Econ 330: Urban Economics

Lecture 13

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Lecture 14: Automobiles

Schedule

Today:
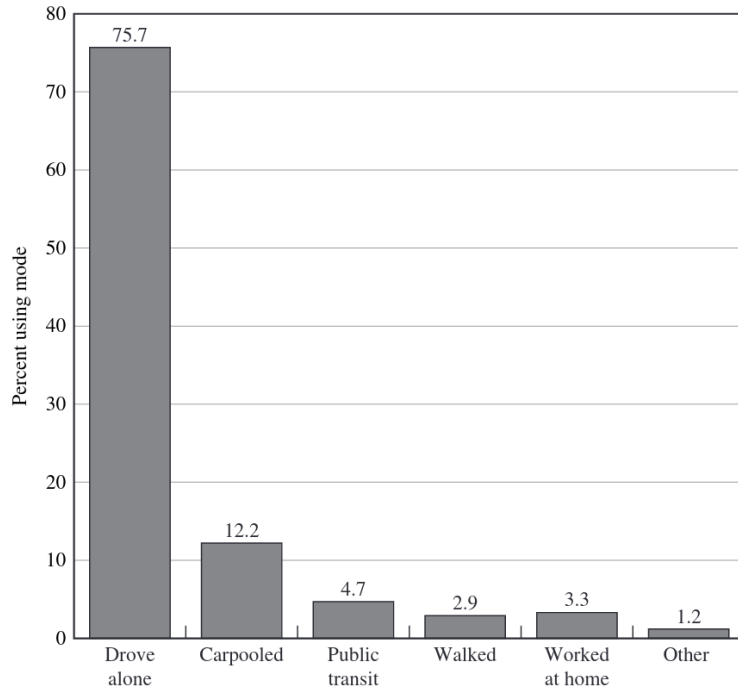
(i). US automobile use

(ii). Externalities

(iii). Congestion Pricing

Upcoming:

- **Reading:** (Chapter 8)

- **Book Report:** Due August 15

- **PS02:** Due August 15

Automobile use data

Auto use in the US

Facts about American auto use:

- 88 percent of commuters use the car
- Only 5 percent of commuters use public transit at the national level
- Only 2 metro areas have public transit use above 10 percent
  - NYC
  - Chicago

Vehicle Miles Traveled

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US: People like Cars

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Carbon Emissions

*iframe src="https://ourworldindata.org/grapher/road-vehicles-per-1000-inhabitants-vs-gdp-per-capita" loading="lazy" style="width: 100%; "target=_self"; height: 500px; border: 0px none;">

Climate crisis

A recent UN scientific report leaves no doubt that humans are responsible for the current climate crisis

Increased frequency of extreme weather including:

- Wildfires
- Winter storms
- Hurricanes

- Heat waves
- Floods
- Droughts

Other consequences include:

- Mass extinctions
- Changes in ocean currents

- Loss of habitat (reefs, rainforest, ice sheets)
- Sea level rise

Climate crisis

Carbon emissions

*iframe src="https://ourworldindata.org/grapher/co-emissions-per-capita?tab=chart&country=USA~BRA~Europe+%28excl.+EU-27%29~IND~RUS~CHN~JPN" loading="lazy" style="width: 100%; "target=_self"; height: 500px; border: 0px none;">

Carbon emissions

*iframe src="https://ourworldindata.org/grapher/annual-co2-emissions-per-country?tab=chart&country=USA~CHN~EU-28~IND~RUS~JPN~BRA" loading="lazy" style="width: 100%; height: 500px; "target=_self"; border: 0px none;">

Policy questions

Currently per capita CO2 emissions in develping countries skyrocket?

The future of global carbon emissions depends heavily on how car ownership rates evolve in China and other emerging economies

How do we reduce CO2 per capita emissions?

What axiom can we apply to improve our understanding of usage?

Do drivers fully internalize the costs of CO2 emissions?

Externalities

Externalities

Recall Axoim 3: Externalities cause inefficiency

What are some externalities from driving?

- Congestion
- Environmental Damage
- Collisions

- Blight (parking lots instead of parks)
- Noise Pollution

How costly is congestion?

