Private Enterprise Development in Low-Income Countries

Highways, Firm Productivity, and Allocative Efficiency in India

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The study of a large scale highway upgrade project in India, called the Golden Quadrilateral (GQ), finds several positive effects on the organized sector for non-nodal districts located in proximity with the GQ vis-à-vis other districts — most notably higher entry rates and improved allocative efficiency.

We study the impact of the Golden Quadrilateral (GQ) Project, a large-scale highway construction and improvement project in India. The GQ project sought to improve the connection of four major cities of India: Delhi, Mumbai, Chennai and Kolkata. The GQ system comprises 5,846 km (3,633 mi) of road connecting many of the major industrial, agricultural and cultural centres of India. It is the fifth-longest highway in the world. The massive project began in 2001, was two-thirds complete by 2005, and was almost finished by 2007.

India's highway in 2000 **India's highway in 2007**

Figure 1 - Before and after snapshots of the road development

The project evaluates the impact of upgrades to the GQ network on organized sector manufacturing using plant-level data from 1994 to 2009 as well as for the unorganized sector manufacturing covering the data up to 2005. Organized sector establishments are defined as those with 10 or more employees for businesses which use electricity, and 20 or more employees for those that do not. We study how proximity to the GQ in non-nodal districts affects the organization of manufacturing activity, using establishment counts, employment levels and output levels, especially among young and newly-entering plants that are making location choice decisions around the time of the upgrades. This work also considers industry-level sorting, manufacturing urbanization and intermediate city development, and the impact of the upgrades for manufacturing productivity.

Non-nodal districts located within 10 km from the GQ network experienced substantial increases in entry levels and higher productivity. The increase in log young firm output from 2000 to 2007-9 is 0.680 (0.286) for these districts, compared to no response in their nearby peers. Similarly, districts within 10 km of the North-South and East-West (NS-EW) highway, shown on Figure 2, do not experience any change in activity. Upgrades were scheduled for NS-EW at the same time, but were postponed, making it a great placebo case.

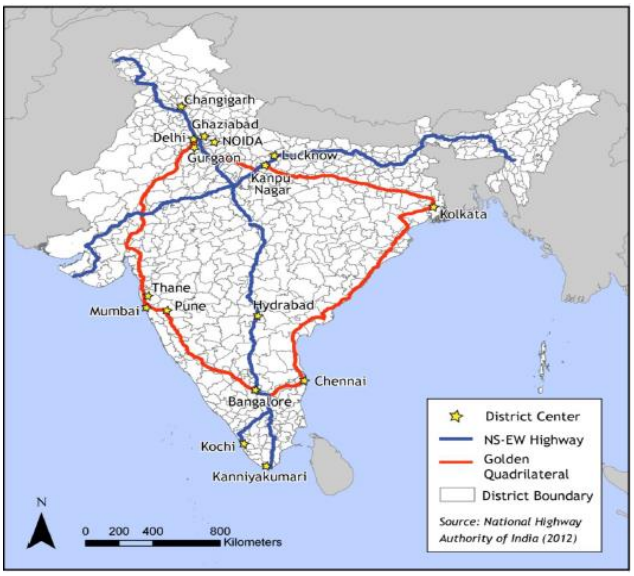

Figure 2 - Map of GQ and NS-EW Economic Effects on the Organized Sector

To better establish the timing of these reforms, we construct two dynamic specifications. First, we separately estimate effects for each calendar year, so that we can observe whether the growth patterns appear to follow that of the GQ upgrades. Effects are measured relative to the 1994 period and tend to confirm the right timing, as in Figure 3 for the output levels of young firms. In an alternative dynamic specification, we identify the sections of highway that were completed earlier than others. We show that the effects are largest where the district's work was completed by March 2003, followed by those finished by March 2006, and then the last sections to be built.

The GQ upgrades also appear to have facilitated a more natural sorting of land- and building-intensive industries from the nodal districts into the periphery locations; the upgrades further appear to encourage spatial decentralization by making intermediate cities more attractive for manufacturing entrants. Importantly, and the subject of ongoing research, the upgrades are also associated with better allocative efficiency in the organized sector (Figure 4). Allocative efficiency measures the extent to which the employment of an industry is contained in the industry's most productive plants. India generally compares very poorly on this dimension to advanced economies like the United States. Industries that were initially positioned along GQ show improved allocative efficiency compared to industries initially positioned on the NS-EW system. This is encouraging for the competitive dynamics induced by better infrastructure.

Impact on the Unorganized Sector

In another phase of our work (report 2), we considered the unorganized sector using the framework identified for the organized sector. As with the formal sector, we examine the impact of GQ on economic activity in terms of establishment counts, employment, output and labour productivity for incumbents as well as for young establishments. Additionally, this work examines issues like the gender of business owners to understand how improved highways affect sub-groups of the population differently. The general conclusion is that there was not much impact on these dimensions. This null finding is not surprising given that enterprises in the informal sector do not depend heavily on transport by national highways for their supplies and products.

