Transport Economics

Lecture 11

16 February 2023

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Review

- Challenges to learning from observations
  - Causal inference
  - Identifying demand/supply elasticities
  - Omitted variable bias

- Applications
  - Usually need to make assumptions to make up for unobserved market features

Today’s Agenda

- Anderson (2014): *Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion*
- Worksheet 10: Quantifying costs/benefits
  - A quantitatively heavy lecture (as promised!)
- Case study ideas / examples

Anderson (2014) review

Anderson, Michael L. 2014. "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion." *American Economic Review*, 104 (9): 2763-96.

- **Question:** By how much does LA's public transit relieve congestion?

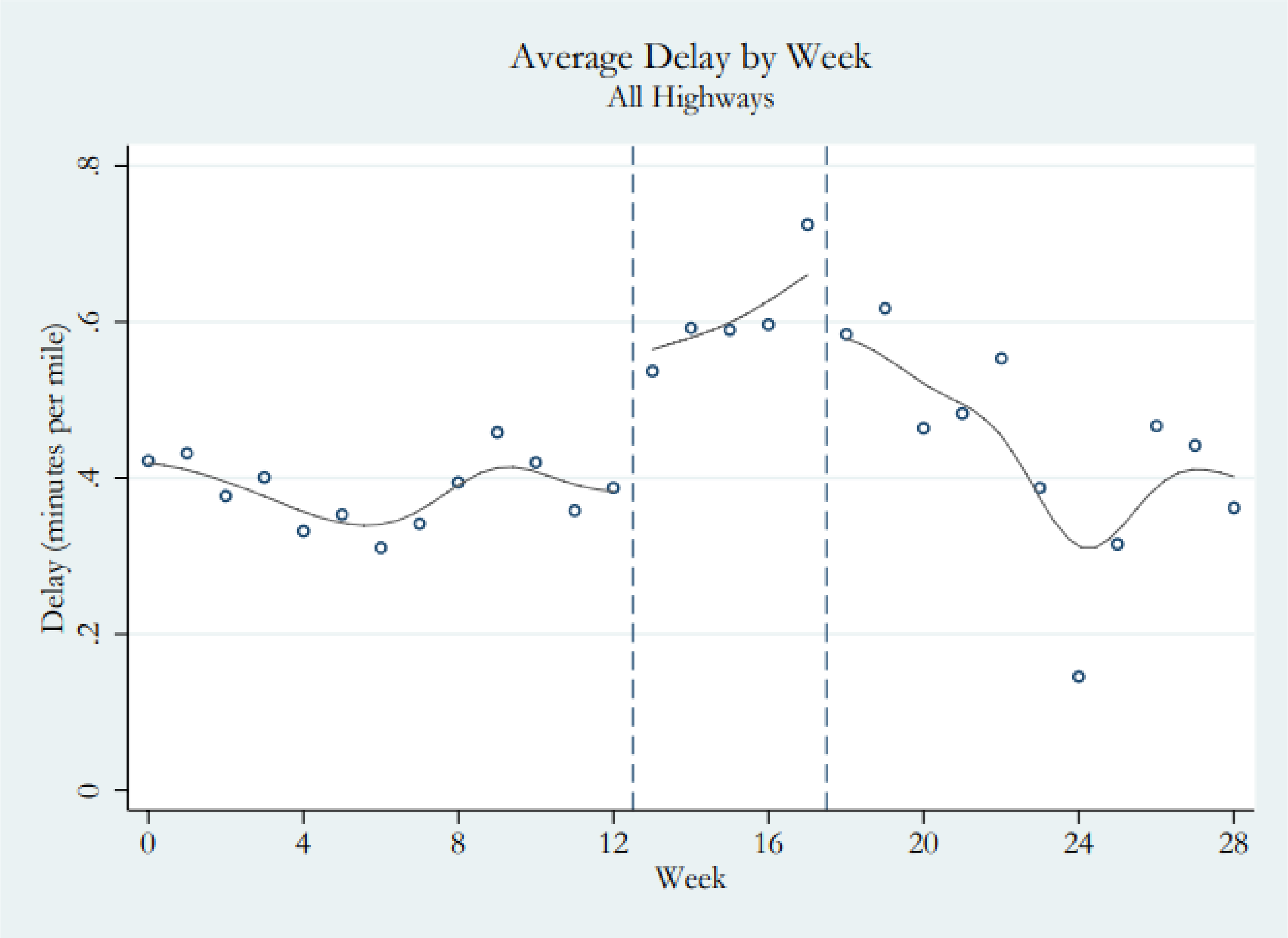
- Exploit a "natural experiment"
  - October 2003: LA public transit workers began a 35-day strike shutting down bus and rail lines

