



Study of vehicle ownership for urban and rural households in India

Ravi Choudhary, M.Tech. Student, Vinod Vasudevan, Ph.D., P.E. *

Department of Civil Engineering, Indian Institute of Technology Kanpur, Kanpur 208016, India



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ABSTRACT

Private vehicle ownership has been growing in double digits over the last decade. This paper examines the factors determining vehicle ownership for urban and rural households in India. Separate nation-wide disaggregate vehicle ownership models for urban and rural areas in India are developed using readily available consumer expenditure survey dataset. A consumption based proxy variable is assumed to represent economic standard of households. Comparison between vehicle ownership behavior of urban and rural households show that rural households are more inclined to own private vehicle than urban households with same economic standards. Amongst households with regular salaried members, rural households' preference to own two wheelers is greater than that of urban households. While the presence of elderly member or children is considered, urban households showed more preference to own four-wheeler than rural households. As a first nation-wise study to understand the differences in vehicle ownership behavior in urban and rural areas of India, this study provides a lot of useful insights which could be valuable to various stakeholders.

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1. Introduction

India is the second most populated country after China and its population growth rate is over 17% over the last decade. Along with the population, India's GDP also grew from 834.2 billion of US dollar in 2006 to 1876.8 billion of US dollar in 2015 (IMF, 2015). Economic development of the country has led to increase in purchasing capacity of citizens due to which private motorized vehicles, like two wheelers and four wheelers became affordable to a larger number of population. The number of registered vehicle has been increased to 159.5 million in 2012 (MoRTH, 2012). Fig. 1 shows the yearly vehicle registration data for the years from 2001 to 2013. It is clear that vehicle registration has been increasing significantly over the years with the number of registered two-wheelers increasing from about 40 million to over 135 million during this period.

In 2013, India became the fourth largest petroleum consuming country in world after USA, China and Japan (USEIA, 2013). The per capita petroleum consumption or energy consumption is very less for the individuals who use public transit as compared to those who use private motorized vehicles (Singh, 2006). Therefore, switching from public to private vehicle may also have contributed to significant increase in per capita petroleum consumption in the country over past few years. This accompanied by incessantly increasing energy demand of population are major contributors in increasing petroleum consumption in India.

According to IEA (2015), out of 122 million tonnes consumption of various petroleum products in India, 55% were consumed in transportation sector in the year 2012. For such a highly populated country like India, even a small increase in per capita private vehicle ownership will result in dramatic increase petroleum consumption and CO₂ emission. Therefore, understanding private motorized vehicle ownership of Indian households is very important. It is believed that like in other countries, the factors influencing vehicle ownership in urban and rural areas would be different in India as well due to the activities and socio-economic characteristics. This has not been addressed in any previous studies conducted in India.

The objective of this paper is to understand factors affecting the private vehicle ownership model of Indian households and to develop models to quantify effect of various factors on vehicle ownership. Due to differences in socio-economic and demographic factors, two separate models, one each for urban and rural residences are proposed. It is assumed that due to huge differences in life style, economic activities, and requirements, factors affecting vehicle ownerships in urban and rural areas could be different. By developing two separate models, a comparison of vehicle ownership models in urban and rural areas can be made. From a policy perspective, this would be helpful in identifying difference in various factors contributing to vehicle ownerships in urban and rural households.

2. Literature review

Several studies have attempted to understand the factors that influence vehicle ownership. Two broad categories of models exist: aggregate and disaggregate. Aggregate models define vehicle ownership at

* Corresponding author.

E-mail addresses: ravich@iitk.ac.in (R. Choudhary), vinodv@iitk.ac.in (V. Vasudevan).

