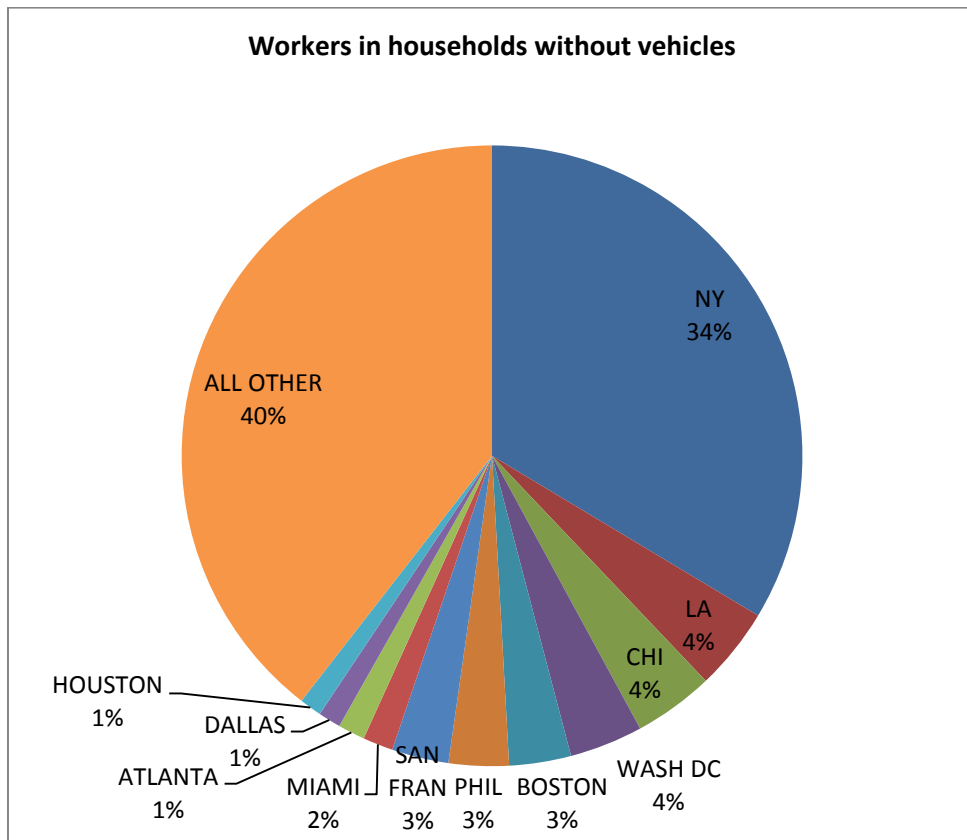
Source: *Commuting in America 2013*

None of this is to suggest that some modes are preferable and more women driving alone to work is a more desirable social outcome but it does argue that race, ethnicity and gender differences in travel are diminishing and their explanatory power in understanding travel behavior is less powerful. In the future, it is clearer that factors such as age, education, occupation, geographic location and incomes will be the main factors of behavior differences.

Where are the zero vehicle households?

There are 10.7 million households in America without a vehicle. However, many of these households consist of single retirees, the majority of which are women who do not have licenses. There are only 6.5 million workers who live in zero vehicle households. Of these, about one-third, 2.2 million, live in the greater New York metropolitan area. The remainder are distributed among the top ten metros as shown in the figure and with a remainder of 40% distributed in smaller metros, small towns and rural areas of the country.

