Questions for Lecture Notes IV

- How do governments deal with traffic problems such as Congestion, Pollution and Accidents?
- Why do so few commuters use mass transit?
- How do government policies affect mass transit?
Some facts about car use

**FIGURE 10-1** Modal Choice for U.S. Commuters

![Bar chart showing percent using mode of transportation.]

- Drove alone: 75.7%
- Carpoled: 12.2%
- Public transit: 4.7%
- Walked: 2.9%
- Worked at home: 3.3%
- Other: 1.2%

Externalities from autos

- There are big benefits from cars but also costs to society.
- Negative externalities are the costs we impose to the rest of society from our actions, without paying for them.
- Externalities always lead to inefficiencies when considering the social optimum result.
- Negative externalities from the use of cars:
  - Congestion
  - Pollution
  - Accidents
Some facts about congestion

- In 2003 the typical commuter wasted 47 hours because of traffic congestion (93 in LA, 72 in San Francisco, 69 in DC)

- In 2003 waste of $5 billion worth of gasoline and diesel fuel because of delays and slow traffic.

- Adding these two costs, the annual cost of traffic in the US is around $63 billion per year.
Externalities from autos

Consider $T=$Trip cost and $V=$Number of vehicles

- Demand of commuting trips $\quad V = 120 - T$

- Private trip costs (time and car costs) as a function of the number of vehicles on road $\quad T = 3V$

- Externalities (costs imposed to other cars by an additional vehicle) $\quad E = 2V$

- SOCIAL COST $\quad ST = T + E = 5V$
Externalities from autos

<table>
<thead>
<tr>
<th>Number of vehicles (in millions)</th>
<th>Trip Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>Private Trip Costs</td>
</tr>
<tr>
<td>100</td>
<td>Social Trip Costs</td>
</tr>
<tr>
<td>90</td>
<td>Demand or Marginal Benefits of Trips</td>
</tr>
</tbody>
</table>

Inefficient vehicles

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Externalities from autos

- Private Trip Costs
- Social Trip Costs
- Demand or Marginal Benefits of Trips

Net gain from congestion tax

Number of vehicles (in millions)

Inefficient vehicles

Tax = 40

Trip Costs

Number of vehicles

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Congestion taxes and urban growth

Utility per worker (in $)

Workers per city

Region A

Region B

Congestion taxes
In city B

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Congestion taxes under “rush hours”

- **Private Trip Costs**
- **Social Trip Costs**
- **Off-Peak Demand**
- **Peak Demand**

Trip Costs vs. Number of vehicles (in millions)

- **Tax=40**
- **Tax=20**
Some considerations on congestion taxes

- **Estimations**
  - San Francisco
    - Rush hour: Between $0.65 (per mile on central urban highways) and $0.17 (per mile on fringe highways).
    - Off-peak hours: Between $0.03 and $0.05
  - Los Angeles
    - Congestion exists around 28% of the time. Tax around $0.15/mile

- **Implementation**
  - VIS (Vehicle Identification System)
  - Prepaid System
  - Area Licensing System (Singapur)
  - Toll Roads
  - HOT (High Occupancy and Toll) lanes
Some considerations on congestion taxes

- Congestion pricing and taxes are a nice way to reduce traffic problems in cities.

- Prices is the best way to induce change in behavior:
  - **Modal substitution**: Forming carpools and switching to mass transit.
  - **Time of travel**: Switching to off-peak travel
  - **Travel route**: Picking alternative routes and combining two or more trips into a single one
  - **Location choices**: Decreasing commuting distances by moving closer to jobs
Some considerations on congestion taxes

- **Alternatives**

- Gasoline tax
  - Affect the cost of traveling in general. Helps in modal substitution and location choices but not in time or route of travel.

- Subsidies for mass transit
  - Only affects modal substitution. The volume of car transit is not very elastic with respect to the price of mass transit.

- Elimination of parking subsidies
  - Estimations show these subsidies by employers increase the volume of traffic by 19% in LA. This alternative affect modal substitution. High elasticity with respect to the price of parking.
Road capacity decision

- Decision on road width. If the expected revenues from tax congestion coming from the road is greater than the construction cost, the road should be built.
Air pollution

- The idea is the same than congestion. Autos generate an externality which is not internalized by the person who makes the decision.

