Wider Economic Benefits of Investments in Transportation Infrastructure

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Introduction

Inter-related nature of topics for roundtable

One possible broader goal:

- Synthesize several of these into a BCA framework that incorporates G.E., spatial spillovers, agglomeration
Focus of my paper:

Overview of wider benefits:

Main focus: spatial spillovers across geographic boundaries

How spillovers have been incorporated in cost function models of public capital
Motivation: Different for each mode

- Highways
- Airports
- Ports

*Similarity*: Infrastructure in other jurisdictions has spillover features
Positive Spillovers: Production Function

- shifts supply curve to the right

Figure 1 - Change in Equilibrium Output from an Increase in Public Infrastructure Stock in a Neighboring Locality
Partial Equilibrium Analysis

- Measures distance between supply curves
- Assumes perfectly elastic demand
Alternative to Production Function Approach:

- A popular alternative: Cost function models
- Based on assumption of cost-min by firms
- State-level Total Cost function:

$$TC = VC(Y, P_{LP}, P_{LN}, P_M, K, I, G, t) + P_KK + u$$

- Can estimate VC function econometrically, given data on $Y, P_{LP}, P_{LN}, P_M, K, I, G, t$
Recent advances in Measuring Wider Benefits in form of Spillovers

1st type: Spatial Lag

2nd type: Spatial Autocorrelation
Source 1 of spillover estimates:

- Elasticity of VC with respect to G
  \[ \varepsilon_{VC,G} = \left[ \frac{\partial VC}{\partial G} \right] \left[ \frac{G}{VC} \right] \]

- Question: How to compute G?
  - “weighted” average of I in “neighbor” states or localities
  - Weights may be different depending on the motivation for type of spillovers
Source 2 of spillover estimates:

- Spatial autocorrelation

Most common:

First Order Spatial Autocorrelation

\[ u_i = \lambda \sum_j w_{i,j} u_j + \gamma_i \]
Possible Causes of Spatial Autocorrelation

- Shocks to some regions that spill over borders across space (e.g., weather shocks)

- Common unobservables across jurisdictions that vary spatially

- Decisions made in one location for production in other locations (e.g., output choices for firms with corporate headquarters in another state)

Consequences of ignoring spatial autocorrelation:

- Inefficient parameter estimates, which may lead to apparent insignificant infrastructure variables when they actually are significant
Applications: Highways

- Cohen and Morrison Paul (2004):
  Focus on U.S. states, manufacturing sector

- Linkage: contiguous states

- Average $\epsilon_{VC,I}$ is -0.230

- Average $\epsilon_{VC,G}$ is -0.011

- G parameters in cost function are jointly significant
- G effects for highways are second order but significantly different from zero
- Adaptation made for spatial autocorrelation
Applications: Highways

Moreno, et. al. (2004)
Focus on Spanish regions for manufacturing industries

Linkage: contiguous regions

Somewhat different infrastructure specification:

\[ T \equiv I^0 G^{1-\theta}, \]

They find \( \theta = .58, (1-\theta) = .42 \)
So G appears important to include in cost function estimation

But \( \varepsilon_{VC,T} > 0 \) with this specification, implying possibly too much infrastructure during the 1980’s in Spanish regions.

No evidence of spatial autocorrelation in this particular specification
Applications: Ports

Cohen and Monaco (2007)
U.S. States, manufacturing sector

Examined ports capital stocks in own and neighboring states
I represents ports, G represents neighbors’ ports

Linkage: contiguous neighbors

\[ \varepsilon_{VC,I} = -0.04 \]
\[ \varepsilon_{VC,G} = 0.129 \]

For states whose neighbors improve their ports, manufacturing costs rise

Neighbors may have too much ports capital

May arise due to “leeching” behavior (along the lines of Boarnet 1997)

Adaptation made for spatial autocorrelation
Applications: Airports

Motivated by hub and spoke network
Linkage: number of flights between states

For “large hub” states:
\[ \varepsilon_{VC,I} = -0.113 \]
\[ \varepsilon_{VC,G} = -0.116 \]
Applications: Airports

- Improvements to destinations are just as important as origins in generating cost savings

- Why?

  To make a trip by air, need both an origin and destination point.

  Different from highways, where a trip can be made with small strip of road.
Conclusions

- Spillover effects are different in sign and magnitudes for different transportation modes.
- May be due to the nature of interactions between regions for different modes.

- Spillover effects are different in sign and magnitudes for different countries.
- May be due to variations in existing levels of infrastructure stocks in different countries.