Figure 18. **Workers in households without vehicles**



Source: US Census Bureau ACS 2014

Travel times, mode use and access

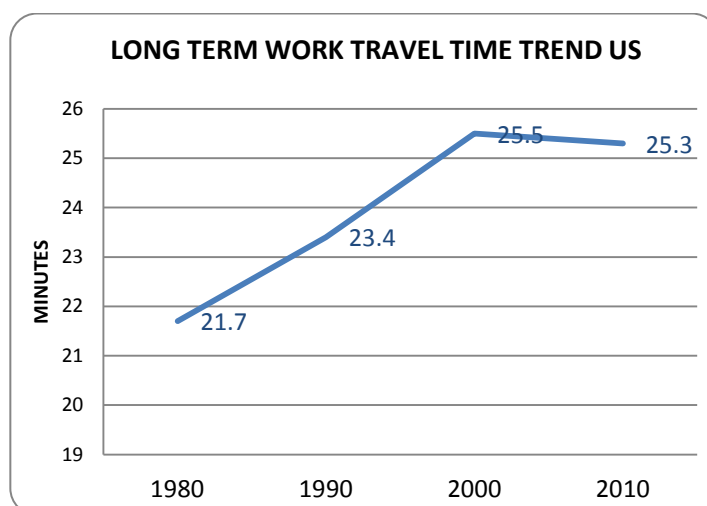
It was not so long ago that the majority of American workers reached work in less than 20 minutes. As of 2014, the following pattern existed:

- Of the 146 million workers in the US in 2014, 6.5 million worked at home, therefore with a remainder of just over 139 million who left home to work.
- Of those, 19 million were at work in 10 minutes or less;
- 20 million were at work within 10 to 14 minutes;
- And 22.5 million reached work within 15 to 19 minutes

- In total over 61 million were at work in less than 20 minutes and if those who work at home are included, then very close to 68 million were at work in less than 20 minutes, representing 47% of the work population.
- The trend in average travel times over time are shown in the figure below.

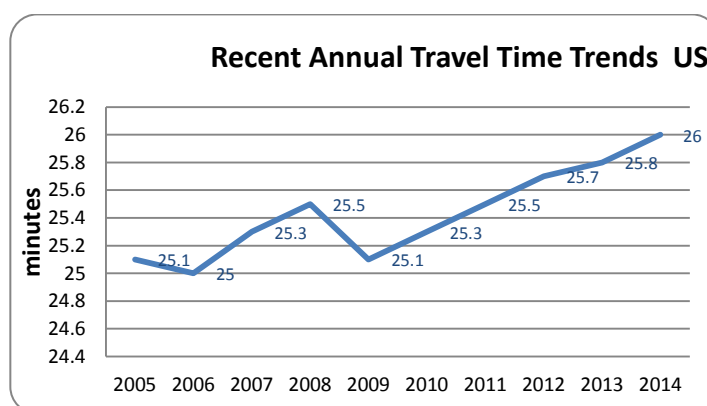
America has had a very stable period in which travel times were effectively constant, largely due to 9/11 and the more recent recession, which reduced work travel, especially in that job losses were heaviest in construction and in manufacturing, which frequently involve long distance, carpool trip making. Between 2000 and 2009, average travel times remained constant at 25.5 minutes. As the job recovery began after 2008, travel times slowly increased to the level of 26 minutes as of 2014 – that is a gain of a half a minute in this century. The two travel time figures represent two different surveys of the Census Bureau – the decennial conducted each decade and now the American Community Survey, ACS, which began as an annual survey in 2005. Their designs are structured to carry forward constant comparable measurements.

Figure 19. Long term work travel time trend US



Source: US Decennial Census

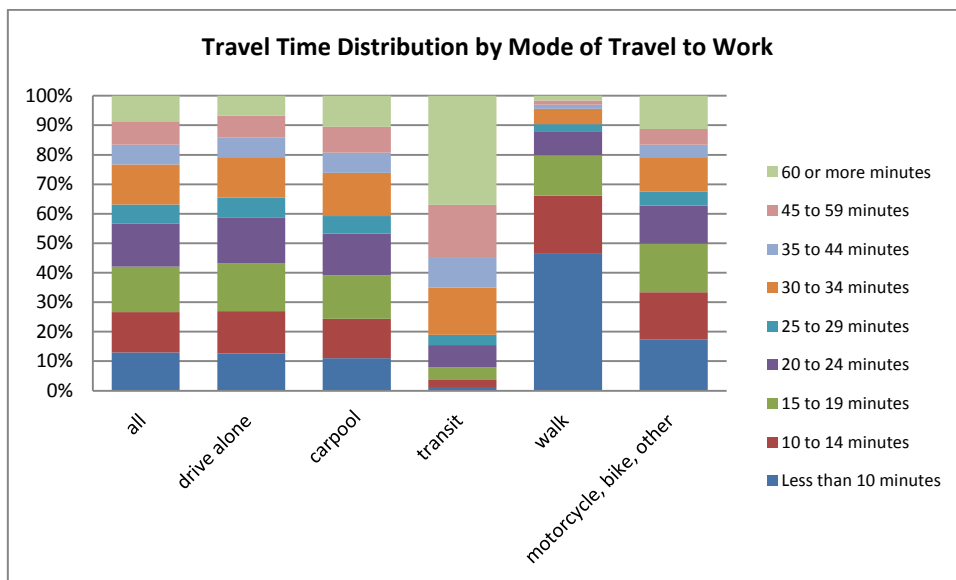
Figure 20. Recent annual travel time trend US



