Rural Highway Expansion and Economic Development

Impacts on Private Earnings and Employment

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Infrastructure Benefits

- Urban locations
  - § Agglomeration economies
    - ▶ Firm-level spillovers among non-related firms
    - ▶ Shared use of non-excludable inputs
      § transportation infrastructure
    - ▶ Investment mitigates externalities
  - § Accessibility
    - ▶ Access to larger markets, labor pools, etc.
Infrastructure Benefits

► Rural locations
  § Expand use of existing resources
    ► Capital, labor, etc.
  § Attract new resources, inputs
    ► Firm/household relocation
  § Raise productivity of existing businesses
    ► More intensive use of resources
    ► *Primary* benefit
Renewed Emphasis: ARRA, Fiscal Stimulus

► Oct. 2010: Dept. of Treasury report
  $ $50 billion infrastructure package

► Authors claims
  $ Long-term economic benefits
  $ Middle class benefits greatly
  $ Make use of underutilized resources
  $ Strong demand for investment from people and businesses
Crowding In or Crowding Out?
Highways and Economic Growth: Estimating Casual Relationships

- “Natural” experiments
- IV Regression
- Panel Analysis
- Granger causality
Data Sources

BEA Earnings data

► Advantages
  § Longer time series

► Disadvantages
  § Higher level of aggregation

QCEW employment data

► Advantages
  § Greater spatial disaggregation (MCD level)

► Disadvantages
  § Only available since 2000
Aggregate (County-Level) Analysis of Earnings
Empirical Approach

- Counterfactual Analysis of Earnings
  § Highway improvement as binary
  § Pre/post-construction periods
  § Time/location-specific interaction variables

- Panel data set
  § County with highway improvement + neighbors
  § Private earnings, Years 1991-2009

- Focus on “transportation-intensive” industries
Empirical Model of Earnings

\[ \ln y_{it} = \alpha + \beta_1 \ln GDP_t + \beta_2 \ln StateEarnings_t + \beta_3 \ln Pop_t + \sum_{j=1}^{3} \gamma_j \text{County}_j + \epsilon_{it} \]  

(4.1)

where:

\( \ln y_{it} \) = natural log of earnings in a given industry in county \( i \) at time \( t \)
\( \ln GDP_t \) = natural log of real GDP (in 2009 dollars) at time \( t \)
\( \ln StateEarnings_t \) = natural log of state-level earnings in a given industry at time \( t \)
\( \ln Pop_t \) = natural log of population in county \( i \) at time \( t \)
\( \text{County}_j \) = indicator variable identifying the county (or counties) in which the highway improvement was located during a specific period, \( j \)

\( \epsilon_{it} \) is an error term, and
\( \alpha, \beta_1, \beta_2, \beta_3, and \gamma_j \) are parameters to be estimated.
Estimation

- OLS with panel-corrected SE
  - Allows for individual (county) specific effects and correlation across panels

- Error structure
  - Assumes AR(1) process for serially-correlated residuals
TH 371 Improvements (Crow Wing/ Morrison Counties)
Traffic Volume Growth

TH 371 just south of Brainerd bypass

AADT

Crow Wing 371 ADT


0 2000 4000 6000 8000 10000 12000 14000
Industry-Level Earnings Regressions: TH 371 Improvements

<table>
<thead>
<tr>
<th>Variable</th>
<th>Construction</th>
<th></th>
<th>Manufacturing</th>
<th></th>
<th>Retail</th>
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<th>Wholesale</th>
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<td>Coeff.</td>
<td>S.E.</td>
<td>t-value</td>
<td>Coeff.</td>
<td>S.E.</td>
<td>t-value</td>
<td>Coeff.</td>
<td>S.E.</td>
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<td>In GDP(_t)</td>
<td>-0.648</td>
<td>0.303</td>
<td>-2.14</td>
<td>0.654</td>
<td>0.239</td>
<td>2.73</td>
<td>-0.390</td>
<td>0.131</td>
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<td>In StateEarn(_t)</td>
<td>1.084</td>
<td>0.174</td>
<td>6.24</td>
<td>0.871</td>
<td>0.233</td>
<td>3.73</td>
<td>0.839</td>
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<td>In Pop(_t)</td>
<td>0.743</td>
<td>0.155</td>
<td>4.79</td>
<td>-0.091</td>
<td>0.179</td>
<td>-0.51</td>
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<td>3.82</td>
<td>2.194</td>
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<td>0.099</td>
<td>2.13</td>
<td>1.504</td>
<td>0.133</td>
<td>11.28</td>
<td>-0.030</td>
<td>0.098</td>
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<td>Morrison(_t3)</td>
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<td>6.863</td>
<td>1.73</td>
<td>-10.220</td>
<td>4.510</td>
<td>-2.27</td>
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<td>(\hat{\rho})</td>
<td>0.688</td>
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<td>Wald (\chi^2(9))</td>
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<td>Adjusted (R^2)</td>
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<td>94</td>
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Disaggregate Analysis of Employment
Empirical Approach

