ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURAL AND DEVELOPMENT STUDIES

THE DETERMINANTS OF CHOICE OF TRANSPORTATION MODE IN ADDIS ABABA

BY

KUMLACHEW GEBEYEHU AYNALEM

JUNE 2018

ADDIS ABABA, ETHIOPIA

THE DETERMINANTS OF CHOICE OF TRANSPORTATION MODE IN ADDIS ABABA

BY

KUMLACHEW GEBEYEHU AYNALEM

A Thesis Submitted to School of Graduate Studies, St. Mary's University Institute of the Agriculture and Development Studies, For Partial Fulfillment of the Requirements for the Masters of Science Degree in Development Economics

JUNE 2018

ADDIS ABABA, ETHIOPIA

ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

Board of Examiners

As members of the Examining Board of the final MSc, open defense, we certify that we read and evaluated the thesis prepared by Kumlachew Gebeyehu and recommend that it be accepted as fulfilling the thesis requirement for the Degree of Master of Art in Development Economics.

1. _____ _____

   Name of Chairman Signature and Date

2. _____ _____

   Name of Advisor Signature and Date

3. _____ _____

   Name of External Examiner Signature and Date

4. _____ _____

   Name of Internal Examiner Signature and Date

DECLARATION

I declare that this MSc. thesis is my original work, and has never been presented for the award of any degree in this or any other university and all source of materials used for the thesis have been duly acknowledged.

Kumlachew Gebeyehu Signature _____

St. Mary's University,

Addis Ababa, Ethiopia

JUNE, 2018

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School Of Graduate Studies for examination with my approval as a University advisory.

Adviser's Name and Signature:

_____

Maru Shete (PhD and Assoc. Prof.)

ACKNOWLEDGEMENT

First my innumerable praise to the Almighty God and His Mother Saint Merry for giving me the opportunity, capacity and guidance throughout my life. Next I am deeply grateful and indebted to Dr. Maru Shete (Assoc. Prof.), my advisor, for his encouragement, suggestions, guidance and overall assistance. Successful accomplishment of this research would have been very difficult without his generous time devotion from the early design of the proposal to the final write-up of the thesis by adding valuable, constructive and ever-teaching comments; and thus, I am indebted to him for his kind and tireless efforts that enabled me to finalize the study.

I am greatly indebted to my friends Mengsitu Alamirew and Kindu Temesgen, for giving their lap top and supporting by any materials. My gratitude also goes to my boss Ato Shemelis Tamru, their comment and moral support during my study time. My sincere appreciation and thanks also goes to my colleagues for the remarkable memories and constant moral support during the study period. I also feel great to express my thanks to the peoples who participated in the study for sparing their precious time and for responding positively to the lengthy for filling the questions patiently.

TABLE OF CONTENTS

LIST OF TABLE

Page

LIST OF FIGURE

Page

ABSTRACT

The main objective of this study is to investigate the determinants of choice of transport mode in Addis Ababa. The study hypothesized the effects of independents variables on the choice of transport mode. This research used primary data that collected from participants by using both open and closed ended questionnaire method and employed multinomial logit model. The study found out that traveler's characteristics (age, family size, income, occupation and educational level) and mode of transport characteristics (travel time, travel cost, travel distance, comfort, accessibility, safety and security) are statistically significant. From the findings, 53.8% of the participants used taxi, 25.2% of the participants used buses. Surprisingly, the number of participants who used/chose to use train and private cars is equal with 10.5%. So taxi is the most popular mode of transport used in Addis Ababa. To minimize the forces that push dwellers of Addis Ababa from choosing modes of transportation that have unsafe and insecure attributes, the government and concerned stakeholders should manage the transport system like Higer and Anbessa bus in their safety and comfort to make competitive to others transport modes. Moreover, to improve travel time, the government should invest on infrastructure to reduce traffic jams.

***Key words**: Addis Ababa, Transport Mode, Choice, Multinomial Logit, Odds Ratio*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Transport plays a vital role in the development of the modern era as an integral part of the socioeconomic and political structure of the country. Thus urban transport, transport infrastructure, and traffic management should involve the optimal integration of the means and ways of mobility to make maximum ease and comfort maintaining the socioeconomic and physical integration of the city (Mulu, 2015). Transportation is one of the basic sectors supporting people's daily activities because without any movement it is impossible for them to fulfill their needs. People conduct activities in different places due to biological needs, social obligations, and personal desires (Vilhelmson 2007; Eriksson, 2009). People's uses transport for different purposes, like working activity, education activity, social activity, and recreation activity.

The urbanization process increase substantially the demand for urban transport also increases. Urban transport has a great role in the transformation of society and facilities modernization at large. The demand for urban transportation is affected by the size of the city and population (Mulu, 2015). Urban transport includes all types of means of transportation used in urban areas. Urban transport is usually accepted that cities are the engines of economic growth in most developing as well as developed countries. Essentially, urban transport can be viewed as the oil that prevents this engine from seizing up (ORAAMP, 2010)

People's activities become more complex and also increase people move from place to place. In this case, peoples tend to choose and determine which travel mode most suitable and fair cost for them to fulfill their needs. Therefore the availability of various mode of transport is developing time to time. A few decades ago, the travel modes existed only in the small shape and number of vehicles ware build to accommodate people's movement, but now the travel modes also become parts of people movement. Nowadays the travel modes are available starting from the cheapest to the most expensive one and also from the availability of the common service standard until the exclusive quality (Utami, 2010).