Source: American Community Survey annual series

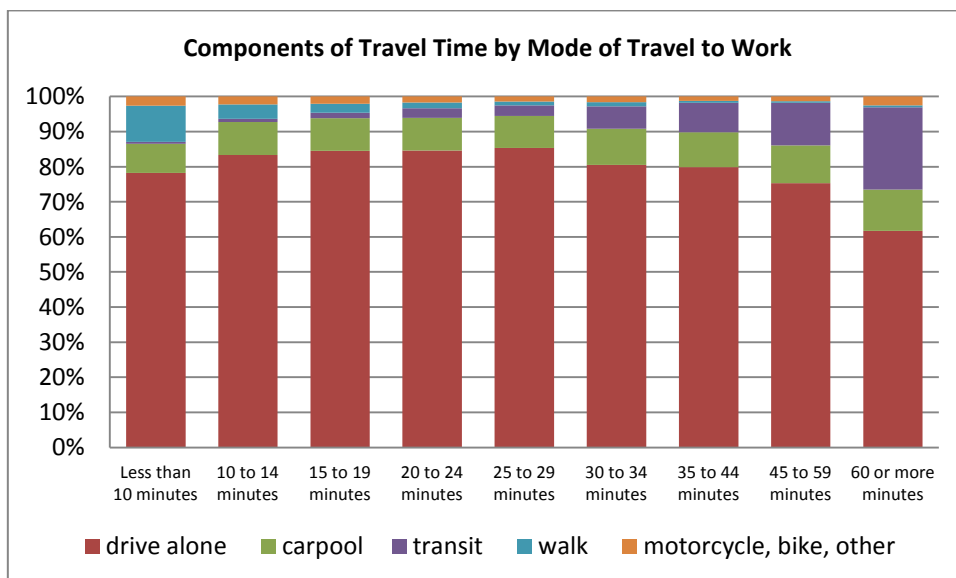
The average travel time is of course a function of the modes of transportation used. The following shows the variation in travel times by mode. Among the keys are that almost 40% of transit users take 60 minutes or more to get to work; and over 60% of walkers arrive within 15 minutes.

Figure 21. Travel time distribution by mode of travel to work



Source: American Community Survey 2014

Figure 22. Components of travel time by mode of travel to work



Source: American Community Survey 2014

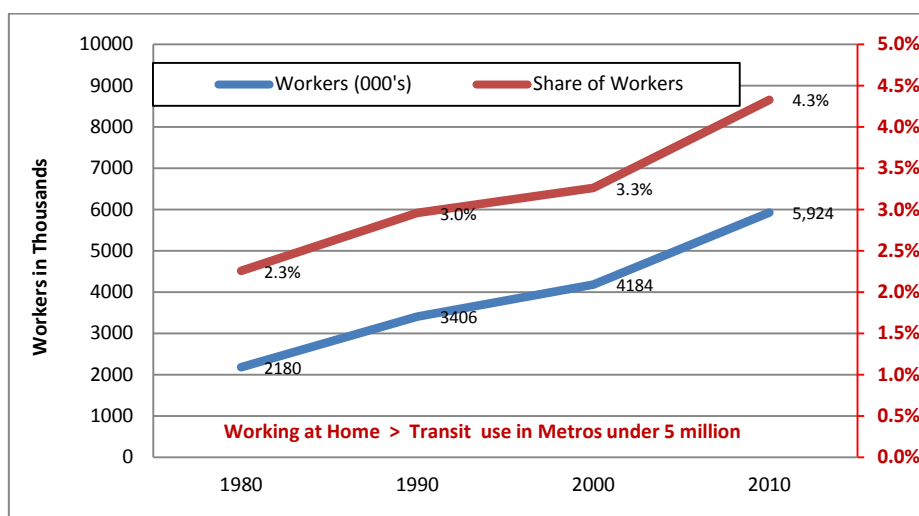
As mentioned earlier the role of transit is in the 30 minute and beyond categories. Transit represents almost a quarter of all trips made at 60 minutes or more. Note also that walking is a significant component, on the order of 10%, of work trips of less than ten minutes.

