CHAPTER 6

TRANSPORTATION

Draft 3.0 April 2009

Transportation is a prime example of an economic issue that involves lots of public goods. Consider streets, highways and traffic regulations. Imagine if all streets were provided by private entrepreneurs? There would be a massive under-provision of good quality streets except in wealthy areas of cities. This would cause problems for everyone, including the wealthy. To have a good street system in cities and a good highway system outside of cities, therefore, we need to get together and decide as a collectivity what to do and how to pay for it. The same is true for the provision of airports and air traffic control, rail systems, and harbors. In all cases in one way or another public authority is essential for the organization of an efficient transportation system. The market alone will not work.

Transportation also involves in various way problems of externalities, especially around the environment. Automobiles run primarily on nonrenewable fossil fuels, so transportation systems that rely heavily on private automobile transportation will tend to contribute more to the depletion of petroleum for future generations than will systems that rely more heavily on public transportation. Automobile traffic also contributes disproportionately to global warming though carbon emissions. These externalities also will not be counteracted by markets; they require public authority.

Still, actual systems of transportation will always involve some combination of public and private provision. The question is: how are these combined, how are they regulated, how much democratic control over the whole process is there?

One pivotal aspect of this general problem is the social choice between a dense network of publicly-organized transportation in cities and a system relying primarily on private cars. In this chapter we will begin by presenting a general picture of public and private transportation in American cities compared to other places in the world. We will then examine the sociological issues involved in this choice, showing how public transportation is a special kind of collective action problem. This will be followed by an empirical case study of a notorious example of the problems of over-reliance on private cars in a large city: the case of Los Angeles. The chapter will end with a discussion of solutions to the problem of public transformation.

I. Urban Transportation in the United States and Elsewhere

Within the family of developed capitalist economies, the United States relies more heavily than any other country on the automobile for urban transportation. Figure 6.1 presents the breakdown in the percent of all urban trips by type of transport in the United States and a number of other countries. In the United States over 90% of all trips were taken by car compared to 45-60% in most European countries. Public transportation accounts for 10-20% of all trips in most other developed countries; in the US it is only around 2%. For bicycles the contrast is even more striking: In the US less than 1% of all urban trips are done by bicycle compared to 20% in Denmark and 28% in the Netherlands. This cannot be attributed to climate differences, for even in Sweden 10% of all trips are taken by bike.

-- Figure 6.1 about here --

This overwhelming reliance on the automobile was not always the case. Figure 6.2 shows the long term historical trends in ridership of public transportation in the United States. In 1950, public transportation was still a major source transportation: the average person took about 130 public transit trips a year. By 1960 this had decline to around 50 trips per year, and by 2000 to less than 40. When we look more narrowly at commuting rather than all urban trips, we see that not only has there been a steady decline in the use of public transportation in recent decades, but more people drive alone rather than in carpools (Figure 6.3). While automobile use is important in all economically developed countries, in no other country does the automobile so totally dominate the way people move around cities.

-- Figures 6.2 and 6.3 about here --

II. Urban Public Transportation as a collective action problem

One way of understanding the problem of public transportation is to see it as a particular kind of collection action problem. What is especially interesting in this case is that the nature of the free-rider problem faced by individuals is strongly affected by the character of the public transportation system in which individuals make their choices. Let us illustrate this with a hypothetical example of two contrasting public transportation systems in a large city: one that relies entirely on busses that share the streets with cars, and another that has a developed system of light rail or subways.

If you live in the first kind of city you have a choice between riding the bus to work or driving your own car. Suppose the only thing you worry about is "how long will this take"? Here is a possible "pay-off matrix" – a matrix telling you how long it will take for every combination of your choice and the choice made by most other people:

FIGURE 6.4 THE PUBLIC TRANSPORTATION FREE RIDER PROBLEM WITH INEFFICIENT PUBLIC TRANSPORTATION

		YOUR CHOICE	
		BUS	**PRIVATE CAR**
MOST OTHER PEOPLE'S CHOICE	**BUS**	**A** **25 minutes**	**B** **10 minutes**
	PRIVATE CAR	**C** **1.5 hours**	**D** **45 minutes**

The entries in the cells are the length of time it will take you to get to work under different patterns of transportation choices

If all you care about is your time, the best option for you is B. There are relatively few cars on the streets since most people take the bus, so you can get to work in ten minutes. The second best option is for you and most other people to take the bus. This is significantly better

than a situation in which you and most other people drive cars; the high traffic congestion with everyone driving slows everyone down. And the worst choice is to be a bus rider in a world in which most people are driving cars. Your preferences are thus ranked B>A>D>C. Since everyone thinks the same way, alas, you end up with D. This is another classic "free-riding problem".

We can define two interesting numbers for this table: the *free-riding bonus* and the *sucker penalty*. The *free-riding bonus* is the difference in the amount of time it takes you to get to work if most people including you cooperate with the collective good – taking the bus in this case – and the amount of time it takes if you drive a private car and other people takes the bus (i.e. A minus B). The *sucker penalty* is how much longer it takes you to get to work if you take a bus and most other people drive (C minus D). In the example here the free-riding bonus is 15 minutes and the sucker penalty is 45 minutes. Clearly if all you care about is minimizing your own time, you want to get the free-riding bonus and avoid above all the sucker penalty.

Now suppose that instead of buses the city in which you live has and extensive light rail trains and subways. Now the pay-off matrix looks rather different:

FIGURE 6.5 THE PUBLIC TRANSPORTATION FREE RIDER PROBLEM WITH EFFICIENT PUBLIC TRANSPORTATION

		YOUR CHOICE	
		LIGHT RAIL	**PRIVATE CAR**
MOST OTHER PEOPLE'S CHOICE	**LIGHT RAIL**	**A** **15 minutes**	**B** **10 minutes**
	PRIVATE CAR	**C** **25 MINUTES**	**D** **45 minutes**

The entries in the cells are the length of time it will take you to get to work under different patterns of transportation choices

Note how different the pay-offs are here. First, the advantage of driving your car even if most other people take the train is less than the car/bus difference. B is still the fastest, but not by much. The free-riding bonus has declined. Second, if you have a rail system in place and most other people drive a car you are suddenly better off going by train. Why? Because, whereas busses compete with cars for road space, subways and trolleys do not. (The reason why the train takes longer in C than in A is that if most people take the train more trains will be provided so they will run more frequently). There is no longer a sucker penalty!

In actual urban transportation systems, of course, many other factors will influence the actual commuting choices people make: the density and frequency of the transportation network; the precise number of people who drive even when there is good rail available; the available parking, both at commuter rail stations and at destinations; the cost of different transportation choices (public transportation fares, gas, insurance, parking, etc.). One consequence of these

other complications is that in large cities with particularly good public transportation the free-riding bonus will often disappear: for many people public transportation will be consistently quicker than private transportation (B will be greater than A).

This account of the contrast between a city with a public transportation system using only buses and one with efficient light rail illustrates an obvious, but often ignored, point: the private choices people make between different kinds of transportation depend not simply on their general preferences for one kind of transportation or another, but on the practical costs and benefits they face in making those choices. And this, in turn, depends upon the public policies that determine the transportation infrastructure and thus the nature of the alternatives people face. The key question then becomes how we explain these public policies about the transportation choices people encounter.

One answer to this question sees these public policies over transportation as themselves the result of the preferences of citizens. This is what a democracy is supposed to do: citizens elect political representatives who will translate the preferences of voters into policies. If public policies favor urban freeways over subways, then this is because voters prefer to drive cars than use public transportation. The "American love affair with the car" means that politicians who advocate expanded public spending on more efficient light rail systems will tend to lose elections to politicians who argue for more freeways and better parking facilities. It is therefore the preferences and choices of ordinary people acting as consumers who buy and use cars and voters who support highways that determine both the transportation alternatives faced by individuals and the choices they make given those alternatives. In effect, the argument goes, the transportation patterns we observe simply reflect market forces: directly through the private consumption choices of individuals, and indirectly through their political choices in support of those consumption decisions.

