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

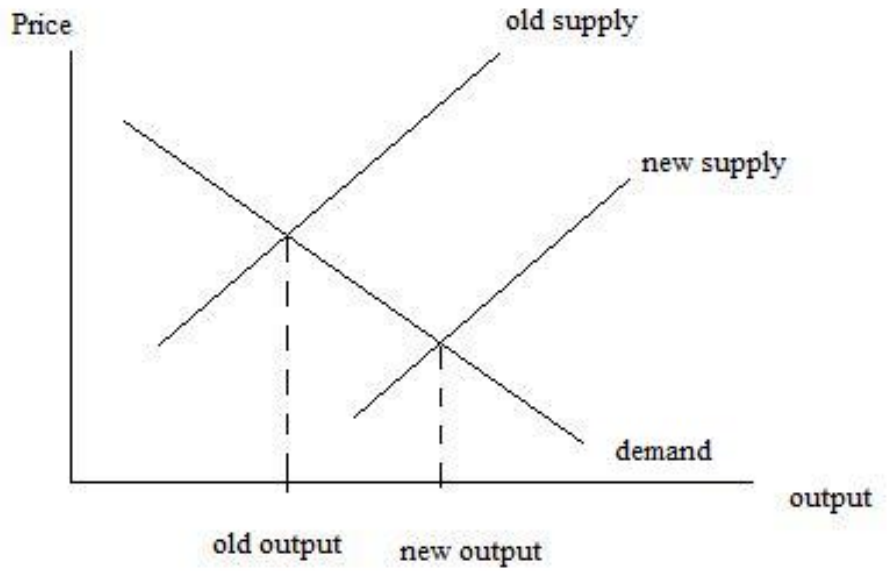
Motivation: Different for each mode

- Highways
- Airports
- Ports
- *Similarity:* Infrastructure in other jurisdictions has spillover features

Positive Spillovers: Production Function

- shifts supply curve to the right

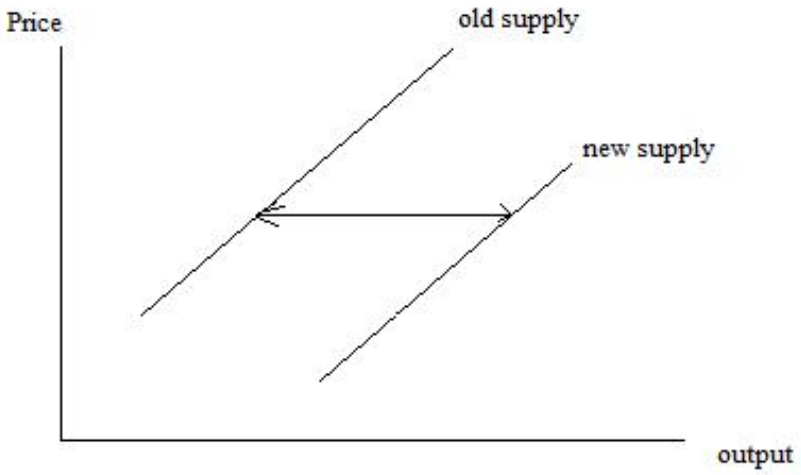
Figure 1 - Change in Equilibrium Output from an Increase in Public Infrastructure Stock in a Neighboring Locality



Partial Equilibrium Analysis

- Measures distance between supply curves
- Assumes perfectly elastic demand

Figure 2 - Change in Supply from an Increase in Public Infrastructure Stock in a Neighboring Locality



Alternative to Production Function Approach:

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

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

- 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

$$\varepsilon_{VC,G} = [\partial VC/\partial G][G/VC]$$

- 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

- $u_i = \lambda \Sigma_j w_{i,j} u_j + \gamma_i$

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 $\varepsilon_{VC,I}$ is -0.230

Average $\varepsilon_{VC,G}$ 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:

$T \equiv I^{\theta} G^{1-\theta}$,

They find θ=.58, (1-θ) = .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

- Cohen and Morrison Paul (2003):

U.S. States, manufacturing sector

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