- An obvious solution is taxes:
  - Pollution tax (through a device to measure emissions)
  - One time pollution tax for new cars, charging the expected pollution in its “productive life”
  - Gasoline tax (incentives to use cars less but not to use cleaner cars)
  - Subsidize mass transit

- …and also smog tests.
Car accidents

- High costs to society
  - Property damages
  - Injuries (3.1 million per year in the US)
  - Deaths (40,000 per year in the US)
  - Costs are over $300 billion per year in the US (more than $1,000 per capita). Estimates from Miller, 1993.
  - More congestion after an accident ($5 billion per year)
  - External costs of young drivers is nearly 3 times as high as the external costs of middle-aged drivers.

- Why externalities? When a person collides, around 1/3 of the costs are borne by someone else.
Car accidents

- VMT (vehicle miles traveled) tax.

- Vehicle safety policies.
  - Mandated features in cars.

- Almost all countries require car occupants to wear seat belts.
  - Reduce death rates among car occupants
  - Increase the number of accidents
  - Increase the number of deaths among pedestrians and bicyclists

- This puzzle can be explained from the Theory of Risk Compensation (Peltzman, 1975). “Drivers in safer cars take more risk and endanger others”
Summary Ch. 10 O’Sullivan

- There are three types of negative externalities from the use of vehicles in cities. Congestion, pollution, and accidents.
- Car drivers base their travel decisions on private costs, not on social costs. Hence the equilibrium traffic volume exceeds the socially efficient volume (typical result from negative externalities).
- Taxes may provide the internalization of externalities such that people optimally reduces the traffic and approaches to efficiency.
Mass Transit - Facts

<table>
<thead>
<tr>
<th>Travel Mode</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers 16 years and over</td>
<td>128,279,228</td>
<td>100</td>
</tr>
<tr>
<td>Car, truck, or van</td>
<td>112,736,101</td>
<td>87.9</td>
</tr>
<tr>
<td>Drove alone</td>
<td>97,102,050</td>
<td>75.7</td>
</tr>
<tr>
<td>Carpoled</td>
<td>15,634,051</td>
<td>12.2</td>
</tr>
<tr>
<td>Public transportation</td>
<td>6,067,703</td>
<td>4.7</td>
</tr>
<tr>
<td>Bus or trolley bus</td>
<td>3,206,682</td>
<td>2.5</td>
</tr>
<tr>
<td>Streetcar or trolley car</td>
<td>72,713</td>
<td>0.1</td>
</tr>
<tr>
<td>Subway or elevated</td>
<td>1,885,961</td>
<td>1.5</td>
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<tr>
<td>Railroad</td>
<td>658,097</td>
<td>0.5</td>
</tr>
<tr>
<td>Ferryboat</td>
<td>44,106</td>
<td>0.2</td>
</tr>
<tr>
<td>Taxicab</td>
<td>200,144</td>
<td>0.2</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>142,424</td>
<td>0.1</td>
</tr>
<tr>
<td>Bicycle</td>
<td>488,497</td>
<td>0.4</td>
</tr>
<tr>
<td>Walked</td>
<td>3,758,982</td>
<td>2.9</td>
</tr>
<tr>
<td>Other means</td>
<td>901,298</td>
<td>0.7</td>
</tr>
<tr>
<td>Worked at home</td>
<td>4,184,223</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Mass Transit - Facts

- New York, Chicago, LA, DC, San Francisco, Boston Philadelphia and Seattle (in that order) are responsible for 80% of the transit passenger miles among 38 MAs with population of at least 1 million.
- Transit ridership higher among low income families
- Elasticities of demand for mass transit
  - -0.33 with respect to price
  - -0.39 with respect to travel time
  - -0.71 with respect to access time
  - Elasticities for non-commuting trips are higher.
Mass Transit – Modal choice

- Comparison factors among different transit possibilities.
  - **Collection time cost**: Time necessary to travel from home to the main travel vehicle.
  - **Line-haul time cost**: Time spent on the main travel vehicle.
  - **Distribution time cost**: Time necessary to travel from the main travel vehicle to the final destination.