Is this a satisfactory answer? Is it the case that consumer preferences are faithfully translated into the public choices about the nature of the transportation infrastructure as well the private individual choices about what transportation to use? We do not believe that the mix of forms of transportation we observe in the United States today can be explained in this way. Rather, the preferences of powerful business interests have played a pivotal role in shaping the nature of urban transit systems, thus creating constraints on the private choices individual consumers can make. A good historical illustration of this process is the fate of public transportation in the city of Los Angeles.

II. Corporate Power and the Automobilization of America: The LA transportation drama[1]

Los Angeles, California, is the iconic urban environment ruled by the automobile. The metropolitan area is crisscrossed by a massive system of multilane highways. In 2005, the metro

[1] This account of the demise of public transportation in Los Angeles is based on research by Snell, Bradford. "American Ground Transport: A Proposal for Restructuring the Automobile, Truck, Bus, and Rail Industries", Report presented to the Committee of the Judiciary, Subcommittee on Antitrust and Monopoly, United States Senate, February 26, 1974 (Washington, DC: United States Government Printing Office, 1974), 6–24. This report was the basis for a documentary film on the destruction of light rail urban transit systems, *Taken for a Ride.*

area Los Angeles-Long Beach-Santa Ana had 5,870 lane-miles of freeway, enough to cross the United States nearly twice. Daily vehicle miles of travel on these freeways was 140,000,000.

It was not always this way. In the period immediately after World War II, Los Angeles had one of the best public transit systems in the country. The city had a dense network of heavily used trolley lines and most people did not own cars. The rapid suburbanization of residential areas had not yet begun. In the movie, *Who Framed Roger Rabbi?,* set in Los Angeles in the late 1940s, one of the characters, Eddie Valiant, discusses the prospects of an automobile based transportation system for the city with Judge Doom:

> **Eddie Valiant**: A freeway? What the hell's a freeway?
>
> **Judge Doom**: Eight lanes of shimmering cement running from here to Pasadena. Smooth, straight, fast. Traffic jams will be a thing of the past…I see a place where people get off and on the freeway. On and Off. Off and on. All day, all night. Soon where Toontown once stood will be a string of gas stations, Inexpensive motels., Restaurants that serve rapidly prepared food. Tire salons. Automobile dealerships. And wonderful, wonderful billboards as far as the eye can see… My god, it'll be beautiful.
>
> **Eddie Valiant**. Come on. Nobody's gonna drive this lousy freeway when they can take the Red Car [trolley] for a nickel.
>
> **Judge Doom**: Oh, they'll drive,. They'll have to. You see, I bought the Red Car so I could dismantle it.[b]

This is, more or less, what happened.

Let's go back to that time in the late 1940s. Suppose you were an automobile manufacturer – say the president of General Motors – and you wanted to expand the market for your main product, private cars. While you expect that the demand for cars will increase spontaneously as the economy develops and more people can afford cars, you realize that there are a number of obstacles to the growth of the automobile market. One of these is the existence of good public transportation in many cities. So long as public transportation is efficient, inexpensive and convenient, many people in large cities will choose not to even buy cars, and even if they own them, they will rely mainly on public transportation for most trips within the city. So what would you do? What would be a good strategy for dramatically expanding the popular demand for cars? Here is a strategy which might seem very attractive, especially in a place like Los Angeles which was booming and had plenty of surrounding open land to grow: Since you control a rich and powerful corporation, you could buy up local electric public transit lines and convert these systems to diesel buses, which, incidentally, you also manufacture. In order to make this purchase of local transit system not seem too obvious, it would be a good idea to create a subsidiary and have it actually do the work. As part of this business plan, of course, you need to pull up the rails previously used by electric street cars, thus making it difficult in the future to reverse the conversion from electric rail to diesel buses, and you need to destroy the old

[b] Quoted in Alejandro Reuss, "Car Trouble: the automobile as an environmental and health disaster," p.53 in Daniel Fireside, et. al (editors) *The Environment in Crisis: PROGRESSIVE PERSPECTIVES FROM Dollars & Sense (third edition* (Boston: Economic Affairs Bureau, 2005)

electric street cars since will no longer be needed. Once this process has proceeded for a while, people will no longer be so keen on public transportation, since the trips will take longer and be less comfortable, so ridership will decline, and with this decline the costs of public transit will go up. While you might lose some money from this since you will sell fewer buses, you will make it up many times over through the sale of additional cars. Because of the deterioration of public transit and increasing traffic congestion, citizens will begin demanding more freeways. To be sure that these voices are heard, you should also organize a well-funded lobby for building highways. Your friends in tire manufacture, construction, and oil will be happy to join with you on this. You will be able to argue that people are buying cars and choosing them over public transportation, so this is where public investments should be directed. Once this dynamic is set in motion it will be self-perpetuating, producing an ever-stronger popular constituency for automobiles and less and less public support for public transportation.

This is basically what happened in Los Angeles and many other cities in the United States. While it would be an exaggeration to say that all of this was fully clear to the key actors from the beginning, a subsidiary of General Motors did buy up the electric streetcar companies in Los Angeles and converted them to bus systems, and then let the bus service deteriorate as part of a strategy of encouraging private automobiles. The national trends in this displacement of streetcars and light rail transit by buses, followed by the decline in busses, is shown in Figure 6.6.

-- Figure 6.6 about here --

The result was that by the middle of the 1950s there was a strong consensus among political officials throughout the United States in favor of the automobilization of transportation. This combined with construction companies' interests in building freeways and real estate interests in low density suburbanization. As people invested in cars and suburban housing, a mass constituency for these policies also developed: people in suburbs wanted more freeways. This generated a particular model of urban growth: urban sprawl, degraded public transportation, the decline of central cities, and many other features of the urban environment today. The deliberate destruction of efficient public transportation systems played an important part in the process.

At the beginning of the 21st century it is clear to many people that this model of urban life and transportation is undesirable and perhaps unsustainable. The reliance on private automobiles contributes significantly to global warming, traffic congestion creates an enormous waste of time, and the rising cost of gasoline makes private transportation less cost effective for most people than a good public transportation system.

These outcomes were not the result of the operation of the "free market" governed by consumer sovereignty. Rather they are the result of the exercise of private concentrations of economic power that were capable to shaping the economic environment in which individuals made their private choices. And the only way that this environment of transportation choices can be significantly transformed is through the exercise of public power to build new infrastructure and impose new rules of the game in which both individuals and corporations make their "rational" economic choices.

III. The Social costs of an Automobile based transportation system

If the heavy reliance on automobiles had no serious on-going social and economic costs, then it would not be a pressing matter to try to reconstruct an efficient public transit system in the United States. The individual choice to drive would simply be that – an individual choice. The highly privatized automobile system of transportation, however, has significant social costs and thus is not simply a matter of private, individual concern. Most obviously, automobiles are tremendous users of fossil fuel. On a per capita basis Americans consume vastly more gasoline than almost any other country (Figure 6.7) – over 1600 liters per year compared to 400 liters or list in most other countries. Given the finite character of this resource, this is a wasteful use of this valuable resource. But of course, the issue here is not simply squandering a nonrenewable resource. Burning gasoline to move people around cities contributes significantly to carbon emissions and global warming: approximately a quarter of all greenhouse gases in the United States are generated by automobiles.[3] This massive negative externality makes the private use of automobiles a matter of collective, public concern.