Trends in mode use

This discussion has proceeded without a complete reckoning of how people get to work in America.

Just above, it was noted that 6.5 million people worked at home in 2014. The long-term trend is dramatic in nature and important in scope; it has tripled since 1980. The figure below indicates that work at home has grown from 2.2 million in 1980 to almost 6 million in 2010 (and as indicated above added another 600 000 in the 4 years since.). Rising from a 2.3% share in 1980 to 4.3% in 2010 and holding the same share in 2014. Of interest is that 3/4ths of those who work at home have multiple vehicles available for their use.

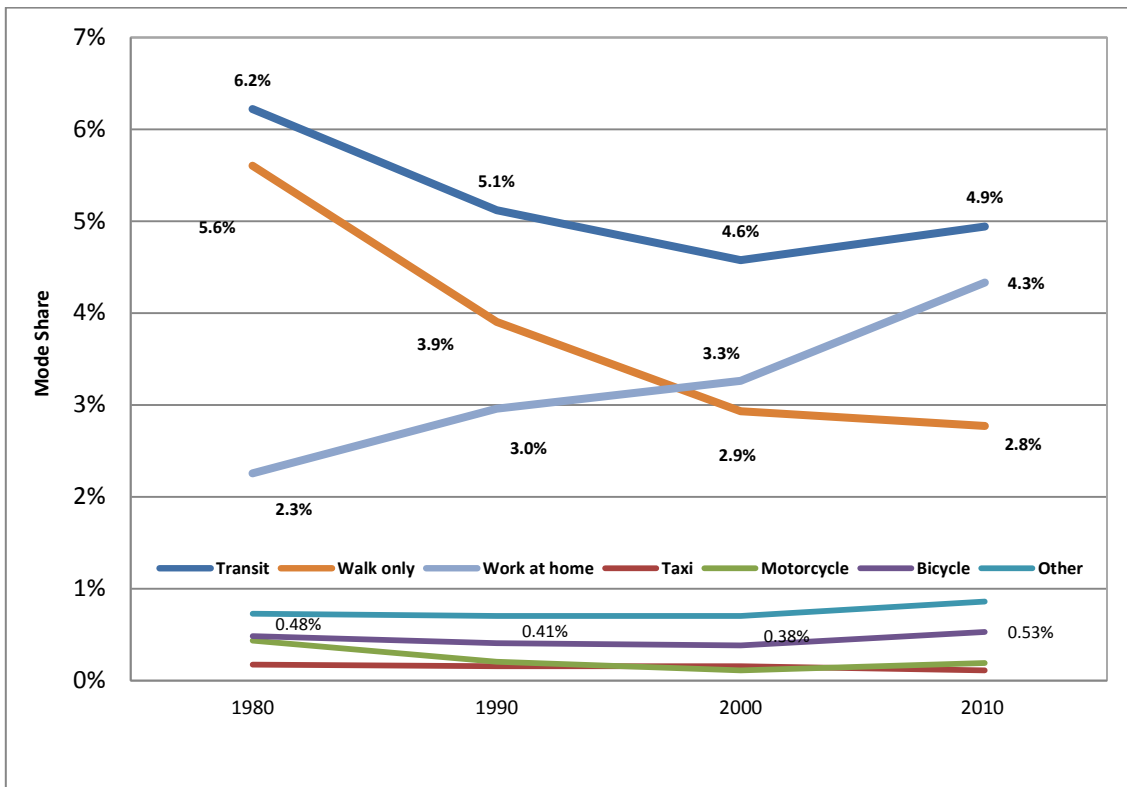
Figure 23. Long term trends in working at home



Source: US Decennial Census

To better frame this statistic, the following figure brings together the mode of work travel in the middle range and in the minor ranges.