- Similar to earnings analysis
- Individual municipalities as units of observation
  - Total private employment
  - Restricted to county/counties where highway improvement is located
- 11-year panel (2000-2010)
Empirical Model of Employment

\[ \ln(e_{it}) = \alpha + \beta_1 \ln(P_{it}) + \beta_2 \ln(I_{it}) + \sum_{j=1}^{5} \gamma_i(Highway_i) + \epsilon_{it} \]

where:

- \( \ln(e_{it}) \) = natural log of total private sector employment in city \( i \) at time \( t \)
- \( \ln(P_{it}) \) = natural log of population in county \( i \) at time \( t \)
- \( \ln(I_{it}) \) = natural log of real per capita income (in 2009 dollars) in city \( i \) at time \( t \)
- \( Highway_i \) = indicator variables representing location and time-varying characteristics of city \( i \)
- \( \epsilon_{it} \) = an error term, and
- \( \alpha, \beta_1, \beta_2, \text{ and } \gamma_i \) are parameters to be estimated.
Location of Cities Relative to Improved Highway

Non-highway city

Non-highway city

Improved highway segment

City on improved highway segment

Upstream downstream cities
Temporal Aspects of Highway Variables

- Off-highway city ($Q_{before}$) base case
- On-highway city ($H_{before}$)
- Upstream/downstream city ($U_{before}$)
- Off-highway city ($Q_{after}$)
- On-highway city ($H_{after}$)
- Upstream/downstream city ($U_{after}$)

Highway Improvement (before) (after)
### Table 1: Private-sector employment regressions for US 71/TH 23, TH 371, and US 53 improvements

<table>
<thead>
<tr>
<th>Variable</th>
<th>US71/TH23</th>
<th>TH371</th>
<th>US53</th>
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<td>S.E.</td>
<td>Coeff.</td>
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<tr>
<td>$\ln P_{it}$</td>
<td>0.926</td>
<td>0.011</td>
<td>84.88</td>
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<td>$\ln I_{it}$</td>
<td>0.660</td>
<td>0.013</td>
<td>49.24</td>
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<tr>
<td>$O_{after}$</td>
<td>0.002</td>
<td>0.028</td>
<td>0.07</td>
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<td>$H_{before}$</td>
<td>0.528</td>
<td>0.045</td>
<td>11.60</td>
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<tr>
<td>$H_{after}$</td>
<td>0.524</td>
<td>0.041</td>
<td>12.90</td>
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<td>$U_{before}$</td>
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<td>-5.91</td>
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<td>$U_{after}$</td>
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<td>$A_{before}$</td>
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<tr>
<td>$A_{after}$</td>
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<tr>
<td>Constant</td>
<td>-6.769</td>
<td>0.140</td>
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<tr>
<td>Adjusted $R^2$</td>
<td>0.995</td>
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<tr>
<td>N</td>
<td>121</td>
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</tr>
</tbody>
</table>
Conclusions

► Very little evidence of significant effects on private earnings, employment
  § Not the same as “no net benefits”
  § Positive, but not significant?

► User benefits analysis better for these types of projects
  § BCA for safety, travel time savings
Conclusions (Technical Issues)

- Corridor strategies (TH 23, 53, 371)
- Limited post-construction data
  - Confounding factors (08-09 recession)
  - More data would be helpful (follow projects)
- Exogeneity of population
  - Simultaneity of population, employment, transportation investment
Why Lower Returns?

- Decline of transport costs
  - Transportation fell from 8% of GDP in 1929 to 3% in 1990 (Glaser and Kohlhase 2004)

- Diminishing Returns
  - Mature networks

- Political interference
This research was supported by a grant from the Minnesota Department of Transportation through the project “Case Studies of Transportation Investment to Identify the Impacts on the Local and State Economy”
Questions or Comments