# A Study on the Travel Behavior of the Low-income People: A Comparative Analysis between Maputo City and Nairobi City

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The demand for transportation has been growing more rapidly in developing countries. The rapid growth of economics and urban population, poverty problems coupled with less organized bus systems make the commuting trips increasingly difficult. Due poverty the majority of people in developing cities cannot afford private cars, motorcycles, or even bicycles. This paper tries to investigate travel behavior of the low-income people through a comparative analysis between Maputo City and Nairobi City. Descriptive statistics is applied using person-trip data of the selected cities. The results of this study are expected to contribute to transport policy measures to improve the mobility of low-income groups in developing cities.

*Key Words : Person Trip Data, Travel Demand, Chapas, Matatus*

## 1. INTRODUCTION

The demand for transportation is growing more rapidly in cities such as Maputo and Nairobi. Meanwhile, the majority of the people in Maputo City and Nairobi City cannot afford private cars, motorcycles or even bicycles. According to World Bank (2002), relatively little is known about the travel behavior of the urban poor in developing countries as well as their residential location. Existing literature consider travel behavior as resulting from the trade-off between the travel mode and the choice of residential location. The goal of this study is to contribute to the knowledge on the travel behavior of the low-income people through a comparative analysis of Maputo City and Nairobi City. In this paper, we assume that rapid economic growth, poverty problems coupled with less organized bus systems are among the factors influencing travel behavior by the low-income people. We define the low-income groups in terms of the income of the households. Person trip survey data conducted in Nairobi City (as of 2013) disclose income categories for all households, while in the case of Maputo person-trip data was conducted in 2012 and very few households reported their incomes. For the purpose of this study, the low-income groups should be understood as the households with the lowest income in the income categories.

**(1) Objectives**

The objectives of this paper are twofold: to identify the travel behavior of the low-income groups in Maputo City and Nairobi City and to investigate the factors affecting their travel behavior. To achieve these objectives we make use of person trip survey data of the selected cities and apply descriptive statistics.

**(2) Research structure**

The paper is organized as follows. In section 2, previous studies are reviewed to indetify the travel behavior and the factors affecting commonly found to influence travel demand. Section 3 discusses briefly the data used in this study. Section 4 introduces the fundamental features of the selected cities, followed by travel behavior analysis in section 5. Section 6 is devoted to discussing the findings and their implication. Finally, the conclusion is presented in section 7.


**Fig. 1** Maputo City (source: Bing map)


**Fig. 2** Nairobi City (source: Bing map)

## 2. LITERATURE REVIEW

Travel demand analysis has long been an active research area. Early efforts to estimate travel demand resulted in what is commonly known as Urban Transportation Modeling System. McFadden and Domencich (1975) state these traditional demand models were primarily developed to forecast the effect of long-term changes in population demography on the travel demand. However, the models fail to recognize that travel decisions represent optimizing behavior by the commuters. These authors argue that the ability of a travel demand model to forecast accurately the effects of policy changes requires that it be causal by establishing the behavioral link between the attributes of the transportation system and the decisions of the individuals. McFadden and Domencich (1975) illustrated this link by developing theories of individual and population travel demand behavior. Under these theories, the consumer is assumed to have a utility or satisfaction function defined on both consumption and transportation attributes.

In order to proceed with the review, it will be useful to consider what is generally meant by travel demand. According to Kanafani (1983), the needs for transportation results from the interaction between social and economic activities dispersed in the space. As result travel demand is defined as the process of relating the demand for transport to the socioeconomic activities that generate it. For Small et al. (2007) the approach most similar to the standard analysis of the consumer demand is the aggregate one. Under the aggregate demand model, the travel demand is explained as a function of variables that describe travelers or the modes of transport. Likewise, a commuter or group of commuters are also assumed to maximize a utility function subject to budget constraints.

Ortúzar et al. (1990) studied the vicious cycle between the car and public transport. They state that the economic growth provides the first impetus to increase car ownership. For Ortúzar et al. (1990), more car owners mean more people aiming to shift from public transport to private car. With fewer public transport passengers, public transport operators may respond either by increasing the fares or reducing the level of services or both. However, according to Ortúzar et al. (1990), these measures make the usage of the private car even more attractive than before and may induce more people to buy cars, thus, inducing the vicious cycle. Furthermore, they emphasize that in mid-or-long terms car users face increased level of congestion, whilst buses are

delayed and running less frequently.