-- Figure 6.7 about here --

Even if we ignore these environmental concerns, the over-reliance on the automobile for urban transportation generates a huge amount of economic inefficiency in terms of time and money. Figure 6.8 presents estimates of the annual hours of delay per traveler due to traffic congestion in selected large American cities in 1982 and 2005. In every city the situation has gotten much worse during this period. In Los Angeles the annual delay per traveler was 72 hours, nearly two standard work weeks. In Dallas-Fort Worth the delays attributable to congestion increased from about 10 hours a year in 1982 to 58 hours a year in 2005. The average for all of the 14 largest metropolitan areas in the United States increased from 21 hours of delay in 1982 to 54 hours of delay in 2005.

-- Figure 6.8 about here –

Time is money. The delays due to congestion in Figure 6.8 are not simply annoying; they are expensive. If we impute an hourly cost to the time lost and add to this the cost of excess fuel consumption, it is possible to calculate a rough cost of congestion. The figures for the ten cities with the highest congestion costs are presented in Figure 6.9.[4] The total for these cities comes to nearly $40 billion annually.

IV. Solutions

[3] Paul Hawkien, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism: creating the next industrial revolution* (Boston: Little, Brown and Company, 1999). p.23

[4] The value of time delay in Figure 6.9 is estimated at $14.60 per hour of person travel and $77.10 per hour of truck time, and the excess fuel consumption is estimated using state average cost per gallon.

Individuals making private consumption decisions can have some impact on problems of traffic congestion and the pollution and energy waste of automobile transportation. Individuals can choose to use public transportation, to ride bicycles, to walk, to buy cars with higher energy efficiency. But to really make headway on these issues, public policy and collective, democratic regulation of the contexts for individual choices must play a major role. Here are a few of the things that could be done.[5]

1. **Use taxes to charge people the true costs of driving and parking.**

Gasoline in the United States is cheaper than in any other developed capitalist economy. This is not because the cost of the gas itself is less but because we have the lowest levels of taxation on gasoline of any comparable country. As shown in Figure 6.10, in 2005 the average tax on gas in the US was a total $.46 a gallon. In other developed countries the typical range is between $2 and $4. One of the reasons Americans drive so much and are willing to drive such inefficient cars is because gasoline is so underpriced relative to its true social costs. This is an example of the more general problem of the way markets underprice things that have large negative externalities: the true costs of producing and consuming gasoline are not reflected in the market price both because of the knotty problem of the future value of the resource and because of the myriad of negative externalities of its present consumption. A high gasoline tax is one way of correcting this inefficient market pricing.

Gasoline, however, is only one aspect of the under-pricing problem for automobile use. Another serious problem is the underpricing of parking. Shopping malls and offices typically provide "free" parking for employees. This creates the illusion that the provision of such spaces is actually costless. Paul Hawken, Amory Lovins, and L. Hunter Lovins, describe the issue this way:

> …instead of today's nearly universal U.S. practice of providing "free" parking occupying up to several times as much area as workers' office space, employers could instead charge fair market value for parking and pay every employee a commuting allowance of equal after-tax value. Workers – a third of whose house-hold driving miles are for commuting – could then use that sum to pay for parking, *or* find access to work by any cheaper method – living nearby, walking, biking, ridesharing, vanpooling, public transit, or telecommuting. Users of alternatives could pocket the difference.[6]

Similar procedures could be adopted to charge people the true cost of using streets and highways. In London and a number of other cities motorists are charged "congestion fees" for driving in the central areas of the city during the day. Many bridges and tollways adopt congestion pricing and

---

[5] The discussion which follows draws heavily on Paul Hawkien, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism: creating the next industrial revolution* (Boston: Little, Brown and Company, 1999).

[6] Paul Hawkien, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism: creating the next industrial revolution* (Boston: Little, Brown and Company, 1999). p.42

reserve lanes for cars with multiple passengers in order to encourage ridesharing. More drastic measures include banning cars altogether from the central areas of cities.

2. Rethinking Public Transportation

In the United States, with the strong ideological commitment to market-based solutions to social and economic problems, most people think that public transportation should be able to cover most of its costs of production through the price of tickets. This sounds reasonable. Isn't this what "fair competition" is all about: you produce something for sale on a market and if people want it at the price that covers costs, then they will buy it. If public transportation is heavily subsidized through taxation, many people feel that this creates unfair competition with other modes of transportation, especially cars. And why, after all, should people who don't use public transportation be subsidizing people who do use. Surely the users should pay.

These are familiar arguments, but they fundamentally misunderstand the complex problem of the relationship between a public good like public transit and market pricing. As we have argued, public transportation has many positive externalities which benefit everyone, not simply the people who directly use the service. Here is a partial list:

- Reduced air pollution, including greenhouse gases
- More efficient labor markets since it is easier for poor people to get to jobs. This is a benefit to employers for it makes it easier to hire people and it is a benefit to the people without cars who now find it easier to get jobs. But it is also a benefit to the society at large because it contributes to a long term reduction in poverty and thus reduces the costs of social problems associated with poverty.
- Less frequent need for house painting because of reduced particulate pollution
- Health benefits: reduced asthma and other illnesses linked to automobile generated pollution
- Less congestion on the highways for those who do need to drive

Now, suppose that we could put a dollar value on all of these positive externalities that would come with a massive increase in efficient public transportation. These are real economic benefits which would not happen in the absence of such investment, real economic value that is being generated by the transportation service. What this means is that the costs and revenue connected to producing the service in question are not properly reflected on the balance sheets of public transportation. The balance sheet of the transportation service only includes the costs directly paid by the service – wages for transportation workers, infrastructure costs, operating costs, etc. – and the revenues they receive from tickets. None of the enormous positive economic benefits appear on the balance sheet. If the economic value of these positive, but hidden, benefits were included on the balance sheet, then we suspect that there would be no need to charge consumers anything for rides in order for public transportation to be "profitable". Rides could be free since even with free tickets, the sum of all of the positive externalities is likely to exceed the

financial costs of building and running a comprehensive public transportation system.[7] Remember also that it costs something to charge people for tickets: you need a monitoring system, cashiers, accountants, ticket machines, etc. Part of the cost of tickets, therefore, simply covers the costs of selling tickets. These costs would be eliminated completely with a free transportation system.[8]

Of course, it could turn out that there might be reasons for charging people something to use public transportation, even if on strict efficiency grounds free rides would be justified. The pivotal issue here is that there are good economic grounds to use our collective resources – which we call "taxes" – to provide intensive and extensive public transportation and to drastically reduce the direct costs of rides to users. This should not be thought of as a "subsidy" in the sense of a transfer of resources to an inefficient service in order for it to survive, but rather as the optimal allocation of our resources to create the transportation environment in which people can make sensible individual choices.

3. Transformation of land use and community

The problem of urban transportation is deeply connected to a much broader and more complex set of issues around the use of land, the character of communities, and the spatial organization of work, leisure, shopping, and residence. In the United States in the decades following the Second World War, cities developed around the use of automobiles, which created sprawling suburbs for which the automobile in turn became a necessity. Shopping was concentrated in malls and shopping districts rather than integrated into neighborhoods. The disappearance of the neighborhood grocery store means that for most people, shopping for food requires a car. Zoning rules which require large plots of land for houses means that public transportation must cope with the problem of low density residence.

