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Can highway development promote employment growth in India?

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ABSTRACT

India has embarked on an ambitious highway development program to significantly improve interstate road transport connectivity. Between 2000 and 2015, total length of India's national highway network has nearly doubled and 4 + lane share of the national highways has increased from 2 to 20%, along with associated improvements in safety and surface quality. National highway development is considered as a tool to promote employment growth by stimulating economic activities and attracting foreign investments. As India's central government continues to increase budget allocations for national highway projects in anticipation of generating more jobs, this study empirically investigates whether past investments can be linked to employment growth. I analyze changes in non-agricultural private sector employment over a 10-year period (2003–2012) across 25 states in response to changes in the density (lane-km per unit area) of national highways, controlling for other factors affecting employment. Using a series of static (pooled ordinary least squares, random-effects and fixed-effects) and dynamic (random- and fixed-effects with first-order autoregressive or AR(1) disturbances, and system GMM or generalized method of moments) panel regressions, I find that 10% increase in national highway density in India is associated with 1–6% (depending on model specification and estimation approach) increase in private sector employment, all else equal. This paper provides first empirical evidence suggesting that India's national highway development efforts have produced positive employment benefits in the past. In addition to contributing to transportation planning scholarship, the findings are expected to inform policy-makers in India as they develop future highway investment plans aimed, in part, at economic development. This paper will also be useful to decision-makers in other developing countries with comparable policy environments.

1. Introduction

India's national highway network has experienced significant improvements over the past two decades. The total route length of national highways was about 52,000 km in 2000, with 2% of the length having 4 + lanes. By 2015, route length doubled to about 100,000 km, and the 4 + lane share increased to over 20%. Data is available from the National Highway Authority of India (NHAI), the highway project execution division of the Ministry of Road Transport and Highways (MORTH), Government of India (data obtained via Indiastat – indiastat.com – a subscription-based socioeconomic data service provider).

Over the 2000–2015 period, India's Gross Domestic Product (at 2004–05 constant prices) increased by 150% (Central Statistics Office data retrieved September 9, 2017, from data.gov.in) and population increased by 30% (World Bank estimate, based on decennial Census data, retrieved September 9, 2017, from data.worldbank.org). Economic and demographic changes alter passenger travel and goods transport demand. India's national highway development correlates with national economic and population growth.

Although India's national highway system has undergone significant improvements, 30% of their total length currently has a width of less than two standard lanes, both directions combined (2015 MORTH data, via Indiastat). National highway route density is also relatively low in India–60 km/million people (2015 estimate). In 2012, route length per million population of functionally similar roadways was about 300 km in the US and 70 km in China (EURF, 2016). Currently, national highways constitute less than 2% of India's road network, but carry over 40% of total traffic (Ghani et al., 2016).

India's major national highway improvement program was launched in 2000 under the multi-year multi-phase National Highway Development Project (NHDP). Total government expenditure is currently estimated at about Rs. 6 billion (MORTH, 2017). The project aims to improve (by construction of new links, widening of sections, and geometric or surface upgrades) high-speed surface transport connections to metropolitan cities, industrial areas and ports, and economically disadvantaged regions to develop a balanced, integrated nation-wide network, much like the US interstate system. Per the NHAI, about 60% of the planned 47,000 km NHDP project was completed till May-2017 (NHAI data, retrieved September 9, 2017, from nhai.org). The rest is either being implemented or is in the planning stage.

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In addition to the NHDP, there are other ongoing or planned central government schemes such as: a) the "Special Accelerated Road Development Programme for the North Eastern Region" that includes 2 + laning of about 7500 km of national highways in the economically disadvantaged north-eastern hilly states, b) the "Improvement of Road connectivity in Left Wing Extremism" project that has an objective of 2-laning over 1000 km of national highways across eight states affected by home-grown extremist movements, and c) the "National Highways Interconnectivity Improvement Project" that aims to upgrade single-lane national highways to two lanes with paved shoulders in five states (MORTH, 2017).

The list of ongoing projects and new programs suggest that political support for highway-building is high. Indeed, highway projects can generate direct employment (temporary construction jobs and permanent maintenance jobs) and also, in theory, stimulate economic activity to reduce unemployment if regional accessibility is significantly improved (Giuliano, 2004), and costs of moving people and goods are significantly reduced (Glaeser and Kohlhase, 2004). The current government aims to build 40 km of roads, including national highways, per day (MORTH data, retrieved September 9, 2017, from morth.nic.in). Rapid implementation of the ambitious road development program is marketed as one the key drivers of employment growth and a selling point for the "Make in India" campaign (information retrieved September 9, 2017 from makeinindia.com).