Figure 24. Long term trends in the middle and minor modes

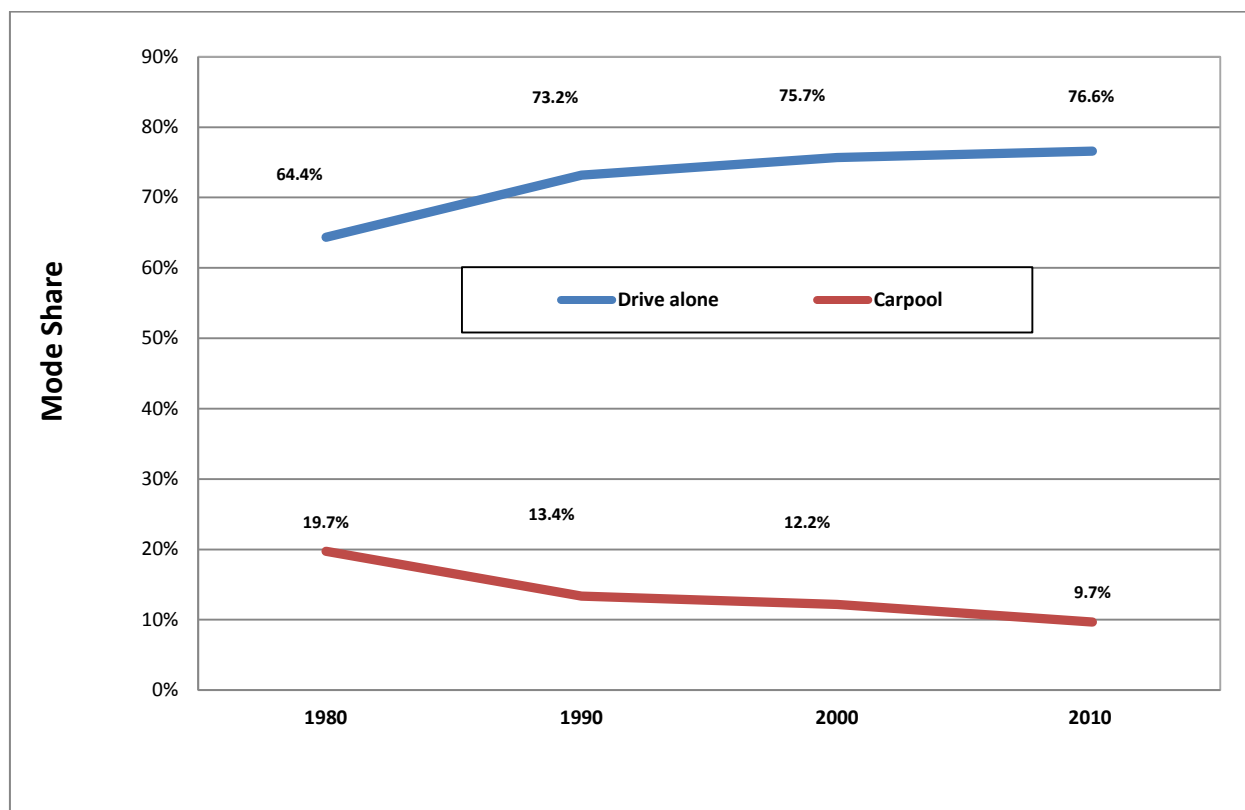


Source: US Decennial Census

The figure above refers to the middle and minor modes. The middle modes are those in a range of 2% to 5% of commuting; while the minor modes are those defined as less than 1% of work travel.

For statistical completeness the major modes are shown below. The decline in carpooling, discussed earlier is shown here losing more than half its share of travel from 1980 to 2010. The Driving Alone mode after a sharp increase in the eighties has registered modest increases per decade. The overall share of the auto-based modes then was 86.3% showing some overall growth despite the sharp declines in carpooling.