It is no easy task to undo these developments, both because of the cultural expectations about housing and transportation, and because of the physical constraints created by a given "built environment" of cities. In the long run, however, a fundamental transformation of existing

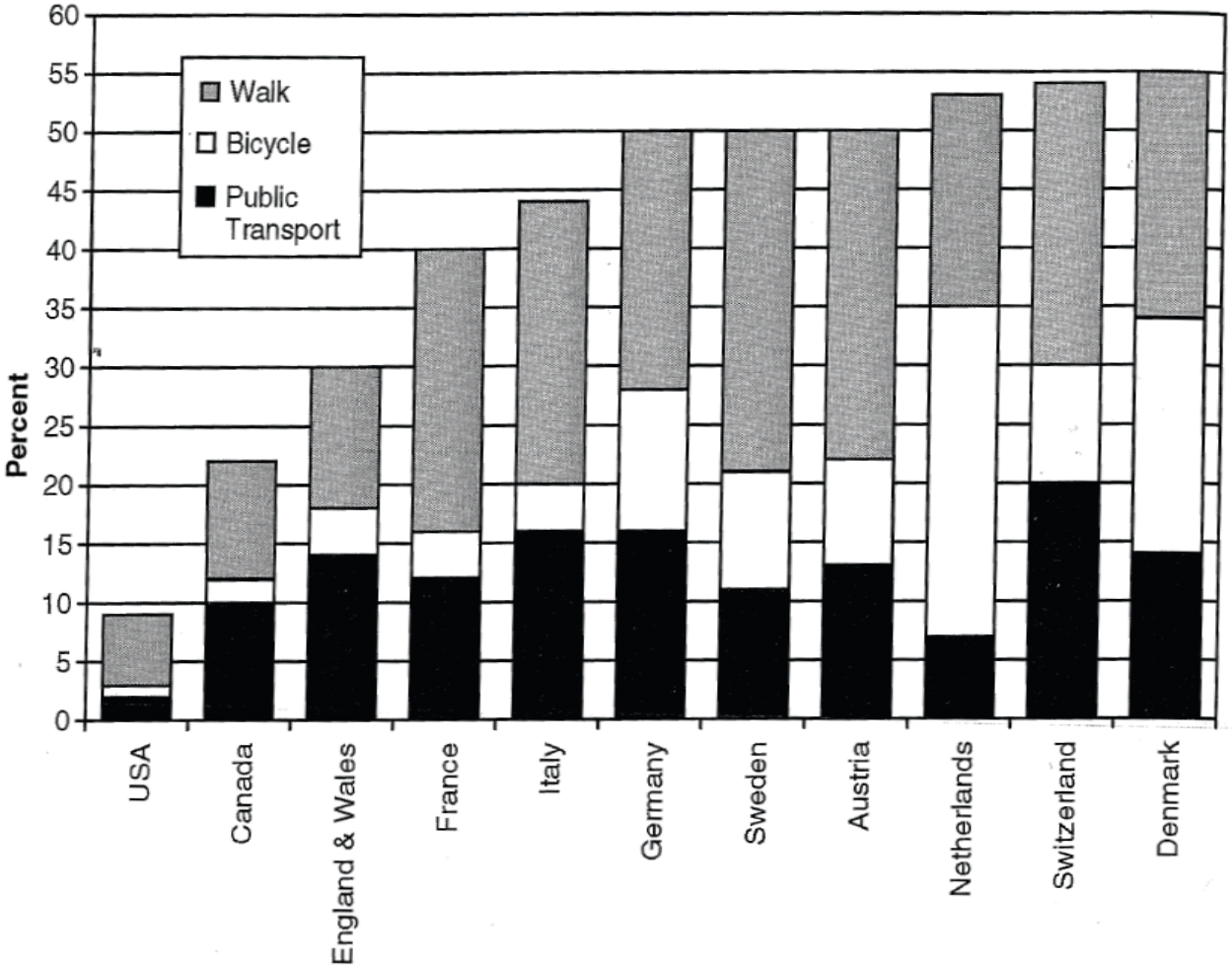
---

[7] Remember also that it costs something to charge people for tickets: you need a monitoring system, cashiers, accountants, ticket machines, etc. These constitute "deadweight losses" for public transportation since they constitute a cost of letting people have access to the rides but do not themselves contribute to providing rides. We know of no attempt at estimating the full gambit of positive externalities – including positive externalities for future generations – of a comprehensive public transportation system, so this claim remains speculative. What is for certain, however, is that it is grossly inefficient economically for ticket prices to cover most of the costs of rides on public transportation.

[8] Imagine what it would be like, for example, if we charged people for walking on sidewalks on the grounds that the users of this service should cover the costs of providing the sidewalks. This would make sidewalks more expensive, for now the "cost" of a sidewalk includes the cost of sidewalk fee enforcers and collectors.

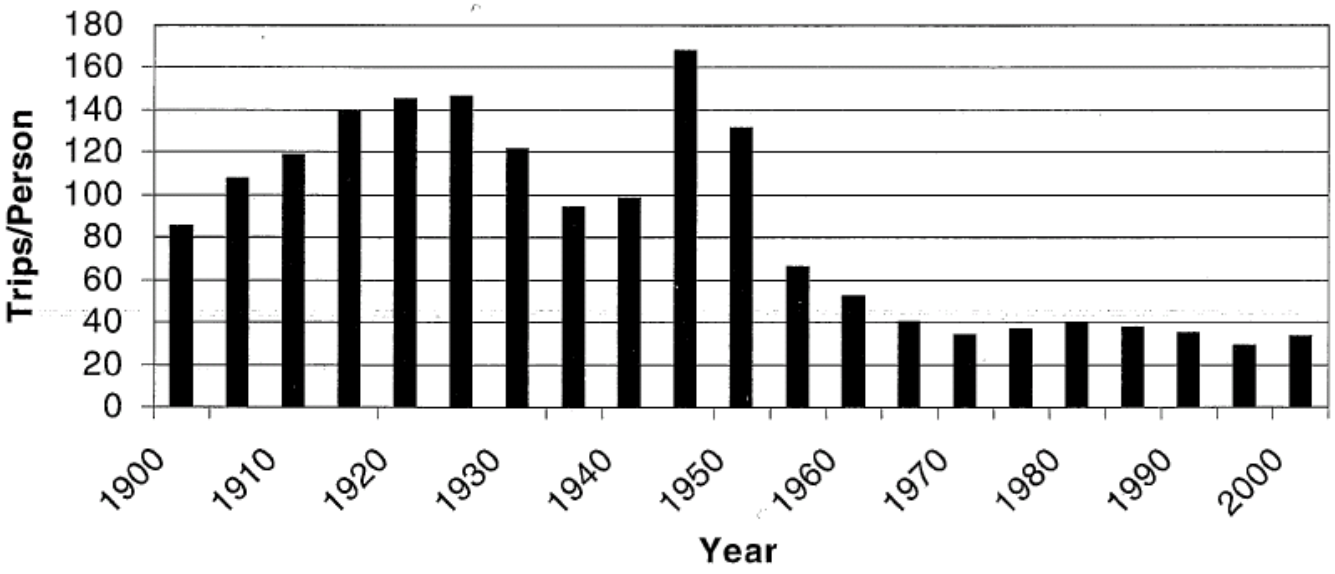
patterns of land use and urban development is essential for reasons of environmental sustainability, economic efficiency and quality of life. There is a wide range of proposals for accomplishing this transformation, including new rules for land use zoning that encourage higher density residential areas; developing residential areas that are more closely integrated with commercial districts, employment centers, and recreation; building urban transportation systems around bicycles, walking and public transportation, rather than cars. None of these developments will happen simply as a spontaneous result of market forces. They require the exercise of public power to democratically solve collective transportation problems.

