What Explains the Varying Cost of Highway Construction in the U.S.?

Leah Brooks
Trachtenberg School of Public Policy and Public Administration
George Washington University

Zachary Liscow
Yale Law School

June 2020
This presentation draws from

“Infrastructure Costs”

and

“Can America Reduce Highway Construction Costs? Evidence from the States”
Can We Afford the Infrastructure We Want?

- California’s high speed rail and Boston’s Big Dig costly and highly publicized
  - outliers or
  - typical projects?
- US costs are multiples of European costs
  Gordon and Schleicher, 2015; Barro, 2019
Can We Afford the Infrastructure We Want?

• California’s high speed rail and Boston’s Big Dig costly and highly publicized
  • outliers or
  • typical projects?

• US costs are multiples of European costs
  Gordon and Schleicher, 2015; Barro, 2019

Systematic evidence on costs is quite limited.
  Mehrotra et al, 2019; Swei and Gillen, 2020
How to Measure “Infrastructure”? 

Infrastructure is varied → consistent cost is hard to measure
How to Measure “Infrastructure”? 

Infrastructure is varied → consistent cost is hard to measure 
- Port vs road vs train station 
- We need a common denominator
How to Measure “Infrastructure”?  

Infrastructure is varied → consistent cost is hard to measure
- Port vs road vs train station
- We need a common denominator

We look to the Interstate system
- Product relatively constant over time
- Observable over a long time
- With a per unit denominator: miles
- Large investment: $504 billion 2016 dollars
Four Findings: Facts

1. The cost of a new US highway mile is increasing, 1956 to 1991
   • conditional on pre-determined cost drivers, tripled in real terms, 1960s to 1980s
   • increases concentrated after 1970

2. There is substantial cross-state variation in spending
   • If above-median states capped spending at median, system would have cost 40% less
Four Findings: Why?

Suggestive evidence

3. Cross-state variation in Interstate spending notably higher than that for other public spending

4. Spending increases over time track with greater ancillary highway investment and greater citizen empowerment and concern
Context for Spending Growth
1956 Federal-Aid Highway Act provides interstate funding
  - Plans a 41,000 mile system
  - Virtually all funding limited to initially determined routes
  - Feds pay 90%, states pay 10%
  - Similar federal standards for construction in all states and time

Construction largely complete by 1993
1956 Federal-Aid Highway Act provides interstate funding
- Plans a 41,000 mile system
- Virtually all funding limited to initially determined routes
- Feds pay 90%, states pay 10%
- Similar federal standards for construction in all states and time

Construction largely complete by 1993

System is relatively fixed → States choose how much to spend, not how many miles to build
Finding 1: Per Mile Spending Increases Over Time, Inflection Point c. 1970
Interstate Spending on the Rise

Year Fixed Effects: Regression of State Spending on State and Year Effects

spending change, relative to 1960, conditional on state FE
Interstate Spending on the Rise

Year Fixed Effects: Regression of State Spending on State and Year Effects

costs rise after 1970
Spending: Conditional on Pre-Determined Geographic Covariates

With Controls for Population Density, Share in Water and Wetlands, and Slope
Finding 2: Substantial cross-state variation in spending
Interstate Spending per Mile by State, 1956 to 1993

National average:
$11.5 million
2016 dollars
Variance Meaningful Conditional on Geographic Covariates
Interstate Spending per Mile, 1956 to 1993, Conditional on Pre-Existing Geographic Cost Determinants
What Drives These Cost Patterns?
What Could Drive Cost Increase and Cross-State Variation?

1. Labor costs
2. Materials costs
3. Technical features
   - design standards
   - type and location of projects
4. Bidding and procurement
   - procurement institutions
   - market concentration in construction
4. Regulatory environment
   - environmental regulation
   - litigation threat
   - eminent domain costs
5. Political institutions
   - jurisdictional fragmentation
   - common or civil law
6. Project management
   - management quality
   - economies of scale
What Could Drive Cost Increase and Cross-State Variation?