Typical commuter spends **47 hours per year** in traffic

- Very high in some metro areas (LA: 93, SF: 72, Atlanta: 67)
- Estimated gasoline cost due to congestion delays: **5 billion per year**
- Time + Gas cost estimate: **63 billion per year**

Externalities

Definition: Marginal Social Cost (MSC)

> Added cost to *society* from one extra unit of production/consumption

Note: $MSC \neq MC$

Definition: Marginal Private Cost (MPC)

> Added cost to *agent* from one extra unit of production/consumption

MSC is the marginal cost (private) plus the marginal external cost (social)

Definition: Marginal Social Benefit (MSB)

> Added benefit to *society* from one extra unit of production

Definition: Marginal Private Benefit (MPB)

> Added benefit to *society* from one extra unit of production

Externalities: Example

Consider the market for **gasoline**

Using gasoline in cars causes air pollution and generates greenhouse gases

Gasoline producers pays its input suppliers and workers but does not consider the external costs to society

- MSC > MPC

Congestion externalities

Let's start by assuming the only externality from driving is congestion

Consider a commute within a metro area with the following characteristics:

- Distance (d): Let the commute distance be 10 miles $d = 10$
- Monetary travel cost (m): Monetary costs are \$0.2 per mile $m = 0.2$
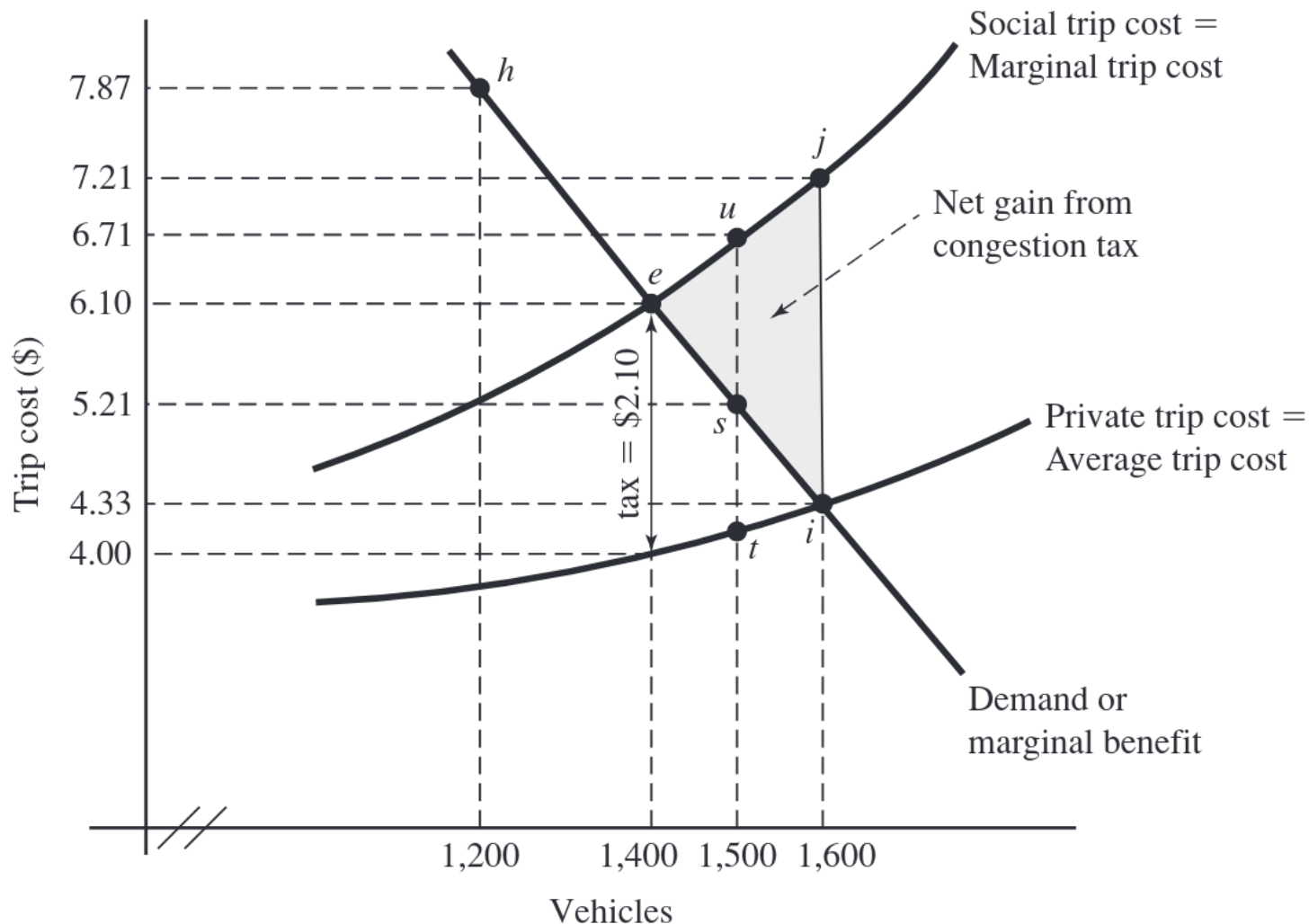- Time cost (c): Opportunity cost of time is \$0.1 per minute $c = 0.1$