Figure 25. Long term trends in the major modes



Source: *Commuting in America 2013*

The advent of new technologies and new approaches to transportation demand

Many new technologies seem to be on the horizon for transportation promising substantial change. One of the attributes of these potential changes is the time line questions expressed either in years or in decades. The degrees of freedom and the variations in conceptual approaches vary sharply and make planning an almost fruitless exercise.

The one technological change that is here now and generating substantial positive and negative disruption is the work of Transportation Network Companies, such as Uber and Lyft, which arrange travel among private providers and users. Their immediate impact, of course, is on the regulated taxicab industry all over the world. They have found immediate positive response from both users and providers, but have generated complex and varying governmental responses to their approach to service. It will be some time before the balances between the heavily regulated cab industry and these new providers are resolved, and a more level playing field established. If nothing else, they have demonstrated how fast-moving, nimble technology companies can quickly out-perform government response.

However, their prospective influence goes well beyond the competition with old-line regulated cab operators. They challenge private vehicle carpooling and transit usage, and even small package delivery systems. American carpooling has been in decline ever since measurement began in the 1980's. Carpooling was responsible for moving almost 20 million workers in 1980 and was down to just above 13 million by 2010. Today in San Francisco the home of the Uber start-up, their carpooling usage exceeds their replicated-taxicab services. Many in transportation planning, particularly in the United States, have long seen carpooling and van pooling as the greatest potential resource for responding to transportation work commute issues, recognizing that the great unused resource are all the empty seats in a car driven by a solo driver, but governmental efforts to expand vehicle occupancies have had very limited success. Today carpooling has fallen below a 10% share of work travel in the US, for many complex economic and demographic reasons, some discussed above. The potential for TNC's to resurrect vehicle pooling using real-time internet tools, as opposed to the more rigid past arrangements can change commuting patterns dramatically drawing from taxicabs, from personal drivers and from transit. The implications of this seem positive but the full implications are unclear. Moreover, added to the potential vehicle fleet are new rental models that include kiosks for cars and for bicycles such as car2go, carshare, bike rentals, bikeshare on an hourly or daily basis. Again, given their nascent nature the roles of these semi-modes are unclear.

Given that Uber-like systems have such substantial potential, imagine a world where the Uber vehicle is driver-less – an autonomous vehicle that can provide similar services at far lower costs and probably lower energy and environmental costs as well. If the concept of a fully autonomous vehicle is considered, either individually owned or available on a service to use basis, the implications are massive.

Consider, for the typical metro area the nature of travel demand as in the following broad demand typology:

Table 9. **Autonomous vehicle implications by trip purpose at the metro level**

Demand typology	Impact	Areas affected
Commuting	High	Alternative use of time, stress reductions
Other Resident Travel	High	More access for young, old, infirm
Tourism	High	Increased opportunities
Service Vehicles	Low	Demand mostly unaffected
Public Vehicles	Low	Demand mostly unaffected
Urban Goods Movement	Low	Delivery functions unaffected, cost changes
Thru Passenger Travel	High	Increased ease
Thru Freight Travel	High	Increased ease and cost changes

These factors focus on the direct demand impacts, other than the much broader general impacts such as increased safety, increased speed, reduced vehicle weight savings, fuel savings and ownership costs.

All of these factors are likely to induce greater ease and reduced impediments to travel resulting in more trips, of longer lengths among an expanded user base (those too young or old, or impaired to drive). However, there are many degrees of freedom in the potential that are open questions which will affect the potential benefits; among these: whether trips are shared or not; whether vehicles park or move on to other uses; what mode shifts will occur in both passengers and freight; and what are the long term land use implications.

In the broadest perspective, it should be seen as a positive step forward for a greater potential market, providing greater access to jobs, workers, social opportunities, services and suppliers. However, there are serious questions that challenge us at this time:

- There are degrees of autonomy. How does the society function in a partly autonomous world?