1. Labor costs
2. Materials costs
3. Technical features
   - design standards
   - type and location of projects
4. Bidding and procurement
   - procurement institutions
   - market concentration in construction
4. Regulatory environment
   - environmental regulation
   - litigation threat
   - eminent domain costs
5. Political institutions
   - jurisdictional fragmentation
   - common or civil law
6. Project management
   - management quality
   - economies of scale
Finding 3: Cross-state Variation in Spending Exceeds Other Public Spending
Conditional Variation in Interstate Spending Large
Std. Dev. of Residuals Divided by Mean, 1971-1993

- Interstate Cost per Mile, 1971 to 1993
- Local Gov't. Exp. per capita, 1972-1992
- Medicare per Enrollee, 1991
- Residential Private Construction Cost

Standard Deviation of Residuals / Unconditional Mean

0.0 0.2 0.4 0.6
Finding 4: Timing of Increase Tracks with Heightened Citizen Empowerment and Concern
Statistically, Income and Home Price Explain Increase in Spending

- Conditional on state income and home price measures, we see no increase in Interstate spending per capita.
- In other words, as people become wealthier after 1970, they purchase “more” highways.
- What makes a highway “more”?  
  - ramps to enter and exit
  - depressed highways to preserve above-ground features
  - noise walls

But is this increase in demand the whole story? Why only after 1970?
Additional Explanation: Citizen Voice

- In the late 1960s and early 1970s
- Rise of institutions that allow for greater citizen voice in government
- An amalgam of the environmental movement, civil rights movement, and growing homeowner organization
- Plus changes in judicial doctrine and statute that give citizens more tools to challenge government decisions
Additional Explanation: Citizen Voice

- In the late 1960s and early 1970s
- Rise of institutions that allow for greater citizen voice in government
- An amalgam of the environmental movement, civil rights movement, and growing homeowner organization
- Plus changes in judicial doctrine and statute that give citizens more tools to challenge government decisions

Two pieces of evidence here – more in the paper
- Evidence of citizen accommodation: noise walls
- Evidence of politician attention: Congressional speech
We Built No Noise Walls Before 1970
Noise Walls Are Children of the 1970s
1950s: Politicians Rarely Use “Environment” near “Interstate”

Times Stem “Environ” Appears within 100 Words of “Interst” Divided by Number of “Interst”
With Passage of Nat’l Envir. Policy Act, Usage is Heightened

Times Stem “Environ” Appears within 100 Words of “Interst” Divided by Number of “Interst”
Discussion Remains Permanently Elevated

Times Stem “Environ” Appears within 100 Words of “Interst” Divided by Number of “Interst”

1956: Federal Aid Highway Act
1970: National Environmental Policy Act

use of environ* w/i 100 words of interest*

Congressional Session, Second Year
In Sum

We find that

- Over time
  - Interstate costs are increasing
  - Even conditional on pre-determined cost drivers

- Across states
  - Cross-state variation is large
  - Much larger than almost any other public spending
In Sum

We find that

- Over time
  - Interstate costs are increasing
  - Even conditional on pre-determined cost drivers
- Across states
  - Cross-state variation is large
  - Much larger than almost any other public spending

Why? Perhaps due to

- the provision of “nicer” Interstates
- due in part to the increasing ability of citizens to moderate government behavior
- where the most wealthy are the most successful in this
- and when income inequality is increasing
In Sum

We find that

- Over time
  - Interstate costs are increasing
  - Even conditional on pre-determined cost drivers
- Across states
  - Cross-state variation is large
  - Much larger than almost any other public spending

Why? Perhaps due to

- the provision of “nicer” Interstates
- due in part to the increasing ability of citizens to moderate government behavior
- where the most wealthy are the most successful in this
- and when income inequality is increasing

Cost drivers are critical:

More infrastructure hinges on the ability to produce it affordably