2011 Indiana Construction Industry Conference
Dr. Kevin Christ, Ph.D., Associate Professor of Economics, Rose-Hulman Institute of Technology
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If You Build It …

1. What difference will it make?
   - Is our Infrastructure “adequate”?
   - Does infrastructure spending have measurable effects on overall economic performance?

2. Can we afford it?

3. Will it solve our present difficulties?
The fastest rail link in the world was launched, connecting the cities of Guangzhou and Wuhan at the speed of 350 kilometers an hour, reducing the time required for the 1,069-kilometer journey to only three hours.

The project began in 2005 with the aim of expanding the high-speed network between Guangzhou and Beijing.

Beijing has been quite ambitious with the rail development program. The authorities are very keen on increasing the national rail network from the present 86,000 kilometers to 120,000 kilometers.
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Infrastructure as an Economic Input

Economic Inputs

- ~ $250 billion hours of labor
- ~ $41 trillion of "capital"

Economic Outputs

- ~ $13.2 trillion of goods & services
Some Basic Facts About Infrastructure Capital

U.S. Aggregate Capital Stock (Fixed Assets)

1970 Total Estimate: $15.6 trillion
2009 Total Estimate: $41.4 trillion

- Private Residential: $6.4 trillion (41%)
- Private Nonresidential: $5.0 trillion (32%)
- Public: $4.2 trillion (27%)
- Private Nonresidential: $15.2 trillion (37%)
- Private Residential: $17.6 trillion (43%)
- Public: $8.6 trillion (20%)

Source: Bureau of Economic Analysis Fixed Asset Tables 1.1 and 1.2, Chained 2005 dollars.
Is Our Infrastructure “Adequate”?

A surprisingly difficult question to answer ...

Historical trends
Indicators of Optimality
Some Basic Facts About Infrastructure Capital

Graph Title: Ratio of National Public to Private Capital Stock

Graph shows a downward trend in the ratio from approximately 0.90 in 1960 to around 0.50 in 2010.
Some Basic Facts About Infrastructure Capital

Levels of Private and Public Capital

Source: Bureau of Economic Analysis Fixed Asset Tables 1.1 and 1.2, Chained 2005 dollars.
Some Basic Facts About Infrastructure Capital

Annual Growth Rates
(3-Year Trailing Average)

Source: Bureau of Economic Analysis Fixed Asset Tables 1.1 and 1.2, Chained 2005 dollars.
Some Basic Facts About Infrastructure Capital

Public Capital as a Percentage of Aggregate Fixed Assets

Source: Bureau of Economic Analysis Fixed Asset Tables 1.1 and 1.2, Chained 2005 dollars.
Some Basic Facts About Infrastructure Capital

Selected Trends in State & Local Government Expenditures

- State & Local Government Expenditure as a Percentage of GDP (Left Scale)
- Investment as a Percentage of State & Local Government Expenditures (Right Scale)
In 1970, Americans drove about 5,500 miles per year for every man, woman and child. Today, that number is about 10,000 miles per year. The United States had about $753 worth of highway capital stock for every 1,000 miles driven in 1970. Today that number is about $560.
Is Our Infrastructure “Adequate”?

Historically there have been four approaches to this question:

- **Engineering Needs Assessments**
  “... do not make a compelling case for there being an overall shortage of infrastructure capital.”

- **Political Voting Outcomes**
  “... no clear evidence of an infrastructure shortage from ... voting data.”

- **C-B-A and Economic Rates of Return**
  “... the picture is mixed.”

- **Productivity Impact Estimates**

Estimating the Influence of Public Capital on the Economy

Economic Inputs

THE ECONOMY

Economic Outputs

$\cdots$
A Speculative Bubble in Public Capital Research

An output elasticity tells us how much output increases (or decreases) for each percentage change in public capital. Thus, given the estimates here, each 10% increase in public capital stock is associated with about a 2% to 4% increase in Gross Domestic Product.