- To improve the use of mass transit would be necessary to
  - Increase line-haul cost of cars (more taxes to gasoline)
  - Increase distribution time cost of cars (less parking subsidies).
  - Reduce line-haul cost of mass transit (less fares)
  - Reduce collection and distribution costs of mass transit (higher frequency of service)
Mass Transit – Density

New York is one of the few US cities that meet these requirements (40 people per hectare).

In Europe the requirements are easier to fulfill: Barcelona (171/hectare) and Paris (88/hectare)
Mass Transit – Subsidies

FIGURE 11–3 Fare-Box Ratios for Public Transit, 2002

Subsidies have been increasing over time.

Mass Transit – Subsidies

- Demand
- Total Subsidy
- Cost per passenger trip ($)
- Average Cost
- Marginal Cost
- NO Deficit
- Efficiency
- Ridership (thousands)

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Mass Transit – Regulation

- Government has a monopoly of mass transit in most cities and countries

- Problem with deregulation: Cream skimming

- Contracting for transit services
  - More efficient results than government (NOT CLEAR!)

- Paratransit
  - Alternatives in the middle of the two extremes regulated by the government (solo-ride taxis and large public buses)
  - Shared-ride taxis, jitneys, shuttles, subscription to commuter vans

- Experiences of deregulation
  - Good in Great Britain (improved competition)
  - Bad in Peru (reduced quality)
Mass Transit – Land use pattern

- Mass transit has not proved to be a good way to modify land use patterns. This is, new supply of stations do no generate demand and location among them.

- Experiences:
  - Good in San Francisco: BART
  - Not so good in Atlanta: MARTA
Summary Ch. 11 O’Sullivan

- Only around 5% of commuters use mass transit
- Subsidies for mass transit systems are high (and necessary)
- Deregulation may be harmful from a cream skimming and quality perspective but may be good from a competition perspective.
- Transit systems have modest effects on land-use patterns.
Los Angeles – A “freeway city”

- Based on Martin Wachs, 1993

- Los Angeles experience the heaviest traffic congestion among cities in the US.
- 77% of workers drive to work alone, 5% use the mass transit system and 15% vanpool.
- LA has the worst air quality of any major US city.
- Even when smog checks exist, it seems that 80% of air pollution comes from 10% of the vehicles.
Los Angeles – A “freeway city”

- As we discussed in previous notes, LA is a moderate density city connected by thousands of miles of high capacity freeways.

- Three transportation crises in LA.
  - 1920: Rapid growth of automobile ownership -> More highways
  - After WWII: Huge suburban growth -> More and wider highways.
  - 1990: More than a car by household -> Provision of alternatives for car use (light and heavy rail lines, bus transit system, transportation management (TDM) such as HOV lanes). Now more concerns on air quality
Los Angeles – A “freeway city”

- Last transportation crises
- Rail system
  - Blue Line: Light rail from Downtown LA to Long Beach
  - Red Line: Metro in the central core of Downtown LA
  - Metrolink: Commuter from suburbs to Downtown LA
  - Problems: Density in LA is very low and stations cannot be so close together. Very costly. Mostly benefit middle and upper income population.
Los Angeles – A “freeway city”

- Last transportation crises
- TDM (Transportation Demand Management)
  - Aimed at reducing reliance on the single-occupant automobile for the journey to work.
  - Employee transportation coordinator in each work site.
  - Number of workers driving alone to jobs decrease from 75% to 65% thanks to carpooling and vanpooling.
  - Preferential arrangements for parking as carpooling and subsidies to mass transit (example, UCLA!)

These policies seem to have had little success when compared with social costs
Los Angeles – A “freeway city”

Alternative policies

- Better pricing
  - Right now cars seem to be subsidized instead of taxed. Free parking, services in highways, traffic police, etc.
  - Ways to price: Gasoline taxes, Annual vehicle registration fee structure, congestion pricing

- Changing urban form and land use
  - Densification. Not clear since very dense cities such as Hong Kong or New York have important congestion problems as well.

- Wider range of mass transportation choices
  - Transit options that compete with cars (be able to cover low density areas, cheap and easily, as cars do)
Questions for Lecture Notes IV

- How do governments deal with traffic problems such as Congestion, Pollution and Accidents?
- Why do so few commuters use mass transit?
- How do government policies affect mass transit?
Practice Exercises - Lecture Notes IV

- O’Sullivan
  - Chapter 10: Exercises 1, 2 and 3.
  - Chapter 11: All exercises.