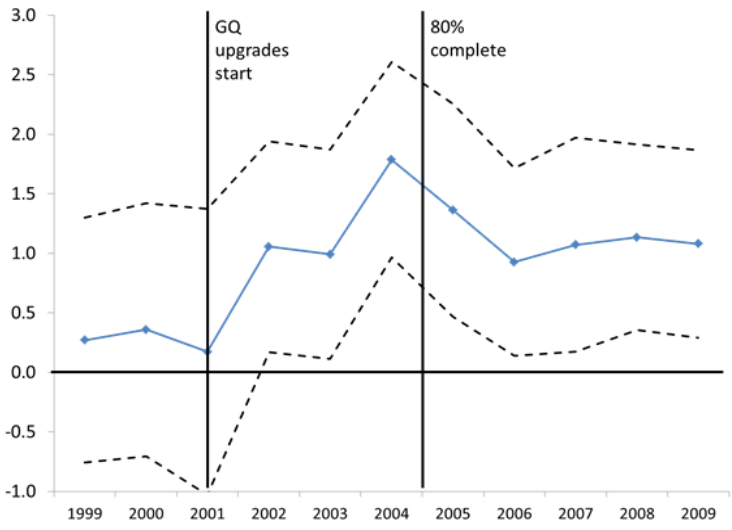

Figure 3 - Dynamics of new output growth (log)

Urban-Rural Context

In earlier work, we analysed the extent to which the manufacturing sector is moving from urban to rural locations within districts. Among its conclusions, the paper finds that the organized manufacturing sector of India is moving towards rural locations, while the unorganized sector is moving towards urban settings. The predecessor study concludes that infrastructure build-up within districts plays a modest role in location placement, with an emphasis towards retaining higher urban shares. These patterns, and especially the extent to which the unorganized sector is the key force driving urbanization of manufacturing, are important for policy makers to understand when designing policies to promote urbanization. Our current study of the impact of

large scale infrastructure investments such as the GQ confirms that the basic patterns documented above are true in both urban and rural settings; they also hold true regardless of the gender of the business owner in the unorganized sector. This suggests that the inter-district infrastructure development plays less of a role in these urban-rural transitions that the intra-district infrastructure.

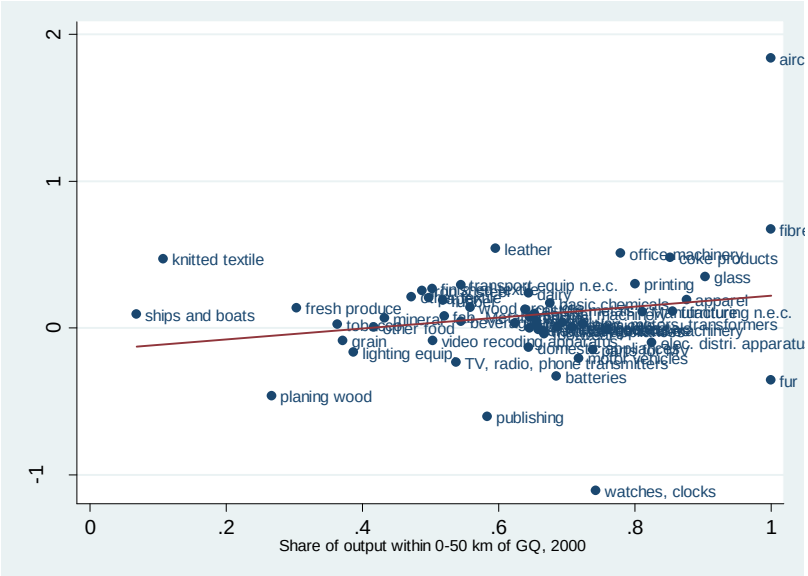

Figure 4 - Change in allocative efficiency, 2000-2009

Conclusions

The massive GQ highway project development had a substantially larger effect on the organized sector than on the unorganized sector (or, more generically, on the largest of plants relative to the smallest of plants). For the organized sector, the aggregate impact is fairly neutral with respect to urbanization. The build-out appears most significant in urban areas closest to nodal cities, while rural areas farther away are less-developed. By contrast, the aggregate impact for the unorganized sector was significantly less.

This project provides an important input into policy choices. Our work provides quantitative estimates of the likely impact of other highway development projects in India, and our work on the relative impacts across districts by distance to the network offers insights into the distributional impacts of these infrastructure projects. We purposefully stop short of attempting a full cost-benefit analysis because this would require us to apportion some measure of nodal city development to the projects, which would be highly speculative in a case like Delhi. Nonetheless, the sizes of the estimates that we measure, their rapid achievement, and the relatively low costs of the GQ upgrades—US$6 billion (1999 prices) as of 2011—suggest it is highly likely the benefits exceeded the costs in this case.

Moving Forward…

The GQ upgrades offer a great laboratory for studying infrastructure and private enterprise development. An upcoming project will examine linkages across industries that were impacted by the GQ upgrades and how these linkages influenced co-agglomeration behaviour in manufacturing. This work will jointly consider related trade reforms.

At a later stage, we might also analyse whether the heightened competition resulting from the GQ upgrades for some industries influenced their ability to discriminate over workers.