- Look at effect on hourly traffic speeds on major Los Angeles freeways
  - Using a Regression Discontinuity Design (RDD)

- Leads to increase in average travel delays of 47% during peak hours
  - Largest effects on freeways that parallel popular transit lines

[Anderson, Michael L. 2014. "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion." *American Economic Review*, 104 (9): 2763-96.]

Figure 2: Weekly Peak Hr. Delay on Major L.A. Freeways (7/14/03–1/30/04)



Quantifying costs/benefits of the LA Metro

- How do travel time gains translate to gains in individual welfare?
  - Of transit riders? Of drivers?

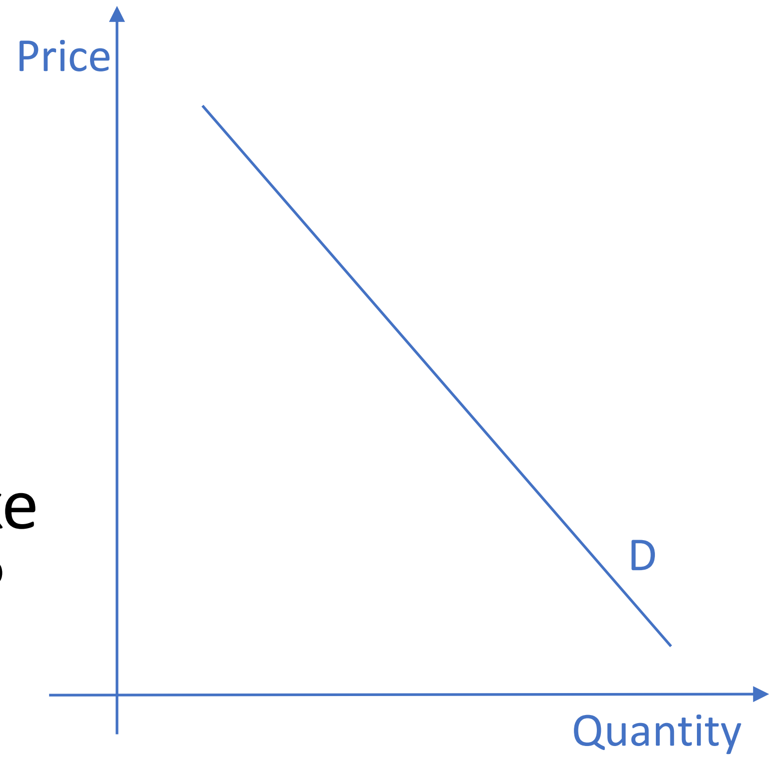
- We need a model of individual preferences in order to interpret observations.

- Worksheet 10

Maximizing Utility: Rationalizing observed choices

- **Utility:** The "surplus" that individuals get from their choices of goods/services
  - Our willingness/ability to pay for an item is meant to maximize our utility (across all our choices)

- To learn from data: What do utilities need to look like to justify observed (equilibrium) choices and prices?
  - First, characterize utility as a function of observables and unobservables
  - Second, "estimate" the unobservable parameters of the function.



Anderson (2014)

Anderson, Michael L. 2014. "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion." *American Economic Review*, 104 (9): 2763-96.

https://are.berkeley.edu/~mlanderson/pdf/Anderson_transit.pdf

Commuter's decision problem

Commuter *i* maximizes utility function: $U_i = X_i - T_i$

where *T* is commute cost and X is a "composite" good (i.e. everything else / opportunity cost).

By choosing to ride rail (*R*=1) or drive (*R*=0).