Several studies have been conducted also in the context of developing countries. For example, Barter (2000) put forward a mechanism to describe motorization phenomena. Known as simple generic model of the urban transport and land use evolution in developing cities, the model is intended to describe the paths taken or potentially to be taken by cities in the developing world. Following Barter (2000), some cities in Asia have moved rapidly from transport systems in which walking, non-motorized vehicles and rudimentary, low-cost, bus-based public transport systems catered for the majority of transport needs, to a situation where cars and motorcycles are beginning to dominate. Barter (2000) underlines that these outcomes are influenced not only by the decisions of individual consumers but also by governments policies towards motor vehicle ownership and use, road supply, urbanization and suburbanization, traffic restraint and relative investments in roads, public transport, and non-motorized modes.

According to Vasconcellos (1997), misunderstandings have occurred in the studies on the demand for transport in developing countries. Vasconcellos (1997) argues that the economic view of the car as a "free consumer desire" is inadequate to understand the context of developing countries. Due to market failures, the majority of people in the developing countries have no choice than to use public transport. Vasconcellos (1997) states that in addition to its utility, the demand for private cars is influenced by urban, transport, and economic policies which shape the space and constraining transport choices.

On the other hand, Kutzbach (2009) analyzed the rise in car use and the decline in bus services in developing countries. He states that although empirical evidence at the country level may suggest a strong relationship between the rising income and car use, at the urban level, local characteristics, traffic congestion, and policies do affect travel decisions. He highlighted the positive feedback between traffic congestion and car use as leading to deterioration of bus services.

ITO et al. (2013) also examined the general mechanism of motorization in the Asian developing mega-cities. Their findings show that motorization is influenced mainly by economic growth and urban structure change. According to ITO et al. (2013), initially, car ownership rises due to economic growth. Then, car ownership growth enhances the convenience of movement and accelerates the expansion of the urban area to suburbs. Dargay et al. (1999) used historical data for more than three dec-

ades worldwide and found a strong relationship between the growth of per-capita income and the growth of car ownership levels. Car and vehicle ownership are expected to continue growing as income per-capita increases. Fujiwara et al. (2007) investigated the motorization in terms of passenger cars and motorcycles in the Asian context. Their findings indicate that motorization is increasing rapidly in the Asian context. With the introduction of competition by Chinese and Indian car producers in the market, the authors expect an acceleration of motorization in Asia.

## 3. DATA

### (1) Basic statistics
This study uses the person trip survey conducted in Maputo City (as of 2012) and Nairobi City in 2013. 9983 and 9999 households in Maputo and Nairobi cities respectively are used as the research sample. Person trip data consist of information about the attributes of households and their trip behavior.

### (2) Methodology
As noted previously, the goal of this study is to investigate the travel behavior of the low-income people in developing countries through a comparative analysis of Maputo City and Nairobi City. Following the literature review, descriptive statistics is applied to highlight similarities and differences between the selected cities.

## 4. FUNDAMENTAL FEATURES OF THE CITIES

Maputo is the capital of Mozambique in the Southern Africa with 2.3 million people (as of 2012) and occupies 1228 km$^2$. On the other hand, Nairobi City with 3.1 million in 2012 and 700km$^2$, is the capital of Kenya in East Africa. The characteristics of the households in these cities are shown in Figures 3, 4, 5 and 6 respectively. According to Howe et al. (2000), East African cities can be considered "young cities" with a substantial proportion of the population being the first generation of the urban dwellers. Household composition in Maputo is characterized by a large number of people below 35 years old. For Nairobi, the majority of household members fall in the age category from 25 to 40 years old. In terms of occupation status, the ratio of the employed is higher in Nairobi City than in Maputo City. The ratio of students is higher in Maputo than in Nairobi. Lastly,