Thus the total cost of the trip is $(m + c) \cdot 10$

Congestion externalities

TABLE 10–2 Traffic Volume, Travel Time, and the Congestion Externality

A	B	C	D	E	F	G	H
Volume (vehicles per lane)	Trip Time (minutes)	Private Trip Cost ($)	Increase in Time per Vehicle (minutes)	Increase in Total Travel Time (minutes)	External Trip Cost ($)	Social Trip Cost ($)	Marginal Benefit (demand)
200	12.000	3.20	0.000	0.00			16.73
400	12.000	3.20	0.000	0.00			14.96
599	12.476						
600	12.480	3.248	0.004	2.40			13.19
1,199	17.268						
1,200	17.280	3.728	0.012	14.40			7.87
1,399	19.985						
1,400	20.000	4.000	0.015	21.00			6.10
1,599	23.262						
1,600	23.280	4.328	0.018	28.80			4.33
1,799	27.100						
1,800	27.120	4.712	0.020	36.00			2.56

Congestion pricing

Congestion pricing

How do we fix **Congestion?**

Popular Answer: Build more roads

Building more roads $\Rightarrow$ more space for cars $\Rightarrow$ congestion will decrease

Q: What assumption must we make when stating

"building roads will reduce congestion"

A: The number of drivers will remain the same after the road is built

Is this true?

My nightmare: LA Traffic

Congestion pricing: Cost incentives

Obvious when we think about the incentives of drivers

(i). People avoid driving because it is costly

- Time cost
- Gas cost
- Matinence cost

(ii). Building a new road makes it less costly

- Time cost ↓

(iii). On the **margin**, people will start to drive when the new road is built

Tangent: How do traffic jams start?

What actually causes congestion/traffic?

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player" frameborder="0" allow="accelerometer; autoplay; clipboard-write;
encrypted-media; gyroscope; picture-in-picture" allowfullscreen>

Overbreaking

Externalities: Pigouvian taxes

Roads: Not a great solution. Better idea?

No more monkies driving on the roads? Tech isnt there yet.

Pigouvian taxes

Main insight:

The social cost of driving exceeds private cost

So how can we raise the MPC such that $MPC = MSC$

How can we do this? **Tax them.**

The pigouvian tax specific to reducing road congestion is **congestion pricing**

Externalities: Pigouvian taxes

Many cities across the globe have enacted or are planning to enact congestion pricing

- London
- Singapore
- Milan

- Stockholm
- Bejing
- NYC, LA, SF (coming soon)