Figures, Chapter 6



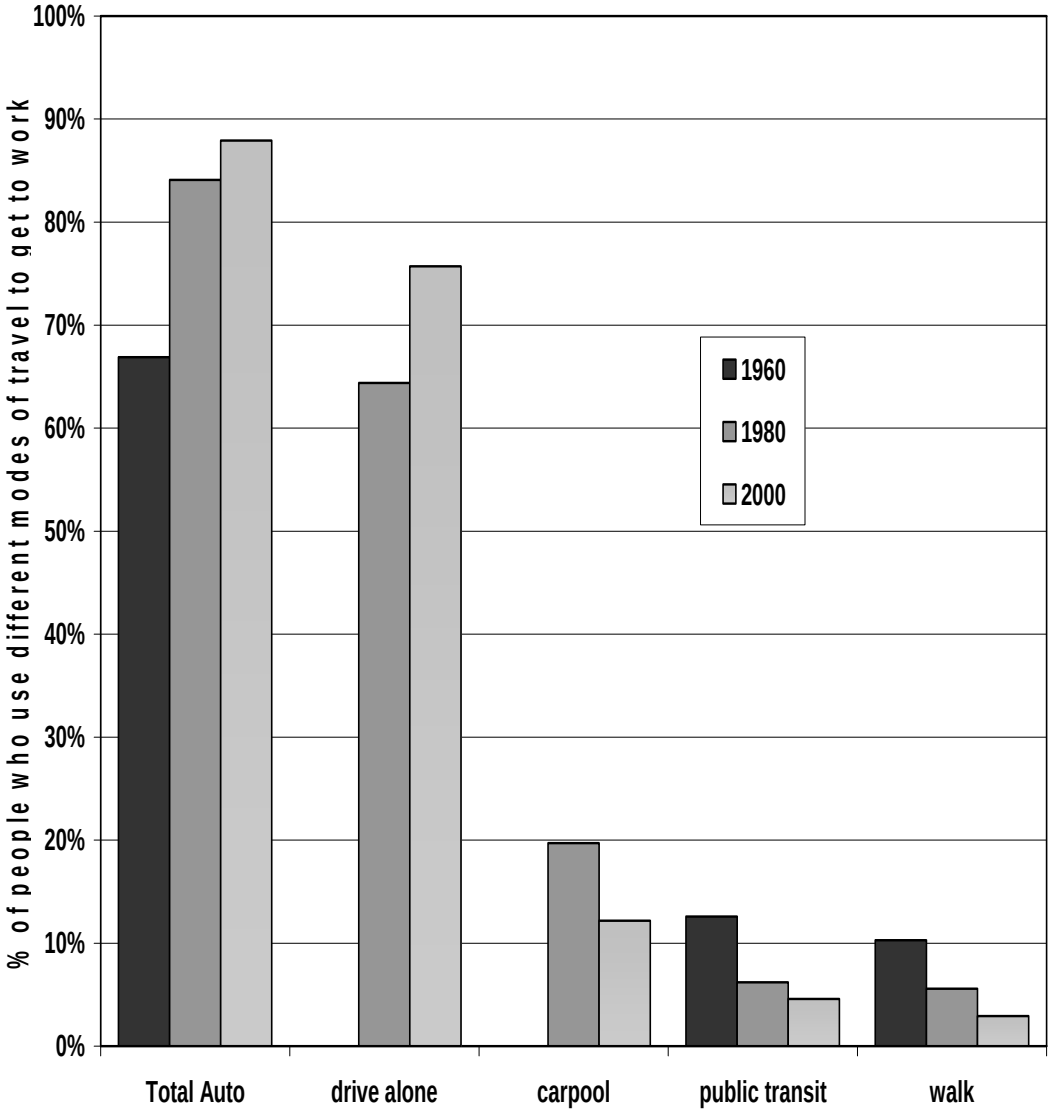
Source: John Pulcher, "Public Transportation", in Susan Hanson and Genevieve Giuliano, *The Geography of Urban Transportation*, third edition. (New York: The Guilford Press, 2004). p.216. Data are from 1995 and cover all trip purposes.

Figure 6.1
Percent of all urban trips by type of transport.



Source: Brian D. Taylor "The Geography of Urban Transportation Finance", in Susan Hanson and Genevieve Giuliano, *The Geography of Urban Transportation*, third edition. (New York: The Guilford Press, 2004). p.317.

Figure 6.2
Trend in per capita annual public transit ridership, 1900-2000



Source: 1980 and 2000 data are from *Commuting in America: Third national report on commuting patterns and trends* National Transportation Research board of the National Academies of Sciences, (Transportation Research Board, Washington DC 2006) p.xiv. The 1960 data are from John Pucher and John L. Renne, "Socioeconomics of Urban Travel: Evidence from the 2001 NHTS," *Transportation Quarterly*, Vol. 57, No. 3, Summer 2003 (49–77).

Figure 6.3
Percent of people who use different modes of travel to get to work, 1960-2000

FIGURE 6.4 THE PUBLIC TRANSPORTATION FREE RIDER PROBLEM WITH INEFFICIENT PUBLIC TRANSPORTATION

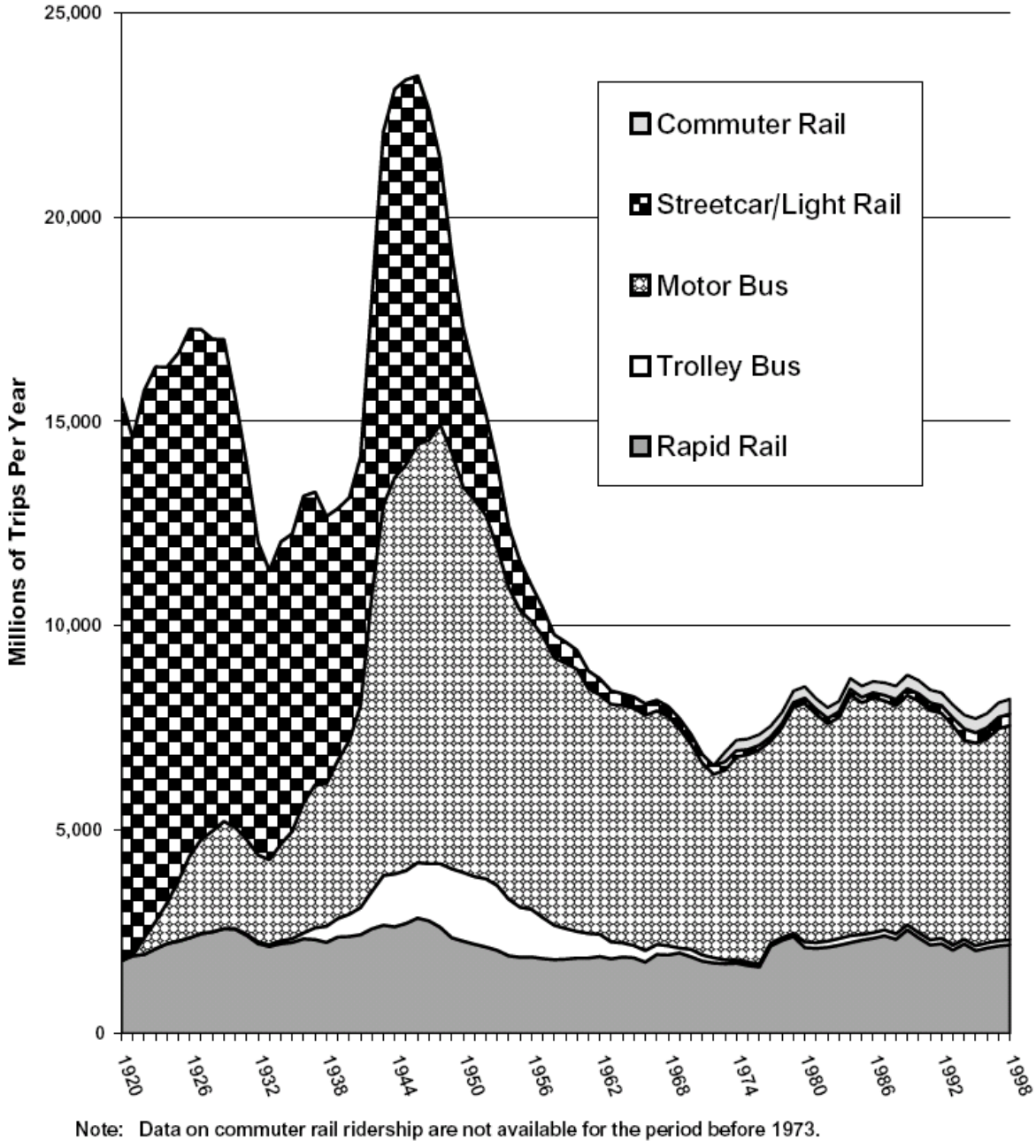
		YOUR CHOICE	
		BUS	**PRIVATE CAR**
MOST OTHER PEOPLE'S CHOICE	**BUS**	**A** **25 minutes**	**B** **10 minutes**
	PRIVATE CAR	**C** **1.5 hours**	**D** **45 minutes**