the proportion of employment in the informal sector is significant in both cities. As it would be expected, these attributes influence the travel behavior in these cities.
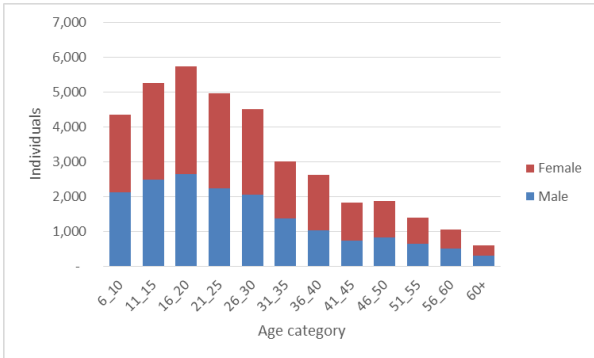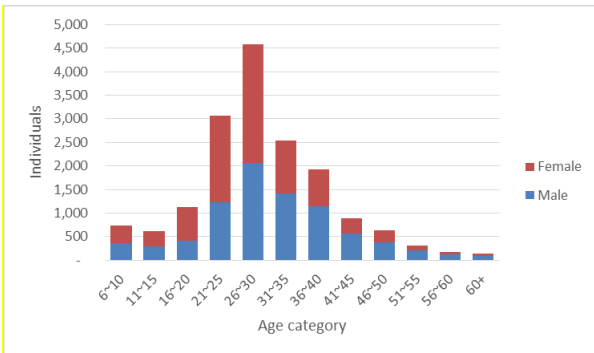


**Fig. 3** Household attributes, Maputo, 2012



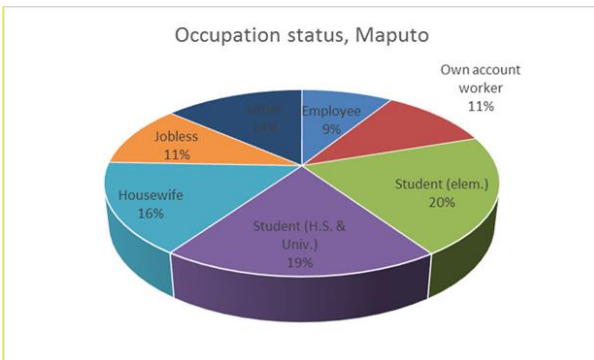**Fig. 4** Household attributes, Nairobi, 2013
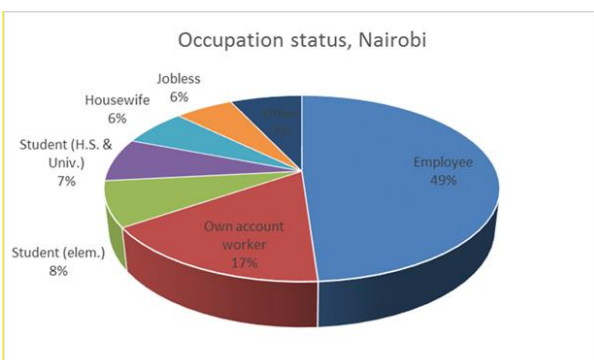


**Fig. 5** Occupation status, Maputo, 2012



**Fig. 6** Occupation status, Nairobi, 2013

## 5. TRAVEL BEHAVIOR OF THE LOW-INCOME PEOPLE

This section describes the travel in the selected cities. Unlike Nairobi City (fig.9 and 10), the distribution of trips in Maputo is characterized by three peak-hour periods, namely, at 6 a.m., 1 p.m. and 5 p.m. respectively (fig.7 and 8). This pattern reflects the nature of the urban activities in these cities. In the case of Maputo, most of the trips that occur in the peak-hour periods include trips to home, school and work trips. School trips comprise three distinct starting periods: 6:30 a.m., 12:00 and 5:30 p.m respectively. On the other hand, trips to work and to home appear to be more predominant in the case of Nairobi City.

The modal share by income category is shown in Figures 11 and 12. We classified households into 5 and 8 income categories corresponding to monthly income in these cities. Mozambique currency is Metical (Mt) while Kenyan currency is Shilling (Ksh). As shown in Figures 11 and 12 the modal share of walking trips by the low-income household is the highest. In general, trips by walk decrease as income increases. Likewise, the low-income groups are the main users of both buses and paratransit, "Chapas" and "Matatus". Lastly, as it would be expected, the low-income households are less likely to commute by private car.
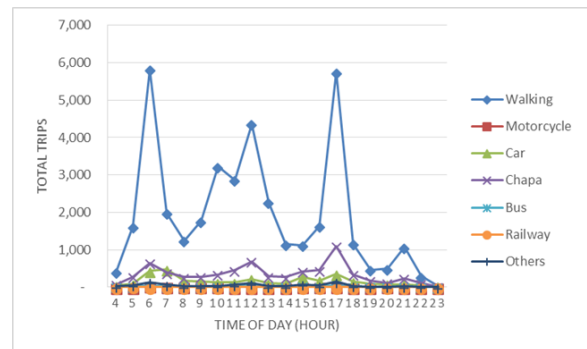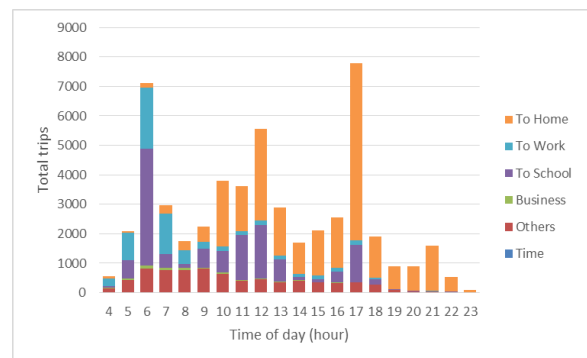