Results:
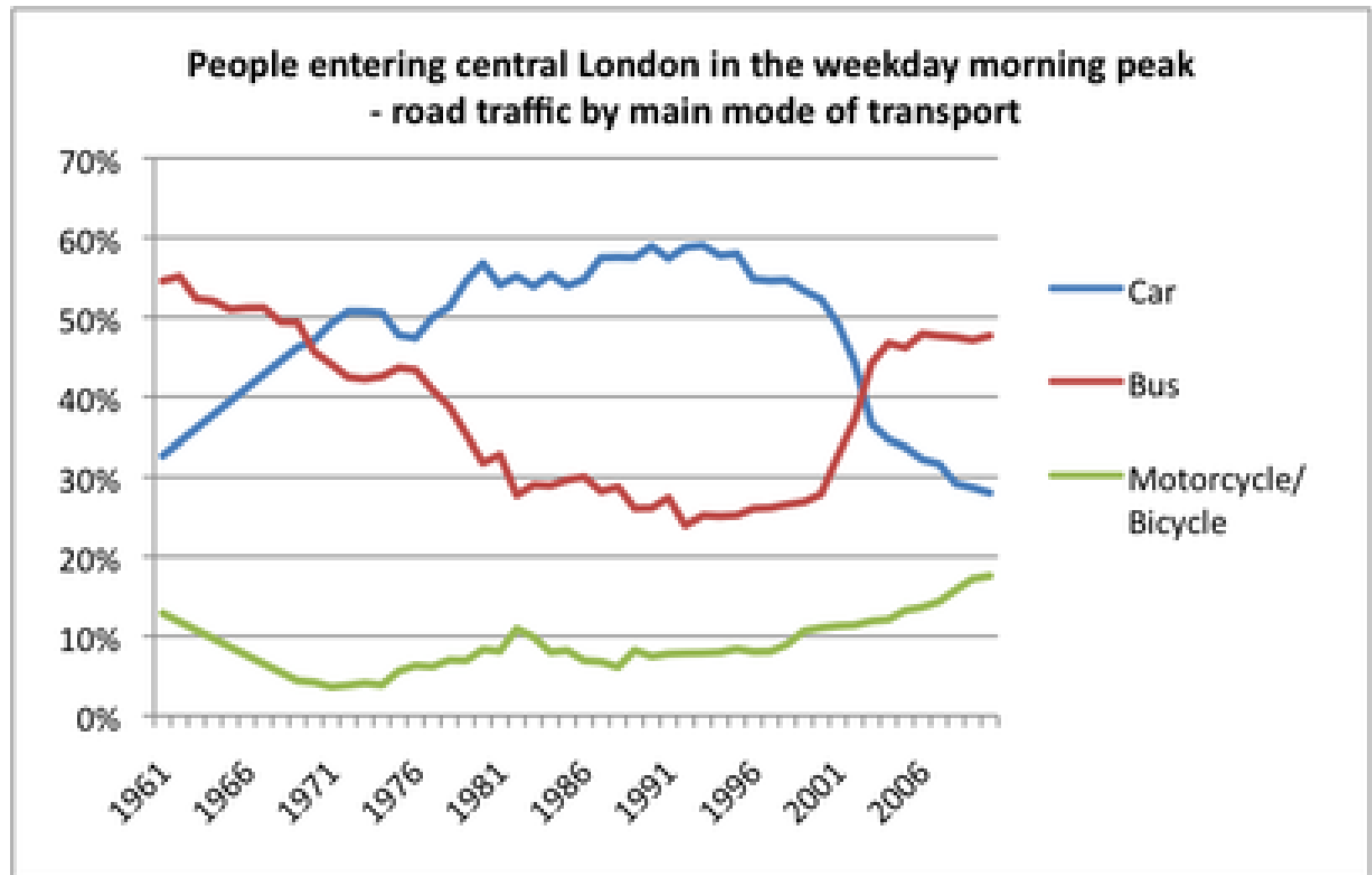
Following enactment of congestion pricing in London:

- Traffic was reduced by 15%
- Reduced travel times in the city by 30%

Congestion pricing: London

Congestion pricing: London

People entering central London in the weekday morning peak - road traffic by main mode of transport

Model with Pigouvian Taxes

Peak vs. Off Period Taxes

Mechanisms

Model demonstrated congestion taxes reduce traffic volume. How?

(i). Modal substition: switch to carpool, public transit

(ii). Switch to off-peak travel

(ii). Switch route

(iv). Location decisions: change residence or workplace

Discussion

Congestion taxes sound like a good idea, right? What are the problems?

- Roads aren't always congested. So tax needs to be time-varying. Gets very complicated

- Are all autos charged the same amount (semis and prius?)

How can this idea be adapted to combat the **climate crisis?**

Put a tax on carbon