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Determinants of commuting patterns in a rural-urban megaregion of India

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ABSTRACT

Contemporary urbanization, as experienced in India, is accompanied by increasing motorization and commuting lengths. A spatially unequal distribution of employment opportunities leads to important differences between urban and rural areas. Making use of newly released data at the district level on home-to-work commuting, this article examines the determinants of commuting patterns in the largest rural-urban megaregion of India.

This paper finds that short trips and non-motorized travel are still predominant in the region. The residents of higher-income districts more often choose to commute by private motorized modes, including cars, whereas residents of poorer areas are tied to non-motorized modes and public transport, and they often must commute longer distances. One problem seems to be the low provision of rail service in the region compared to roads, which is more pronounced in rural areas. Overall, the socio-demographic, economic, infrastructure and area-based variables help explain the variation in the commuting patterns.

This paper emphasizes that policy aiming at sustainable future transport in the National Capital Region requires (i) a shift in government policies from promoting road-based transportation to promoting transit, (ii) the regional integration of rural and urban areas by public transport, and (iii) investment in the provision of rural transport (roads and rail network) for regional development.

1. Introduction

1.1. Background

The Indian urbanization process is characterized by an increasing population and expanding economic opportunities. Therefore, examining the variables that influence commuting patterns has become important because of the rapid growth in the number of vehicles (motorization) and the increase in travel distances. This issue is important from a policy perspective for three reasons. First, reliance on motorized private vehicles increases emissions and environmental problems. Second, longer commuting distances may deprive less mobile or poor people of economic opportunities. Third, improved transportation between urban and rural areas increases access to employment opportunities in rural areas, which reduces development disparities. This article examines the determinants of commuting patterns and whether these patterns provide any indications for decision-makers regarding how to develop a sustainable transportation system in one of the world's largest rural-urban regions (the Capital Region of India).

A peculiar feature of the 2001–2011 period is the population decline in major Indian megacities (Sudhira and Gururaja, 2012) and the continuous growth of the urban periphery. On the one hand, this situation has increased the amount of daily commuting and commuting distances in the metropolises (Basu and Dhar, 2013; WB, 2013). On the other hand, the growth of the urban periphery has resulted in sprawl (Taubenböck et al., 2008; Jain et al., 2013; Jain and Pallagst, 2015), which makes these areas difficult to serve with public transportation and compels residents to rely on private transit modes such as cars and motorized two-wheelers.

In recent decades, Indian cities have experienced a sharp increase in car and motorized two-wheeler ownership (Sharma et al., 2011; Ghate and Sundar, 2014; MoUD, 2014). Consequently, India has become the world's fourth largest emitter of greenhouse gases, and 13% of the country's total emissions originate from its transportation sector (Dhar et al., 2015). In addition, road-based transportation is responsible for 80% of India's emissions (Ramachandra and Shwetmala, 2009). By 2020–2021, the proportion of emissions due to motorized road traffic is projected to increase to 91.7% (Singh, 2006). Although the increase in greenhouse gas emissions and air pollution due to growth in traffic and the growing use of private motorized transit has raised both public and policy concerns, little attention has been paid to these factors in spatial planning and transportation policy research.

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1.2. Limitations of the transportation policies in India

Despite constant calls to integrate transportation with land use and regional planning to encourage sustainable development, transportation has remained consequential only to urban development and has not been appropriately addressed in national policies. The problems are two-fold: first, there are few polices at the national level (e.g., Task Force on Integrated Transport Policy 2001 (PC, 2001)). India's integrated national transportation policy aims to integrate different modes for "an efficient, sustainable, safe and regionally balanced transportation system," but it does not address the issues of reducing commuting lengths and the reliance on private transportation modes.

Second, the policies that exist are focused on urban areas (e.g., National Urban Transport Policy 2006 (MoUD, 2006) and 2014 (MoUD, 2014)). The National Urban Transport Policy of 2006 and 2014 underscores, among other issues, the problem of long commutes and the increased use of private transit, and it notes that longer commuting distances have made the use of non-motorized modes difficult. To address these issues, it recommends integrating land use and transportation policies in order to reduce travel distances, and it encourages the use of public transportation to reduce pollution in urban areas (MoUD, 2006: 3). However, rural areas are not addressed in these documents, and the effectiveness of the policy can therefore be questioned.

The national policy on transportation has a section dedicated to urban transit, whereas rural areas are addressed in a less comprehensive manner (Task Force Report 2001 (PC, 2001)). Similarly, the Mumbai Metropolitan Region plans and the National Capital Region Delhi plans do not emphasize the rural transportation system, especially with regard to making the rural hinterland accessible to firms for economic development. According to Ramaswamy (1998), rural transportation systems should be an integral part of regional planning to connect towns and large and small villages, and they should represent the nervous system of development planning. However, even after decades, this aspect still remains unaddressed in regional policies.