**Fig. 7** Temporal distribution of trips, Maputo, 2012



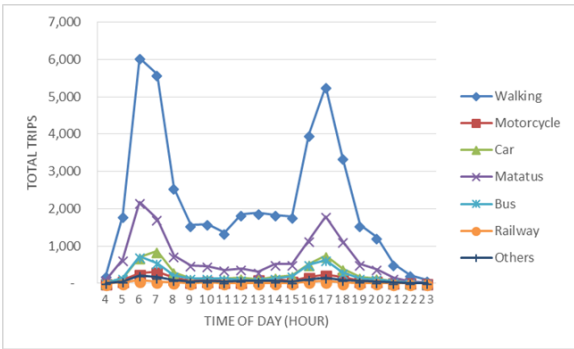**Fig. 8** Trip distribution by purpose, Maputo, 2012

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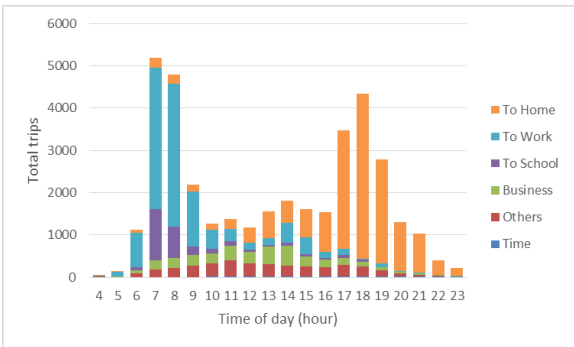**Fig. 9** Temporal distribution of trips, Nairobi, 2013



**Fig. 10** Trip distribution by purpose, Nairobi, 2013
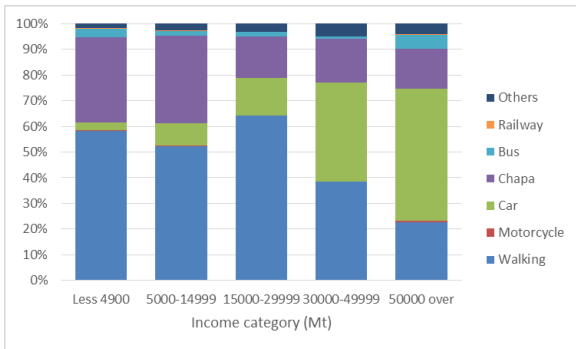


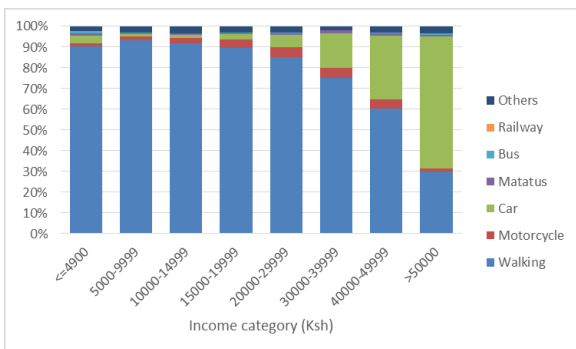**Fig. 11** Modal by income category, Maputo, 2012



**Fig. 12** Modal share by income category, Nairobi 2013

## 6. EXPECTED RESULTS

The analysis of the travel behavior Maputo and Nairobi is expected to contribute to understanding the travel behavior of the low-income people in developing countries. As shown from Figures 7 and 9 urban activities have the potential to induce complex trip patterns in these cities. This pattern of trips distribution will have implication not only in the traveled distance but also in the traffic congestion. This paper will thoroughly investigate residential location and workplaces and the distance traveled by the low-income people. These results are expected to contribute to formulating transport policy measures to improve the mobility of the low-income groups in developing countries.

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