The entries in the cells are the length of time it will take you to get to work under different patterns of transportation choices

FIGURE 6.5 THE PUBLIC TRANSPORTATION FREE RIDER PROBLEM WITH EFFICIENT PUBLIC TRANSPORTATION

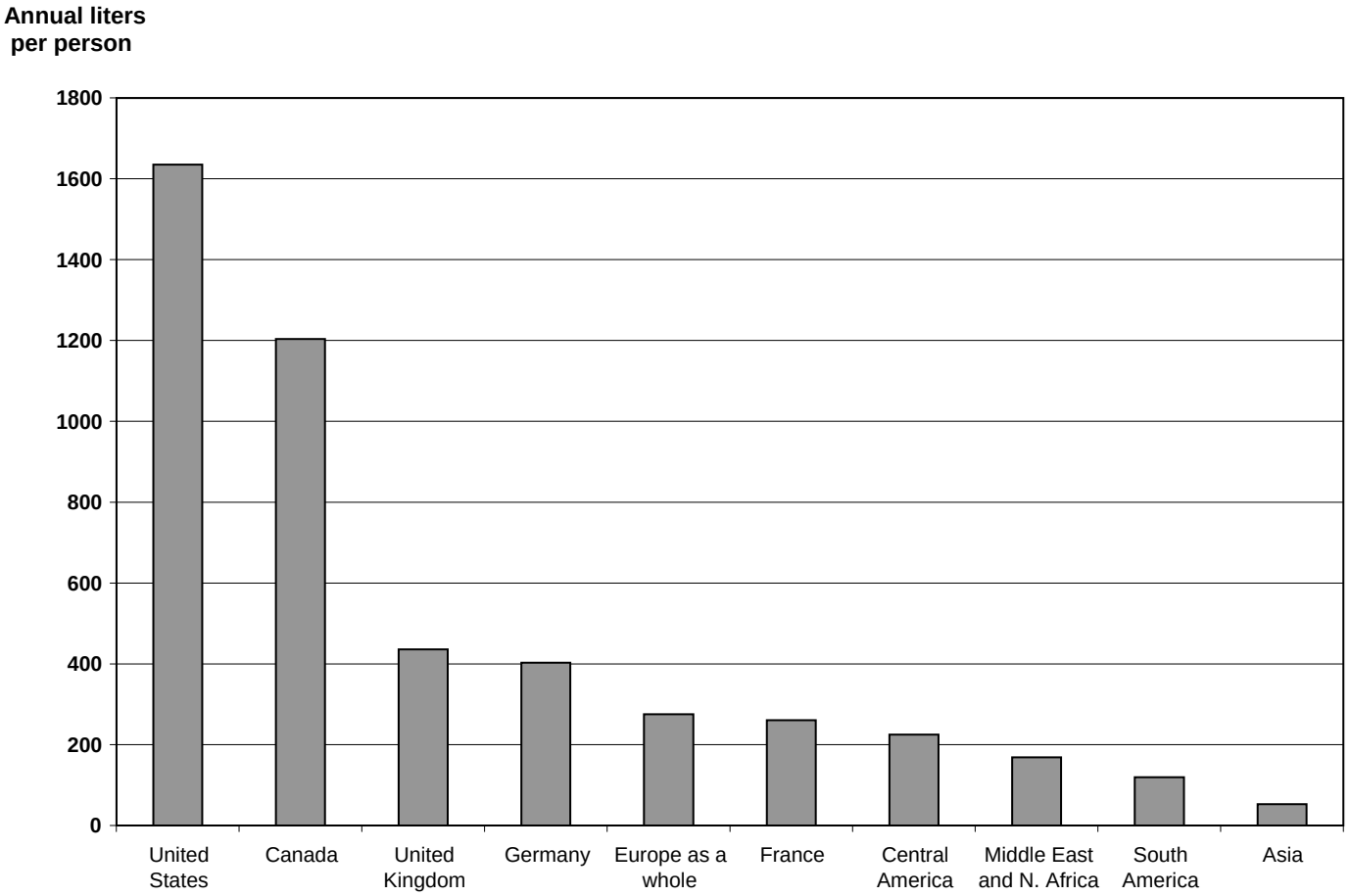
		YOUR CHOICE	
		LIGHT RAIL	**PRIVATE CAR**
MOST OTHER PEOPLE'S CHOICE	**LIGHT RAIL**	**A** **15 minutes**	**B** **10 minutes**
	PRIVATE CAR	**C** **25 MINUTES**	**D** **45 minutes**

The entries in the cells are the length of time it will take you to get to work under different patterns of transportation choices



Source: *Making Transit work. Special report 157* Transportation Research Board , National Research Council (National Academy Press, Washngton DC 2001) p.23