Each mode offers a different travel speed *s(R)*, level of accessibility *a(R)*, and wait time *w(R)* for any given commute distance *m*.

$$U_i = X_i - T(s_i(R_i), a_i(R_i), w_i(R_i), m)$$

Subject to an income/budget constraint:

$$s.t.\ \ Y_i = X_i + m \cdot (p_r R_i + p_d(1 - R_i))$$

where *Y* is income, p_r is the per-mile cost of rail and p_d is the per-mile cost of driving.

Commuter's decision problem

Commuter *i* maximizes utility function:

$$U_i = X_i - T(s_i(R_i), a_i(R_i), w_i(R_i), m)$$

$$s.t.\ \ Y_i = X_i + m \cdot (p_r R_i + p_d(1 - R_i))$$

T = v_i · *travel time*

Where v_i is the value of travel time savings

- relative to income / opportunity cost of time
- Typically varies across commuters and by activity.
- For more on value of time estimations:

Small, K., and E. Verhoef. 2007. *The Economics of Urban Transportation*. New York: Routledge.

Commute costs

If choose rail (*R=1*):

$$\frac{m}{s_r} + c(a_{ri} + w_r)$$

If choose drive (*R=0*):

$$\frac{m}{s_d} + c(a_d + w_{di})$$

Individual *i* has commute cost *T* given by:

$$v_i[R_i(\frac{m}{s_r} + c(a_{ri} + w_r)) + (1 - R_i)(\frac{m}{s_d} + c(a_d + w_{di}))]$$

Commuter's decision problem

Commuter *i* chooses travel mode $R_i \in \{0,1\}$ to solve an optimization problem:

$$U_i = X_i - v_i[R_i(\frac{m}{s_r} + c(a_{ri} + w_r)) + (1 - R_i)(\frac{m}{s_d} + c(a_d + w_{di}))]$$

$$s.t. \;\; Y_i = X_i + m \cdot (p_r R_i + p_d(1 - R_i))$$

Commuter's decision problem

$$U_i = X_i - v_i[R_i(\frac{m}{s_r} + c(a_{ri} + w_r)) + (1 - R_i)(\frac{m}{s_d} + c(a_d + w_{di}))]$$

$$s.t.\ \ Y_i = X_i + m \cdot (p_r R_i + p_d(1 - R_i))$$

Choose rail if? (Worksheet 10.1)

$$[c(a_{ri} + w_r) + \frac{m}{s_r}] - [c(a_d + w_{di}) + \frac{m}{s_d}] \leq \frac{m}{v_i}(p_d - p_r)$$

Say, rail access times a_{ri} vary across individuals with some known probability distribution:

$$P(R_i = 1) = P[c \cdot a_{ri} - \frac{m}{v_i}(p_d - p_r) \leq c(a_d + w_d - w_r) + \frac{m}{s_d} - \frac{m}{s_r}]$$

Figuring out the parameter values

$$P(R_i = 1) = P[c \cdot a_{ri} - \frac{m}{v_i}(p_d - p_r) \leq c(a_d + w_d - w_r) + \frac{m}{s_d} - \frac{m}{s_r}]$$

- Some parameters are observable, others are not: Worksheet 10.2
- Calibrate model parameters (on the right) to match observations from data and other studies.
- Search for unobserved parameters (e.g., rail access times a_{ri}) until we can match share of commuters choosing rail.

Can have more unobservables e.g. individual heterogeneity in experienced congestion delay w_{di}:

$$P(R_i = 1) = P[c(a_{ri} - w_{di}) - \frac{m}{v_i}(p_d - p_r) \leq c(a_d - w_r) + \frac{m}{s_d} - \frac{m}{s_r}]$$

- Vary w_{di} to match average congestion delay w_d.

What is the consumer surplus?