<table>
<thead>
<tr>
<th>Study</th>
<th>Type of Public Capital</th>
<th>Sample</th>
<th>Output Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National-Level Studies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Munnell (1990)</td>
<td>Nonresidential</td>
<td>1947 – 1987</td>
<td>0.34</td>
</tr>
<tr>
<td>Tatom (1991)</td>
<td>Nonresidential</td>
<td>1949 – 1973</td>
<td>0.28</td>
</tr>
<tr>
<td>Finn (1993)</td>
<td>Highways and Streets</td>
<td>1950 – 1989</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>State-Level Studies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costa, Ellson and Martin (1987)</td>
<td>Nonresidential</td>
<td>48 states, 1972</td>
<td>0.20</td>
</tr>
<tr>
<td>Munnell (1990b)</td>
<td>Nonresidential</td>
<td>48 states, 1970 – 1986</td>
<td>0.15</td>
</tr>
<tr>
<td>Eisner (1991)</td>
<td>Nonresidential</td>
<td></td>
<td>0.17</td>
</tr>
</tbody>
</table>

“As for the alleged infrastructure shortage, the evidence ... is decidedly mixed.”

“... it will be hard to ever settle the debate about the effect of public capital on private productivity.”
New Tests of Public Capital’s Role in Production

Ratios of Public to Private Capital Stock, Selected States

- Alabama
- Arizona
- California
- Colorado
- Florida
- Illinois
- Indiana
- Michigan
- New York
- North Dakota
- Texas
- Washington
New Tests of Public Capital’s Role in Production

Annual Growth Rates of Private Capital Stock, Selected States

- Alabama
- Arizona
- California
- Colorado
- Florida
- Illinois
- Indiana
- Michigan
- New York
- North Dakota
- Texas
- Washington
New Tests of Public Capital’s Role in Production

Table 4: Aggregate Production Functions
Equation (1a): \( \ln Y_{it} = a_0 + a_1 t + a_2 \ln N_{it} + a_3 \ln K_{it} + a_4 \ln G_{it} \)
Equation (1b): \( \ln Y_{it} = a_0 + a_1 t + a_2 \ln N_{it} + a_3 \ln K_{it} + a_4 \ln G_{CORE_{it}} \)

<table>
<thead>
<tr>
<th>Estimation Method:</th>
<th>Equation (1a): Total Public Capital Stock</th>
<th>Equation (1b): Core Public Capital Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant, ( a_0 )</td>
<td>0.600</td>
<td>0.798</td>
</tr>
<tr>
<td></td>
<td>(0.999)</td>
<td>(0.910)</td>
</tr>
<tr>
<td>( a_1 )</td>
<td>0.005**</td>
<td>0.005**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>( a_2 )</td>
<td>0.561**</td>
<td>0.616**</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>( a_3 )</td>
<td>0.427**</td>
<td>0.445**</td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>( a_4 )</td>
<td>0.226**</td>
<td>0.149**</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.029)</td>
</tr>
</tbody>
</table>

\( F \)-statistic for \( H_0: \alpha + \beta = 1 \)
- Standard errors are in parentheses.
- ** Significant at a 1% confidence level.
- * Significant at a 5% confidence level.

Dynamic OLS: Leads and Lags not shown; full estimation results available upon request.
Can we afford it?

New Jersey’s Governor Chris Christie: The “political canary in the coal mine” of a looming state & local fiscal crisis?
Can we afford it?

Three modest observations:

➢ Think ahead: Investments in public capital have long-term consequences for economic growth but long lags in effects.

➢ Penny wise, Pound foolish: failure to consistently invest in new public capital creates short-term budget benefits but long-term costs in terms of rising maintenance expense.

➢ Spend wisely: Build up public capital in ways that returns on investment are real and measurable.
Will it solve our present difficulties?
Fiscal Stimulus as False Works
Fiscal Stimulus as False Works -- Is it time to remove them?

Construction-related stimulus funding (~$135 bil.)

- **Transportation**: $49 billion
  - $28 billion for highways
  - $18 billion for transit/rail ($8 “high-speed”)  

- **Buildings**: up to $35 billion
  - $0 to $9 billion for discretionary
    - $8 billion for housing
    - $6 billion for other federal
    - $6 billion for GSA
    - $7 billion for DOD

- **Energy/technology**: $30 billion
  - $5 billion for weatherization
  - $6 billion for energy grants
  - $7 billion for wireless/broadband
  - $11 billion for electric grid ($4.4 “smart grid”)

- **Water/environment**: $21 billion
  - $5 billion for Corps
  - $7 billion for water/wastewater
  - $6 billion for waste cleanup

Source: Ken Simonson, Associated General Contractors of America, “Construction and Materials Outlook”, December 1, 2010