Does transport infrastructure reduce or reinforce regional inequality?

*Evidence from the expansion of the railroad network in 19th century Austria-Hungary*

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Research Question and Motivation

• Transport infrastructure is widely seen as a major driving force of economic development → National and supra national organisations spend a large share of their budget in transport infrastructure projects

• Policy planners want often to combine two objectives with transport infrastructure projects
  • Promote growth
  • Diffuse economic activity to peripheral regions

• This paper studies one of the largest public infrastructure projects in Central Europe – the roll-out of the Austrian-Hungarian railroad network to provide evidence on two questions:

• Does transport infrastructure spur economic growth?
• How does transport infrastructure affect the spatial distribution of economic activity?
Literature

• Theory predicts different effects of transport infrastructure on growth
  • Growth effect
    • Price convergence and reallocation of resources along the lines of comparative advantages
    • Increasing market size, gains from increasing returns
  • Relocation and displacement effects:
    • Decline in transport costs strengthen agglomeration forces $\rightarrow$ firms might relocate from rural to urban areas.

• Most of the literature finds positive relationship between transport infrastructure investments and local economic growth
  • Focus on urban areas
  • Focus on direct effects, neglects relocation effects
This Paper

• Novel data set on municipality population growth and transport costs for over 1,171 municipalities for the years 1846, 1857, 1869 and 1880
• Provides causal evidence on the impact of decreasing transport costs on the annual population growth rate of a municipality
• and on the distributional effects of transport infrastructure

Methodological challenges and identification strategy
• Direct and indirect effects
  • Growth attributed to transport infrastructure investment might reflect a reorganization of economic activity. Shift from non endowed to endowed regions or also between endowed regions
  • This paper measures the effects of transport improvements by changes in “market access”
  • Transport infrastructure improvement does not only improve the market access of one municipality (direct effect) but also has an effect on the market access of all other regions (indirect effect)
• Endogeneity of transport infrastructure
  • Transport infrastructure investments might follow demand → Cherry-picking of railroad routing might overestimate growth effect
  • Unique historical setting of the expansion of the railroad network in the Habsburg monarchy allow me to address this issue
Historical setting

• Railroad network was designed by the state
  • Main objective was to create major transport axes across the country (corridor system)
    • Political integration
    • Attraction of trans-European trade flows
    • Strengthen position as trade power
  • Investment beyond demand especially in the east

• Historical Setting and sources allows to implement an inconsequential unit’s IV approach
  • Calculating of an exogenous market access
    • Official railroad proposals are used to identify main nodes of the network
    • Information on construction costs are used to draw least costly paths (LCPs) between these nodes
Least-cost path (LCP) network with main nodes and the actual railroad network of 1869
Market access and freight rates

• Transport infrastructure improvements are operationalized by market access, which takes into account that manufacturers can send output to more than one regional market:

\[
MA_{it} = \sum_{j=1}^{J} \frac{1}{Costs_{ijt}} \times Population_{jt}
\]

• Railroads and waterways were digitized and information of historical freight rates were collected to calculate lowest-cost municipality-to municipality freight routes
Changes of market access and transport infrastructure improvements.
Spatial distribution of annual population growth
Annual growth rates per municipality type and period

-1.00%  -0.50%  0.00%  0.50%  1.00%  1.50%  2.00%  2.50%  3.00%

1846-1857  1857-1869  1869-1880

-0.50%  0.00%  1.00%  1.50%  2.00%  2.50%  3.00%

from 2,001 to 5,000 from 5,001 to 50,000 above 50,000
Econometric Model

Difference-in-differences estimation

\[ APG_{ijt+1} = \alpha_i + \lambda_t + \theta_{jt} + \beta_1 \ln( MA_{ijt} ) + \varepsilon_{ijt} \]

- **Fixed effects:**
  - *time-invariant*
  - and municipality-specific factors

- **Region-by-period fixed effects:**
  - cycles on a regional level

- **Average annual population growth**

- **Period fixed effects:**
  - *time trends*

- **Market access**
  - (treatment variable)

\[ N = 3,369 \quad t = 3 \]
Regression results

![Graph showing regression results with coefficient estimates and model comparisons.](image-url)
Interaction models
Average marginal effect of a one percent increase of market access on population growth in the subsequent decade

Change in the annual population growth rate

<table>
<thead>
<tr>
<th>Municipality Type</th>
<th>Change in Annual Population Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>-0.813</td>
</tr>
<tr>
<td>Small</td>
<td>-0.911</td>
</tr>
<tr>
<td>Medium</td>
<td>-0.887</td>
</tr>
<tr>
<td>Large</td>
<td>0.799</td>
</tr>
</tbody>
</table>

Percentage points

Baseline 0 0.2 0.4 0.6 0.8 1
Small 0 0.2 0.4 0.6 0.8 1
Medium 0 0.2 0.4 0.6 0.8 1
Large 0 0.2 0.4 0.6 0.8 1

Change in population

<table>
<thead>
<tr>
<th>Municipality Type</th>
<th>Change in Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (3,000 pop)</td>
<td>137</td>
</tr>
<tr>
<td>Medium (10,000 pop)</td>
<td>592</td>
</tr>
<tr>
<td>Large (60,000 pop)</td>
<td>5752</td>
</tr>
</tbody>
</table>

Change in population

Small (3,000 pop) 0 1000 2000 3000 4000 5000 6000
Medium (10,000 pop) 0 1000 2000 3000 4000 5000 6000
Large (60,000 pop) 0 1000 2000 3000 4000 5000 6000
Conclusion

• Large scale transport investments can lead to a reduction in economic activity in peripheral regions. Decreasing transport costs strengthens agglomeration forces and relocated economic activity towards the core.

• The response to market access might be also dependent on factor endowments. But in the case of the Habsburg monarchy agglomeration forces and access to consumer markets were a much more important determinant for location decisions.

• These findings might be relevant for large scale transport infrastructure projects - especially in developing countries - where spatial disparities are particularly pronounced, and rural-urban migration is already a major problem.