- The pace of introduction is estimated anywhere from 5 to 50 years with great transition issues!
- Who will own the fleets: individual owners; rental agencies; manufacturers; governments?
- Substantial legal, liability and infrastructure issues are to be resolved!
- Are all consequences benign environmentally and socially?
- Is the shift from a high capital-low operating cost approach now in use to a low capital-high operating cost regimen positive or negative for the economically disadvantaged? What are the trade-offs?
- The employment impacts could be massive; vehicle drivers such as taxis, delivery vehicles, over the road trucking are a major occupational category. A driver's license has been one credential that has opened job opportunities for many, especially the less educated.

These questions and more are unanswerable, except in a very speculative sense, at this time. These issues will play out over the coming decades. They all raise the question as how does planning function in this environment. How might a city plan for a transit system, or a highway, which will take 20 years to complete, in an environment that could obviate the need for such a system before that time?

Concluding thoughts

This limited survey of critical trends now operating in the United States, while not exhaustive does serve to examine some of the dramatic challenges facing the nation in the years ahead. Other countries may share some or many of these same challenges.

The primary concern has to be where will the work force come from to replace the baby-boomer workforce now moving off stage. They will need to be replaced in both numbers and skills. New skills will be required as well. Among the concerns are these:

- The dependency ratio will shift from workers supporting children to supporting older populations
- At the same time a goal for the society must be to retain large numbers of the over 65 population in the work force. Their health and work focus can help make this possible but the work travel and other mobility questions will be a safety and economic challenge. Many already are achieving this role by working at home – which is a modern solution to many challenges. The work at home workforce makes no demands on the society for infrastructure or services.
- It is likely that the work world will be highly varied in terms of time and effort. Part time employment and even full time employment with very varied schedules will challenge employers, benefit travel congestion and better serve family needs.

- In order to sustain the kinds of life styles now achieved and to extend it to those with lesser economic means, as well as to support the growing dependent populations, greater worker productivity will be essential. New technologies will be a great help, but the critical factor will be education, particularly serving the lower income population and the immigrant populations.
- Given the challenges of finding the needed skilled workers, employers will go to where the workers are or where they want to be. The combined needs of skills and education will make universities natural attractions for growth. Many, if not most, employment occupations will be “foot-loose” in that they can locate almost anywhere which has communications and transportation support.
- Only the resource dependent work sites requiring access to minerals or farm products or transportation hubs will be determined by geographic constraints, others can be amenities-based. This will often be the larger metro areas, which as a result will get even larger filling the needs of employers and workers for an adequate commuter-shed in scope and scale within an acceptable range in time, distance and cost.
- Thus, there will be a mix of close-by walkable/bikeable opportunities at the same time long distance commutes reaching accessible jobs and affordable, desirable housing and communities will grow.
- New technologies and new organizational arrangements that are information/communications based will abet and at the same time challenge, traditional transport infrastructure and services.
- With increasingly autonomous vehicles safety, speed and utility of the road system will be enhanced. In some cases, the autonomous vehicle/transit dyad will prove effective.
- Ultimate questions of who owns what kinds of vehicles, making private and public options far more complex and creating new cost structures that promise reduced costs but with many questions remaining to be resolved.
- The transportation labour force itself – vehicle fleet drivers, taxicabs, bus drivers, truck operators – approaching 10% of the labour force in some countries all will be operating in a new and challenging environment with job opportunities in serious question.
- Long term infrastructure planning and development will be in question given the uncertainties and prospects of new and revolutionary transport services and operations.
- The challenges of planning and policy making in this environment will call for far broader understanding of the implications of future trends. Projecting the present into the future beyond the near term will be a hazardous undertaking.
- Will the low-income population be better off or worse off in this new world? The greater speed and lower prospective costs of accessibility to services and opportunities should be a positive and unifying force increasing the ability of the disadvantaged to better engage fully in the society. That needs to be the goal driving much of the decisions that must be addressed.

Notes

- 1 Commuting in America 2013 Brief 4 Population and Worker Dynamics
- 2 A CU is similar to a household except in some shared households in which each person is responsible for their own food, housing, and other expenditures each person is considered a Consumer Unit, e.g. college students in shared housing. There are 127 million CU's in the 2014 Consumer Expenditure Survey, while the Census Bureau sets 2014 households at 117 million.

References

Consumer Expenditure Survey – selected years; US Bureau of Labor Statistics

American Community Survey –selected years, US Bureau of the Census

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