As the central government invests on the next generation of national highway projects, and as job creation continues to receive highest policy priority, this paper investigates whether past highway development efforts can be linked to private sector employment growth in India. I analyze changes in private sector (non-agricultural) employment over a 10-year period (2003–2012) across 25 states in response to changes in the density (lane-km per unit area) of national highways, controlling for various other factors that are known to affect employment. I am unaware of any previously published study investigating this relationship in India. This work contributes to the highways–economic development and particularly highways–employment growth literature. Results of this study are expected to help estimate effects of future highway investments in India more accurately, and develop strategies to effectively achieve desired policy objectives. Findings and discussions presented in this paper may be useful for other developing countries currently undergoing similar surface transport investments.

In this study, analyses indicate a positive association between highway development and private sector employment growth. The static and dynamic panel regression models show, based on past trends, that we can expect 1–6% increase in private sector employment in response to 10% increase in national highway density in India, all else equal. Results suggest that the first decade of India's national highway development project could have generated positive employment benefits by attracting private sector investments on average across states. This period, however, saw dramatic improvements in nationwide highway connectivity starting from a low baseline. There could be increasing or decreasing returns, relatively speaking, to further highway system improvements. Parameter coefficients presented in this paper can be used for forecasting purposes only after carefully considering the data and methods that produced the estimates.

The rest of the paper is organized as follows: I first present a review of literature analyzing the relationship between highway development and employment growth. Next, I introduce the study approach with details of data and description of methods. I then present the analyses and summarize results, followed by a discussion on findings with study limitations. I conclude the paper with takeaways for policy.

2. Literature review

2.1. Theory

The highway development – employment growth relationship is grounded in theory on the role of public capital investment in regional economic development, productivity improvement, and private sector output growth (e.g. Aschauer, 1989; Button, 1998; Pereira, 2000).

In the short-term, highway development projects generate temporary engineering-design, materials-supply, infrastructure-construction, and project-management related jobs. However, since government funds are used in majority of highway projects, those jobs could have been created by public investment in any other sector (Jiwattanakulpaisarn et al., 2010). Highway development related jobs therefore have no significant (or marginal, considering new longer-term maintenance jobs) positive effect on employment growth.

Highway projects can produce long-term employment impacts within their influence regions. In theory, highway connectivity improvements benefit firms by reducing generalized costs of transporting inputs (e.g. raw materials and workers) and outputs (e.g. finished goods and services). This helps lower production costs all else remaining constant, expand search boundaries for sourcing better and cheaper raw materials and workers, and also increase ranges of product or service delivery, thereby boosting firm productivity and profits. In the presence of demand side increases (which is likely, since higher firm productivity/profits lead to higher incomes of workers and higher consumption), existing firms are motivated to increase output and more firms (new entrants or movers) are attracted to the region impacted by highway development, leading to increased labor demand. Since the geographic size of the labor market expands as well (because people can travel further to access more jobs within a given commute time budget), labor supply increases, and the region experiences employment growth.

Firm and worker productivity increase as a result of highway development could also lead to employment decline as businesses can choose to operate with fewer employees and invest in more automation, output remaining constant. This is, however, likely to be a short-term effect. Output will grow eventually, and employment opportunities created by increased economic activity can outpace productivity growth associated job losses.

2.2. Evidence

There is a large volume of literature exploring the effect of highway infrastructure development (new highway construction and improvement/better maintenance of existing highways) on employment growth. Most studies use cross-sectional time-series data to analyze whether employment growth is comparatively higher in areas or in time periods experiencing relatively greater levels of highway investments, holding other factors affecting employment change constant. The impact of the US interstate highway system has been extensively investigated.

Past studies do not help develop a consistent understanding of the highway-employment connection. For example, some papers, including those by Lichter and Fuguitt (1980), Mofidi and Stone (1990), Crane et al. (1991), Lombard et al. (1992), Boarnet (1994), Carroll and Wasylenko (1994), Luce (1994), Singletary et al. (1995), Dalenberg et al. (1998) and Álvarez-Ayuso and Delgado-Rodriguez (2012) suggest a positive relationship between highway development and employment growth. Others, however, find mixed (temporally- and/or spatially-varying) impacts (e.g. Jones, 1990), or no significant impact on employment (e.g. Briggs, 1981; Eagle and Stephanedes, 1987; Iacono and Levinson, 2016). Some authors report that impact varies by location – metropolitan vs. non-metropolitan, urban vs. rural, high vs. low baseline employment density, etc. Whether highways can be prescribed as effective tools to promote employment is unclear.

Mixed findings could be due to differences in research approach. For example, studies use different geographic units of analysis (e.g. county, state, municipality, etc.), and have different geographic coverages (e.g. country-wide, state-wide, county-wide, city-wide, etc.). Moreover, they analyze employment growth in different sectors (most studies focus on manufacturing, but some consider employment in services,