… from choosing rail? **Worksheet 10.3**

Aggregate consumer surplus (regardless of mode choice):

$$\sum_{i} max\{CS_i(R = 1), CS_i(R = 0)\}$$

Long-run impacts of public transit

Other margins of adjustment (besides mode choice) affect welfare:

- How much to travel
  - Recall fundamental law of congestion
- Where to reside and work
  - E.g., Warnes (2021)
- Land and property values
  - E.g., Gupta et al. (2020)
- Population decentralization / distribution of economic activity
  - E.g., Gonzalez-Navarro and Turner (2018)
- Air pollution
  - E.g., Gendron-Carrier et al. (2020)
- Long-term growth
  - E.g., Heblich et al. (2020)

Partial vs General equilibrium effects

- In “partial” (as opposed to “general”) equilibrium, we assume limited/no changes to equilibrium in most other markets.
  - Causal effects are easier to distinguish both empirically and conceptually.
  - But may underestimate overall costs/benefits

- Anderson (2014): Travel time gains from LA Metro well above its costs
  - based on partial equilibrium effects of short-term natural experiment.
- Severen (2021): Benefits are only 12-25% of annual costs
  - accounting for commuting patterns, housing markets, local amenities, etc.

- More and more research on quantifying general equilibrium effects of transportation infrastructure.
  - E.g., Severen (2021), Tsivanidis (2022) and Warnes (2021)

Courses in Urban Economics

- Urban Economics (31C02100)
  - Formation of cities, urban labor markets and urban structure, land prices, housing and urban policies
  - *Targeted at:* Master’s students in ENG / advanced Bachelor’s students in Economics
  - *Prerequisites:* Principles of Economics

- Urban and Regional Economics (ECON-L6000)
  - More geared towards quantitative research
  - *Targeted at:* Doctoral students / advanced Master’s students

Homework 8

Identify an external intervention (e.g., a government regulation) in a market for transport services (that is not in the textbooks or lectures).

1. Explain how the policy may have shifted the market equilibrium (prices, quantities and net surpluses of producers, consumers, and any external stakeholders) in theory.

2. Describe how you would test your theory above for causality using data that is typically observable. You can assume any data that can be reasonably collected is observable to you.

Bonus: +1 point for sharing with everyone in class.

Your solutions?

Example case study topics from last year

Subway to a rocketing Housing market

Evidence from the Länsimetro project on housing prices in Espoo

Helsinki city bikes: A substitute for private cars?

Transport economics 2022 Case study

Effects of banning studded tyres on local air quality

Case Helsinki

congestion charge

london // the effect on retail

HSL ticket zone changes and its impact on the housing markets

Aalto University
School of Engineering

"Pico y Placa" - the temporary demand management measure that became permanent. Bogotá: Case Study

BY:

SPT – E4050 – TRANSPORT ECONOMICS

ELECTRIC CAR INCENTIVES AND ITS AFFECT ON CO_2 EMISSIONS: CASE NORWAY

TRANSPORT ECONOMICS

Effects of the congestion charge in Stockholm on public transit ridership

A case study

Transport Economics Spring 2022
17.02.2022

Aalto University

Your turn!

Course feedback survey

Survey link sent via email.

A final public good game!

- 1 bonus point to everyone if response rate>90%
- 2 bonus points if response rate is 100%!

Complete by February 23

References

- Anderson, M. (2014). "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion." *American Economic Review*, 104 (9): 2763-96.
- Gendron-Carrier, N., Gonzalez-Navarro, M., Polloni, S., and Turner, M. (2022). "Subways and Urban Air Pollution." *American Economic Journal: Applied*, 14(1): 164-96.
- Gonzalez-Navarro, M. and Turner, M. (2018). "Subways and Urban Growth: Evidence from Earth". *Journal of Urban Economics*, 108: 85-106.
- Gupta, A., Van Nieuwerburgh, S., and Kontokosta, C. (2021). "Take the Q train: Value Capture of Public Infrastructure Projects." *Journal of Urban Economics*.
- Heblich, S., Redding, S., and Sturm, D. (2020). "The Making of the Modern Metropolis: Evidence from London." *Quarterly Journal of Economics*, 135(4): 2059-2133.
- Severen, C. (2021). "Commuting, Labor, and Housing Market Effects of Mass Transportation: Welfare and Identification." *The Review of Economics and Statistics*.
- Tsivanidis, N. (2022). "Evaluating the Impact of Urban Transit Infrastructure: Evidence from Bogotá's TransMilenio." Working paper.
- Warnes, P. (2021). "Transport Infrastructure Improvements and Spatial Sorting: Evidence from Buenos Aires." Working paper.