Figure 6.6
National trends in annual passenger trips by transit mode, 1920-1998

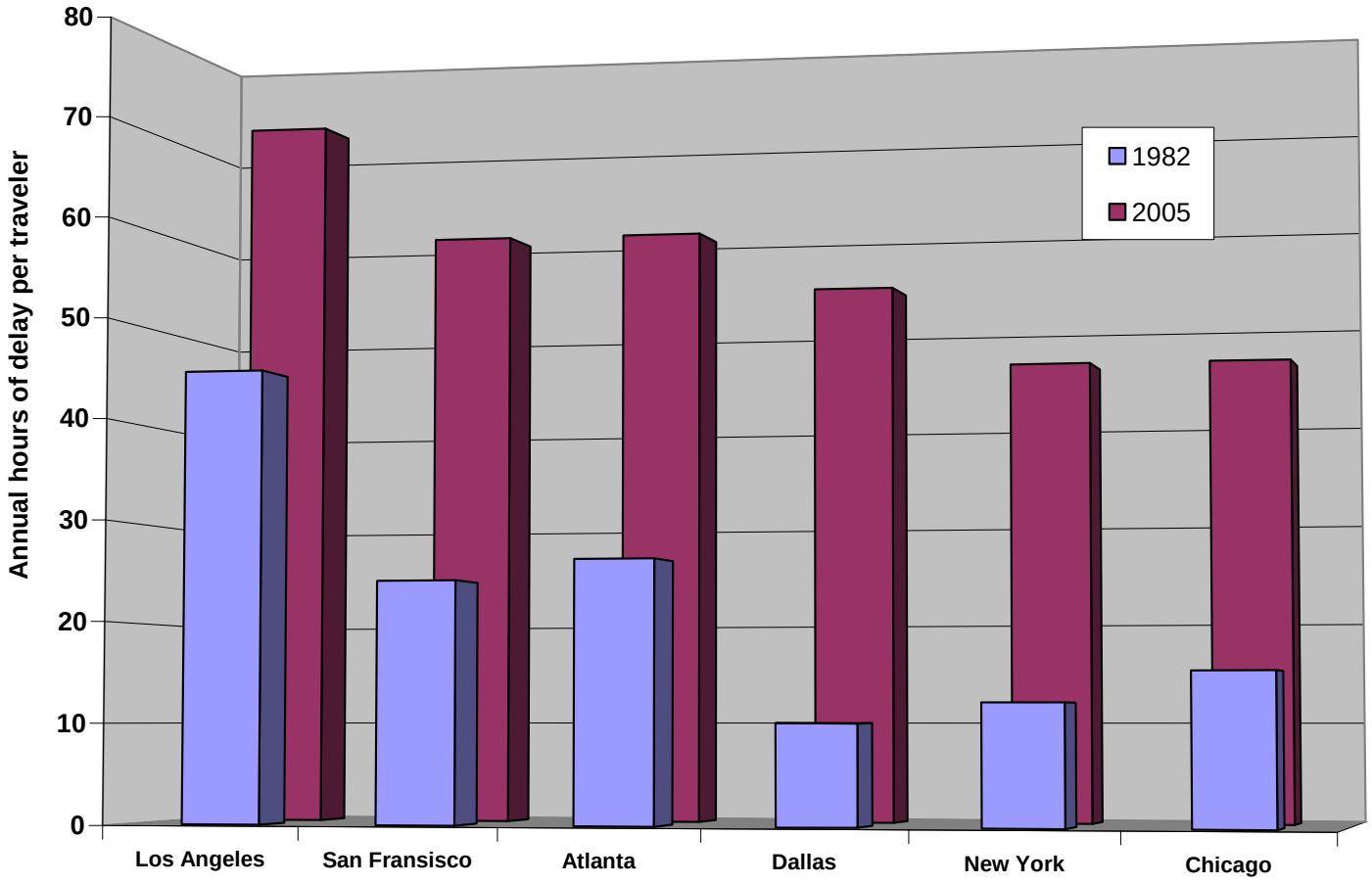


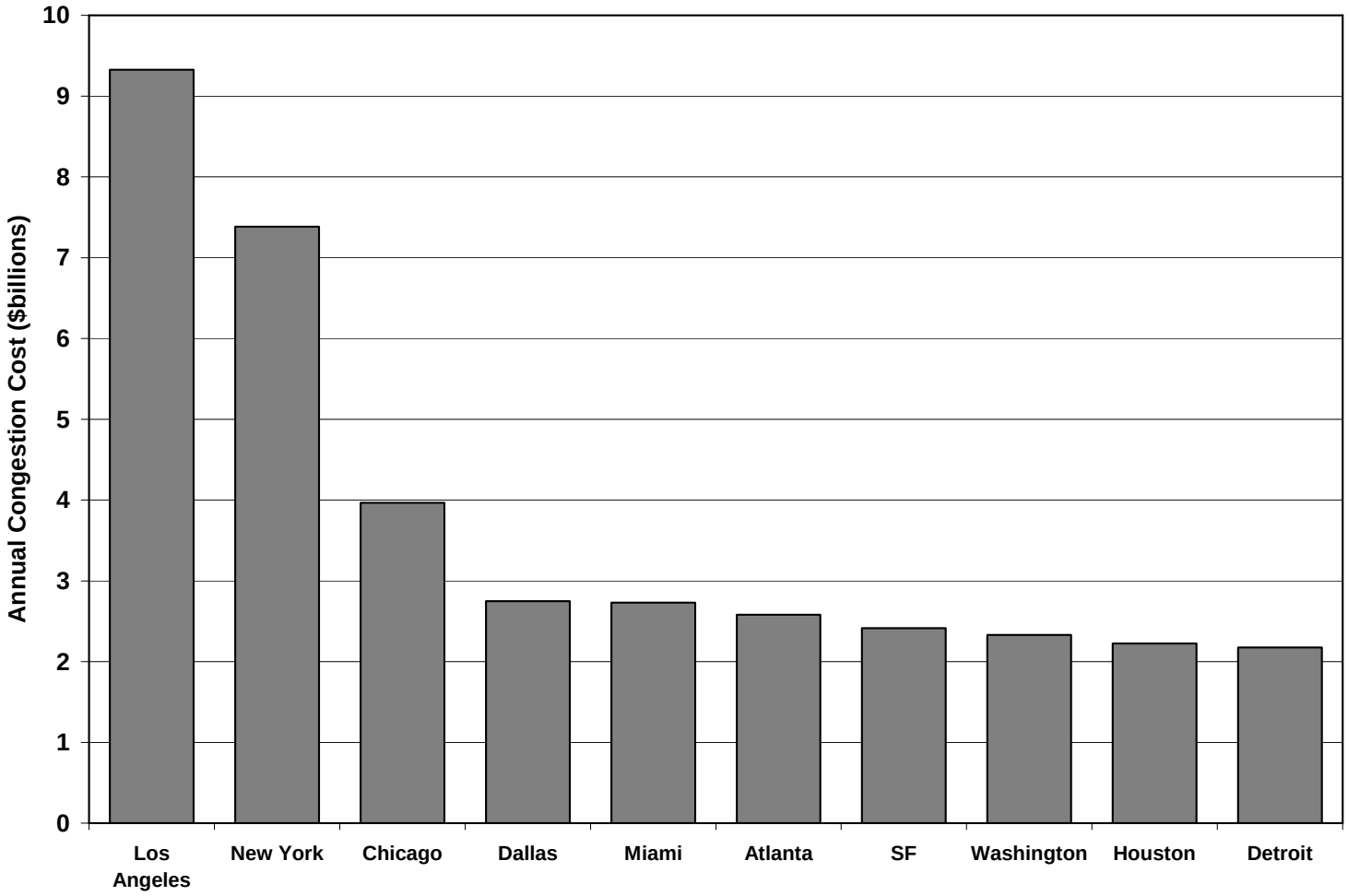
Source: *World Resources Institute. 2009 EarthTrends: Environmental Information. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute. EarthTrends, searchable database*

Figure 6.7
Gasoline consumption per capita, 2003

Source: Schrank, David and Tim Lomax. 2007. *The 2007 Urban Mobility Report*. College Station, TX, Texas Transportation Institute, The Texas A&M University System , table 4, p. 38

Figure 6.8
Annual average hours of delay per traveler due to traffic congestion


Annual hours of delay per traveler
80
70
60
50
40
30
20
10
0
1982
2005
Los Angeles
San Fransisco
Atlanta
Dallas
New York
Chicago



Definitions:

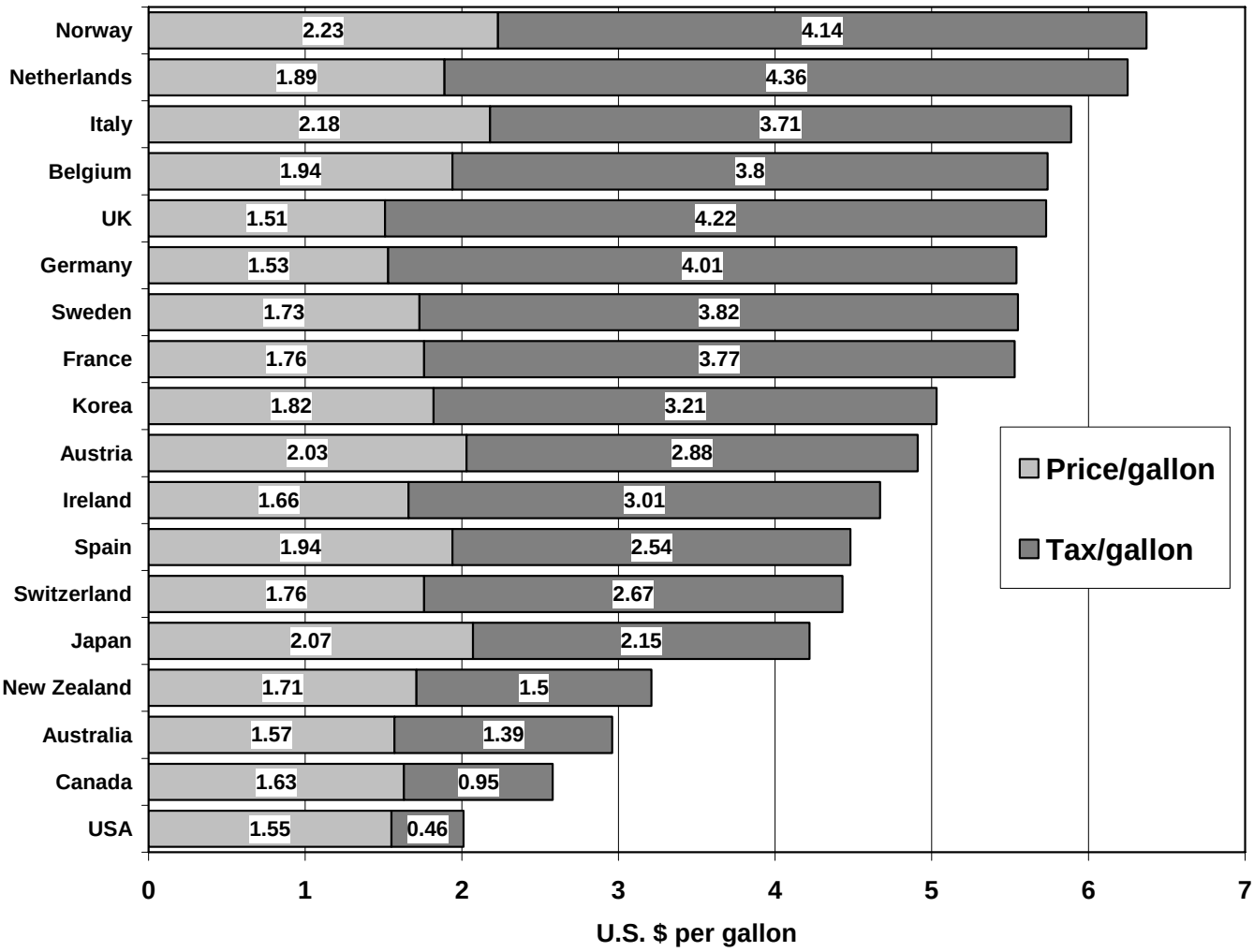
Travel delay = travel time above that needed to complete a trip at free-flow speeds. The value of travel delay is estimated at $14.60 per hour of person travel and $77.10 per hour of truck time.

Excess Fuel consumption = increased fuel consumption due to travel in congested conditions rather than free-flow conditions. The value of excess consumption is estimated using average state cost per gallon.

Congestion cost = Excess fuel consumption + Value of excess travel time

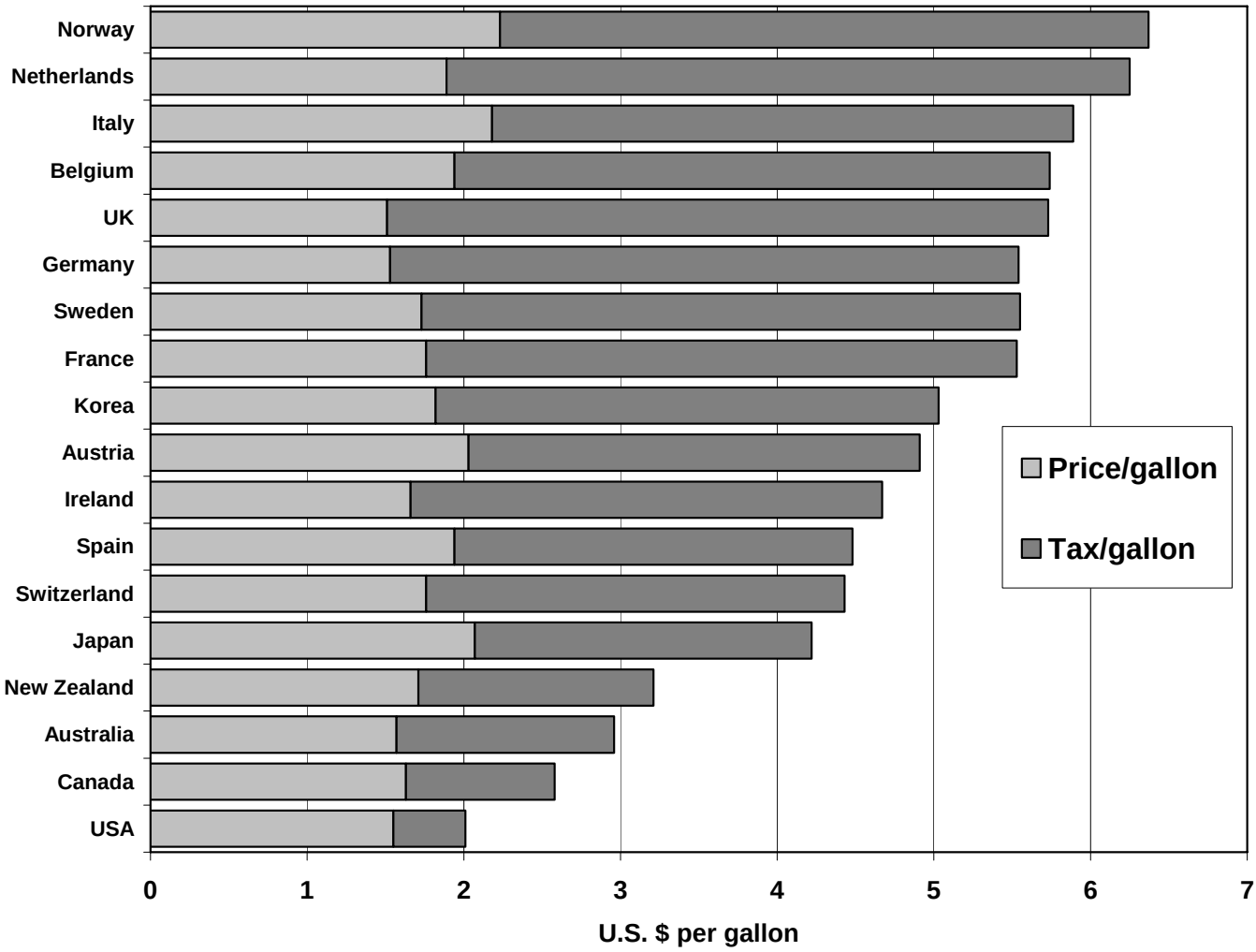
Source: Source: Schrank, David and Tim Lomax. 2007. *The 2007 Urban Mobility Report*. College Station, TX, Texas Transportation Institute, The Texas A&M University System , table 2 p. 34

Figure 6.9
Annual traffic congestion costs in selected large urban areas, 2005



Source: International Energy Agency. Energy Prices and Taxes, Vol. 2005, No. 2, pp. 1-521

Figure 6.10
Gasoline prices and taxes in developed countries, 2005



Source: International Energy Agency. Energy Prices and Taxes, Vol. 2005, No. 2, pp. 1-521

Figure 6.10
Gasoline prices and taxes in developed countries, 2005