In the Delhi region, there has been an exponential increase in private vehicles, especially in car and two-wheeler ownership, and the increased traffic has raised environmental concerns (NCRPB, 2013:60–63, 79). As a result, the recently revised draft Delhi Regional Plan 2021 National Capital Region for the first time introduces policies that promote short trips and move people from private transportation modes to public transit in order to reduce pollution (NCRPB, 2013: 79, 57). A question remains as to whether these efforts are sufficient to reduce automobile reliance in the region because no fiscal or regulatory instruments have been recommended to achieve these objectives.

1.3. Limited research on commuting patterns in India

Compared with developed countries (e.g., Button, 1997; Banister and Gallent, 1998; Coombes and Raybould, 2001; Banister, 2005; Chapman, 2007), spatial analyses of commuting patterns are scant in India and other similar developing countries because of a lack of data (Srinivasan and Rogers, 2005; Sharma and Chandrasekhar, 2014; Ahmad and Puppim de Oliveira 2016). Most of the data on travel behavior is limited to one point in time, and surveys are not conducted regularly (Srinivasan and Rogers, 2005). The travel surveys that are conducted in India are limited to the largest cities and are not necessarily comparable because they are conducted independently by agencies that use different methods (Pucher et al., 2007). Thus, India has no national survey of travel behavior that investigates the entire country. The available surveys focus on large cities and are limited to certain socio-economic variables, they are not representative of the entire country, especially the large rural-urban regions. In addition to the lack of readily available spatial data, there is also little consistency between the socio-economic data and the spatial data. Consequently, much remains to be learned about the commuting patterns in large regions of India.

The existing studies of India that attempt to explain the factors that influence commuting or mobility are limited to either examinations of several cities or of specific cities. Reddy and Balachandra (2012) examine the relationships among energy intensity, the mode of transportation and passenger kilometers traveled for 23 megacities. They identify increased car dominance in large cities and two-wheeler dominance in small cities as well as increasing vehicle ownership. Ahmad and Puppim de Oliveira (2016) conduct a multivariate analysis using representative household data from 98 cities and determine that in addition to city structure, socio-economic and socio-cultural variables influence mobility.

In the context of specific cities, Tiwari (2002), in a descriptive examination, states that in Delhi, the poor are limited to non-motorized travel, i.e., cycling or walking, whereas the wealthy use cars and two-wheelers. Srinivasan and Rogers (2005) use a household survey and socio-economic variables in the city of Chennai and estimate travel behavior in terms of mode choice and trip frequency. They indicate that low-income residents depend heavily on non-motorized transit for both work and non-work activities. The majority of trips are made for work, and there are more trips made from the periphery compared with the core of the city. Daily travel costs are higher from the periphery than from core of the city. In the core of the city, 70% of trips are made by bicycle or walking, while on the periphery, 50% of trips are made by bus. Sabapathy et al. (2012) examine Bangalore city and compare the commuting patterns of employees in two different types of firms (an IT multinational corporation and a traditional public-sector unit (PSU)) using survey data. They identify a significant increase in travel costs as income rises for IT sector employees, whereas for PSU employees, an increase in income significantly increases travel distance, although it does not affect travel costs. Additionally, using a behavioral choice model, the authors find that with increases in income, IT employees are more likely to choose two-wheelers and cars to commute, while PSU employees are more likely to choose public buses or to walk to work. Goswami et al. (2015) examine commuting for work in the city of Kochi. They find that domestic workers use public transportation and commute long distances to work, whereas IT professionals use private cabs, cars and two-wheelers and have shorter trips to work.

Only two recent studies, Sharma (2013) and Sharma and Chandrasekhar (2014), analyze home-to-work commuting for both rural and urban areas. They use data from the Census of India and the National Sample Survey Organization (NSSO) and find that when the proportion of the population that resides in peri-urban areas is larger, they are more likely to commute to urban areas to work. In addition, with a higher level of rural unemployment workers in rural areas are more likely to commute to urban areas, whereas with a higher level of urban unemployment individuals are less likely to commute to and from urban areas. Both studies account for socio-economic variables; however, neither studies conducts spatial analysis or uses variables such as commuting lengths and mode of travel.

1.4. Aim of the study

Previous studies predominantly focus on urban areas. Moreover, none of these studies examine the variables that explain commuting lengths. Finally, the type of area (rural or urban) rarely plays a role in the analysis. This information is crucial to identifying area-based policy interventions. Therefore, this paper aims to fill this research gap by investigating the variables that influence commuting in the world's largest rural-urban region and provides a better basis for transport analysis and policy interventions. The 2011 Census of India data on commuting lengths and mode of travel to work at the district level was released for the first time in 2016. This information can be coupled with the Census of India administrative boundaries to identify the patterns for trip lengths and mode of travel and to answer several questions such as the following: What patterns of home-to-work commuting are discernible in the National Capital Region (NCR)? What factors determine