The Value of Rural and Urban Public Infrastructure

David Albouy University of Illinois & NBER
Arash Farahani Independent Budget Office of New York City
Heejin Kim University of Illinois

Disclaimer: The views expressed in this paper are the authors’ and should not be interpreted as IBOs
What is the value of infrastructure?

- How do investments impact population, incomes, housing, land values?

- What is the return on investment in all its forms?
  - Productivity (3 Kinds): Agricultural, other tradables, non-tradables
  - Quality of Life: non-market, does not show up as income

- Who benefits from these improvements? Landowners? Residents?

- How do results in rural areas differ from urban areas?
Red >40% Urban Population
Blue < 40% Urban Population

Green >40% Urban Population
BUT
Population < 64 per square mile
Population < 50,000
Measuring Public Infrastructure Stocks from Public Investment Flows

- County Area Finance (Census) data from 1957 to 2012 in 5-year frequency
  - 1972 to 2012 data are complete
  - 1957 to 1962 county-level data missing details
    - Must impute more detailed infrastructure categories
    - Based on share of category in later years
- 1902 to 1956 state-level data: Impute county-level based on 1957 to 1977 shares
- Interpolate (in logs) capital outlays for intra-censal years
- Aggregate with perpetual inventory method
  - 1.82 % depreciation for construction
  - 11.0 % depreciation for rest (needs work)
- Rural counties have 9 to 8% Population of Urban counties
- Rural Employment/Population LOWER
- Rural Public Capital/Population EVEN LOWER
Rural incomes about 20% LOWER
- Rural property values another 10+ % LOWER
- Rural Farm values per acre about 40% LOWER
Rural counties have 4X higher agricultural employment (still ~10%)
- Rural counties have slightly higher manufacturing
- Only slightly more of land is farmland!
Empirical Estimates of the Elasticity of Outcomes to Infrastructure for Counties

- Panel regression over 3,000+ counties in lower 48
- Controls for permanent county differences
- Time-varying controls
  - Demographics age, race, and education levels
  - Local and state tax rates and state infrastructure
- Standard errors to account for spatial correlations (Conley 1999)
  - Not reported here
Elasticity of Outcomes with Respect to Infrastructure

- **Population**
  - Rural Counties: 0.198
  - Urban Counties: 0.382

- **Fraction of Population that is Rural**
  - Rural Counties: -0.098
  - Urban Counties: -0.267
Elasticity of Outcomes with Respect to Infrastructure

Rural Counties | Urban Counties

Income: 0.015 | 0.04
House Prices: 0.079 | 0.026
Farm and Land Values: 0.097 | 0.074
Elasticity of Outcomes with Respect to Infrastructure

- **Rural Counties**
  - Total Employment: 0.198
  - Agricultural Employment: 0.082
  - Manufacturing Employment: 0.044

- **Urban Counties**
  - Total Employment: 0.382
  - Agricultural Employment: 0.165
  - Manufacturing Employment: 0.446
What do these changes tell us about local economies?

- Use a spatial model to translate estimates to deeper concepts
  - Assumes workers and firms are fairly mobile

- Productivity effects
  - Agricultural, e.g. farming
  - Traded (non-agricultural), e.g. manufacturing, technology services
  - Non-traded (e.g. housing): e.g. construction

- Quality of Life effects
  - Households bid up housing in places they like
Productivity in Traded Output (Non-Agricultural)

Higher income to labor (wages)
*also greater federal tax revenue
Productivity in Traded Output (Agricultural)

Higher income to labor (wages) and land (values)
*also greater federal tax revenue
Quality of Life (Direct Benefits)

- Raises demand to live in an area
- Housing prices rise relative to incomes
- Current residents gain relative to newcomers
Productivity in Non-Traded ("Home") Output

Easier production and access market goods
Can lower housing prices
Population exceeds that predicted by quality of life and other productivity gains
Housing values lowered relative to land and construction costs
Financing source not always clear in the data

Cost-benefit analysis depends on whether funding was external or internal

- External: Gross benefits – need to exceed $1.00
- Internal: Net benefits – need to exceed $0.00
Who Benefits from those Investments?

- **Land/Property owners**
  - Residential (home-owners)
  - Agricultural

- **Local Residents**
  - Exclusive of ownership – as renters

- **Federal Government/Revenues**
  - Collect tax revenues from higher income
  - The public at large!
Form of Benefits of Public Capital per Dollar Invested

<table>
<thead>
<tr>
<th>Form of Benefits</th>
<th>Rural Counties</th>
<th>Urban Counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Traded &quot;Home&quot; Productivity</td>
<td>0.02</td>
<td>1.15</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>0.11</td>
<td>0.25</td>
</tr>
<tr>
<td>Traded (non-Agricultural) Productivity</td>
<td>0.39</td>
<td>0.79</td>
</tr>
<tr>
<td>Agricultural Productivity</td>
<td>0.12</td>
<td>0.07</td>
</tr>
</tbody>
</table>

RURAL COUNTIES

URBAN COUNTIES
Distribution of Benefits of Public Capital per Dollar Invested

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Rural Counties</th>
<th>Urban Counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Tax Revenues</td>
<td>0.16</td>
<td>0.36</td>
</tr>
<tr>
<td>Residents/Renters</td>
<td>0.52</td>
<td>0.71</td>
</tr>
<tr>
<td>Residential Landowners</td>
<td>0.75</td>
<td>1.13</td>
</tr>
<tr>
<td>Agricultural Landowners</td>
<td>0.17</td>
<td>0.03</td>
</tr>
</tbody>
</table>
More refinements on their way

- Core vs non-core
  - Core slightly higher in urban counties
  - Non-core slightly higher in rural counties

- Spatial spillovers
  - Appear to be generally positive: urban areas usually get more
  - Need to see if urban or rural areas provide more

- More credible identification?
Conclusion

- Infrastructure investments seem to be a good deal!
  - On average exceed cost-benefit test
- Urban areas benefit slightly more
  - Despite having more infrastructure!
  - Rural areas get more quality-of-life benefits
  - Urban areas get more productivity benefits