“Transport Costs, Structural Change and Urbanization: Evidence from a large transport investment (Jamuna Bridge) in Bangladesh”

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Introduction

• Smaller cities and towns: account for a disproportionate share of urban population and urban poor
• Competitiveness of these cities depends on market access
• Improved connectivity is an important policy recommendation
• Impacts of this investment on urbanization and structural transformation, comparing the effects for smaller cities/towns with overall impacts
Empirical Literature

• Vast Empirical literature on the impacts of transport on a range of economic indicators: GDP, population, sectoral transformation, agricultural specialization, industry location etc. Two recent survey papers: Redding and Turner (2014) handbook chapter (Regional and Urban Economics), and Berg, Deichmann, Liu and Selod (2015)

• Most evidence is in favor of a substantial positive impact on economic activities and welfare with a few exceptions

• Our approach is different:
  • Substantial reduction in travel time and costs
  • Geographical setting ideal for testing predictions from center-periphery models vs. comparative advantage models
  • Difference in difference approach afforded by geography and political economy
Jamuna Bridge in Bangladesh

- Opened in 1998
- 4.8 km long
- Reduced travel time by at least 4 hours for buses, 14 hours for trucks
- Reduced freight/ton costs by 40-50%
- Connected 30 million people to more prosperous eastern part of the country
- Poorest region with pre-bridge poverty rate over 61% (vs. 55% in control)
- Poverty rate in Dhaka – center – was about 40% in the same year (1995/96)
- Population density in treatment area was about 908/sqkm compared with 5140 in center. Density in control: 1304
- 66% in agriculture in center compared with 81% in treatment area and 71% in control
Theoretical Literature: Potential Impacts

• Center-periphery models: Krugman (1991), and Krugman and Venables (1995)
  • Reduction in transport costs from high to intermediate levels: industry and people move to center
  • No agricultural productivity change in these models

• Agricultural Productivity and Industrialization (Matsuyama (1992) model)
  • With free trade, industry will move away from areas with higher agricultural productivity because of higher labor costs but population can increase
  • Extension of this model to include services (Foster and Rosenzweig (2004)): Relative shares of agriculture and services should remain unchanged
Treatment vs. Control

- Pre-bridge poverty rate over 61% vs. 55% in control
- Population density in treatment area was about 908/sqkm compared with 1304 in control
- Agriculture’s share in employment: 81% in treatment area and 71% in control
- Services share: 16% vs. 26%
- More semi-skilled workers in control
Differences between the center, treatment and control areas in average luminosity of night lights and rice yields before the bridge.

**Average Luminosity**

- **Treatment**
- **Control**
- **Center**

**Boro Rice yields**

- **Yield in Treatment Area**
- **Yield in Control Area**
- **Yield in Center**
Placement and financing of the bridge

• Bridge construction costs: about $1 billion
• Three donors (WB, ADB, JICA): 24% each of originally estimated costs of $800 million, rest financed by government of Bangladesh
• Three regions: center (Dhaka, capital city), and two peripheries (treatment and control)
• Control areas: that would have been connected to center, had Padma bridge been constructed. Control is isolated from treatment by Padma River
• Why Jamuna bridge but not Padma bridge
  • 3 presidents/ prime ministers in power for most of 1975-1999 were from treatment area
  • Proposed Padma bridge: 6.18 km and costs increase exponentially with length
  • Treatment area was the poorest region in the country
Empirical Specification

• Estimating equation in difference in difference formulation:

\[ Y_{ijt} = \alpha + \beta \times \text{treat} \times \text{year}_{t^*} + \gamma Z_{ijt} + \delta \times \text{treat} + \tau \times \text{year}_{t^*} + \theta_i + \mu_t + \varepsilon_{ijt} \]

• \( \beta \) = treatment effect, \( \text{year}_{t^*} \) is dummy for treatment years (after 1999), \( \text{treat} \) is dummy for treatment areas, \( \theta_i \) = upazila FE, \( \mu_t \) = time fixed effect, \( Z_{ijt} \) = time variant upazila level controls

• Upazilas in Rajshahi division are in treatment group and upazilas in Barisal and Khulna are control groups

• Coefficient of interaction of treatment years and treatment group is the treatment effect

• \( Z_{ijt} \): Pre-treatment characteristics: log(rainfall), log(SD of rainfall), log(1991 population), distance to bridge (Actual for treatment and proposed for control). Also include contemporaneous rainfall

• Data Sources: Population Censuses, Agricultural statistics, Global Satellite data on night lights
Treatment vs. control: no statistically significant differences
• No change in yield in the 6 year period following bridge opening
• Large and significant increase in yield 10 year later: 6-8% increase in yields in treatment area
• Yield increase in treatment area at least as large as that in center
In treatment area, no significant change in population density 3 year after bridge opening, but significant shift in employment share of services (an increase) at the expense of that of agriculture.

- Significant increase in density in the longer term (12 year after), with services share increasing significantly but manufacturing declining.
- In the center: no effect in shorter term, but significant increase in density, manufacturing and services shares and decrease in agriculture share.
• No change in nightlight luminosity growth rate within first 5 years but increase in level (3.8%)
• The magnitudes of effects are nearly double that of short-term effects (first 5 years)
• The longer term increase in level of nightlight luminosity much larger in center, growth rates are comparable
• But treatment areas are starting to catch up with center
Small Cities and Towns Sample
• For treatment areas: effects are slightly larger though in the same direction as full sample
• For center: no effect on density, smaller increase in manufacturing share but large increase in services share
Small Cities and Towns Sample
- Effects are somewhat larger in treatment areas compared with full sample
- For center: opposite (slightly smaller)
Concluding Remarks

• Removal of transport bottleneck had significant impacts on urbanization and structural transformation
  • Significant increase in agricultural yield
  • Within region adjustment in employment (from agriculture to services) with no movement of people in the shorter term
  • Longer term adjustment in population to increase urbanization, reduce industry share in employment and increase services share
  • Industry appears to move to center instead of low labor cost control region pointing to importance of agglomeration economies
  • Welfare improvements in terms of nightlight growth
  • Smaller towns and cities: Industry and people moved to larger cities within the center.
Taking Evidence to Theory

• Results are only partially consistent with center-periphery or Matsuyama type models

• Need a richer model incorporating:
  • Technology adoption and agricultural productivity growth in response to reduction in transport cost
  • Non-homothetic preference to explain services growth and nearly unchanged agriculture’s share in employment and an increase in population density
  • Agglomeration economies in the center