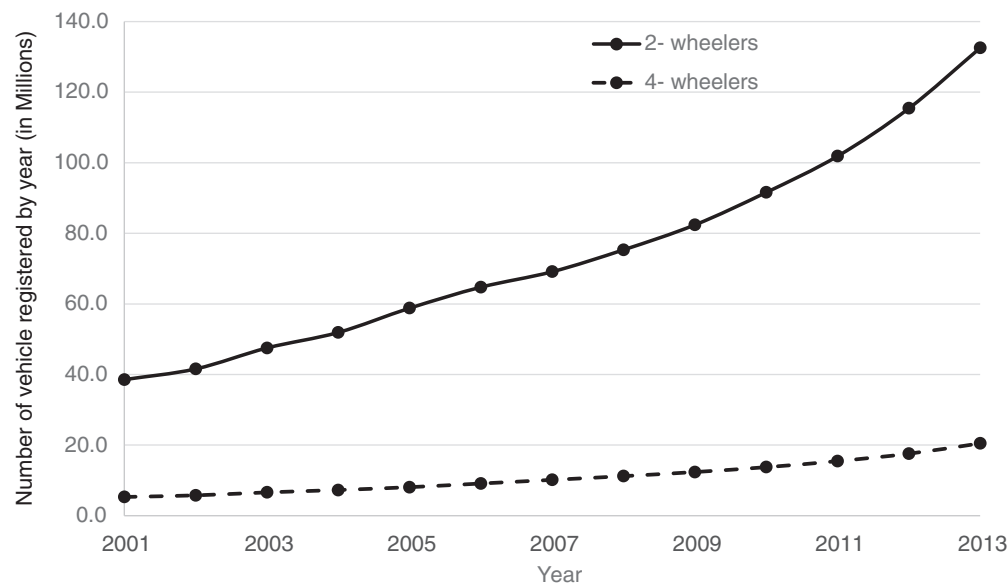


Fig. 1. Vehicle registration data for years 2001 to 2013.
(Source: MoSPI, 2015)

aggregate level whereas disaggregate models help analyze the vehicle ownership level of individual households and are more behavioural in nature. These models capture causal relationship between determinants of decision about vehicle ownership level and actual vehicle ownership level, better than aggregate models (Bhat and Pulugurta, 1998).

There have been several studies on disaggregate modeling of mode choice behavior of travelers conducted in developed countries. Works by Nolan (2010), Whelan (2007), Dargay (2002), Guerra (2015), Clark (2009), Chamon et al. (2008), and Yang et al. (2015) are some examples. Household members' age also play a significant role in deciding vehicle ownership. Pyddoke and Creutzer (2014) in their study found that household with middle aged members are more likely to own car than households with young adults. Potoglou and Kanaroglou (2008) observed that presence of children increases level of car ownership. Since detailed data on demographic and socioeconomic characteristics are unavailable for developing countries like India, these works can only be used as guidelines. There are only limited number of disaggregate models reported for mode choice behaviors of travelers for various Indian cities using private vehicle ownership information. Some of these recent studies are discussed below.

Kumar and Krishna Rao (2006) developed a Multinomial Logit car ownership model for Mumbai Metropolitan Region of Maharashtra, India by conducting a stated preference study. They used attributes like projected family income, travel time, travel cost, car loan payment option and servicing cost of car per annum using survey collected for socioeconomic information. This study, as expected, showed that family income is a major variable deciding car ownership and this result was consistent with studies in the developed economies.

Srinivasan et al. (2007) conducted vehicle ownership and mode choice analysis for Chennai, India using ordered probit models. The dataset was collected by Chennai Household Travel survey between December 2004 and May 2005. The data collected included household characteristics, vehicle ownership information, travel behavior, mode choice information, availability of parking, and public transit facility.

Banerjee (2011) developed a Multinomial Logit model (MNL) for Surat, India. Model was designed for 18 vehicle choices (both new and used alternatives for two wheelers and eight car size segments). Explanatory variables used were income and household size. This study concluded that income has more significant effect than household size in explaining car ownership.

Shirgaokar (2012) used MNL models to study how various factors (like home and work locations, socioeconomic variables, and trip characteristics) influence to middle-class families' decisions to opt for cars (including jeeps and taxis) and motorized two wheelers using household travel survey data conducted by the Mumbai Metropolitan Regional Development Agency in the Greater Mumbai Region. Results showed that vehicle ownership decision depends on marital status of household head, presence of children, higher per capita income, larger household size, and bigger house ownership. Younger people are more inclined towards two wheelers, while older people inclined towards four wheelers.

Dash et al. (2013) developed an all-India disaggregate model for private vehicle ownership using Consumer Expenditure Survey data collected by National Sample Survey Organisation (NSSO) between July 2009 to June 2010. An appropriate proxy variable for economic standard was designed as an explanatory variable in the vehicle ownership model. This study evaluated the effect of various socioeconomic factors on the private vehicle ownership of Indian households after testing the relevance of each of the factors.

There is no study in existing literature that discusses vehicle ownership for urban and rural households in India. The existing studies in India, except one by Dash et al. (2013), are limited to various Metro cities of India. Therefore, it is important to develop vehicle ownership model for Indian urban and rural households. There exists disparity between urban and rural households due to socioeconomic factors such as standard of living, occupation choices, education, and wages. Hence it is vital to study vehicle ownerships of urban and rural areas separately. Such models are expected to provide more insight into the vehicle ownership pattern of rural and urban households.

3. Design of proxy variable for economic standard

As evident from studies of Nolan (2010), Banerjee (2011) etc., income has been proven to be a good explanatory variable for household vehicle ownership models. While use of income as an indicator of economic standard is appropriate for developed countries, for developing countries like India, it can be erroneous. It has been reported in many studies about difficulties encountered in collecting income data of households because of people's unwillingness to disclose their income (Potoglou and Kanaroglou, 2008; Kumar and Krishna Rao, 2006). Beside all this, annual or monthly income data is believed to be

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