People are highly concerned with the choice of travel modes that are convenient and suitable to the purpose their trips (Joe et al, 2015). There are different modes of transportation and people can choose the mode to accomplish their needs. Now the travel modes are becoming various aspects from the conventional models and peoples tend to choose the mode with concerning the comfort, security, vehicle in time, trip distance, time reliability, cost of the travel mode etc. with the different accessibility of travel modes since the people have various opportunities to choose the mode. For example, the car is fast, comfortable, convenient and provides carrying capacity, privacy and expensive travel mode than the public bus. Thus the car is instrumental in that it increases freedom to perform activities in different places, such as work, shopping, and leisure activities (Eriksson, 2008).

The dominant mode of public transport in developing countries in road-based transport is the use of the conventional bus. It has wider social, economic and environmental benefits. It is the best affordable for urban poor people (Wright et al, 1987). It satisfied both short and long distance mobility demand. It needs less investment and feasibility economically to all group and environmentally friendly system. In Indonesia, using private owned cars and motorcycles becomes the dominant choice in supporting people's daily activities. One of the main reasons to choose this mode of transportation is its easiness such as the car price now is cheaper and also there is a belief in society that owning a private car will increase the prestige of the people (Utami, 2010). Hence, investigating the determinants for the choice of the transport system in day to day activities to fulfill their needs and it has a strong relationship to the transport policy that is essential to design workable policy and strategy for suitable urban transport. Therefore this study intends to examine determinants for the choice of transport services in Addis Ababa.

1.2 Statement of the Problem

Due to the ever-increasing population in the country and also in urban areas in particular as a result of immigration and natural growth, there was increased demand for transportation in the city. Efficient and readily available transport facilities are common problems in any metropolis where the movement of millions of people makes it a daily reality of modern living in Addis Ababa. Rapid urbanization and population growth have led to a rise in poverty and social inequality. Therefore, demand for transport has increased faster than the city can provide it and is

creating health and safety risks, impeding economic development and producing more greenhouse gas emissions. People may live in the suburbs or borders of the city and move in and out for work (Meron, 2011).

Even though there is a high demand of transport in Addis, people had a choice of different mode of transportation such as buses, higer bus, Railway, minibusses, Ladas and other small taxis that serve the millions of residents on a daily basis. The government has also introduced the so-called Public Service blue buses to serve not only the civil servants but also other clients. There was no rail transit within the city. The existing public transport is low quality and a limited number of bus and taxi. Taxi is the majority choice of public transportation. Because of the availability and the number of taxis better than buses even if the price of taxi is expensive and the belief in society to use taxi was increase the status of the people (Mintesnot and Takano, 2007).

Accordingly to Mintesnot and Takano (2007), mode of choice is affected by people's perception because perception is a significant role in the mode of choice and there are only two modes of public transportation which are bus and taxi was addressed by the study. Perception responses have ranking nature and the methods of analysis are ordered logit models with four ordered levels of perception on the three mode related-aspects (fare, convenience, and frequency) have a significant influence on public transport mode choice. The study didn't considered different transportation mode like a private car, train and different buses and also it didn't includes some important variables such as comfortably, accessibility, prestige, safety and security which affecting the mode of transport choice in Addis Ababa.

Therefore, the purpose of this study is to fill the research gab by providing detail analysis on factors affecting on mode of transportation choice depending on socioeconomic characteristics, and mode of transport characteristics. Due to the fact that the availability of several modes of public transportation in Addis Ababa. And people maybe choice more than two alternatives.

1.3 Research Objective

1.3.1 General Objective

The main objective of the study is to investigate the determinants of the transportation mode choice in urban mobility in the context of Addis Ababa.

1.3.2 Specific Objectives

- To identify the most chosen transport system in Addis Ababa.
- To identify the traveler's characteristics that affect choice of transportation in Addis Ababa.
- To identify the mode of transport characteristics that affecting transportation mode of choice in Addis Ababa.

1.4 Research Questions

In order to meet the study objectives, the following questions were addressed in this study:

1. What are the determinants of the mode of transport choice in Addis Ababa?
2. Which transport mode is chosen by majority people in Addis Ababa?

1.5 Significance of the Study

Due to the ever-increasing population in the country and also in urban areas in particular as a result of immigration and natural growth, there will be increase demand for transportation in the city. Even though there is limited transportation system the people tends to choice mode of transport, policy makers require information about mode choice of transportation to facilitate the formation of effective policies. The study gives a contribution by identifying the potential determinants of household’s choice for the transportation system in Addis Ababa. It is important to find out factors affecting people in choosing transportation means for a different activity, to give a recommendation to the government, designer, and other related stakeholders to

accommodate what people needed related with transportation mean and give to others who have interest with the related topic with this research.

1.6 Scope and Limitation of the Study

This study examines the determinants of household choice for transportation services in Addis Ababa and the findings cannot be generalized to other cities and towns across the country even though they might experience similar challenges as Addis Ababa. The mode of choice in Addis Ababa for this study was based on the fact that it is the capital city of Ethiopia and one of the fastest growing cities. This research were observed the factors affecting people in choosing transportation means for a different activity and involves only land transportation modes which are a private car, bus, train, and minibus taxi. This research is limited to the head of the household because of time and financial constraints, it was impossible to conduct research among all family members. The head of the household is choosing as the researcher believed that he/she is the principal source of information for this research topic. Other limitation of this study is lack of local literature particularly on the mode of transportation choice in Addis Ababa context.

1.7 Organization of the Thesis

This paper contains five chapters. The next chapter presents a review of the literature, while chapter three discusses the methodology of the study. Chapter four presents the data analysis and discussion of the results. Chapter five presents the conclusion and recommendation based on the finding.

CHAPTER TWO

LITERATURE REVIEW

2. 1 Urbanization and Transportation

The population of urban cities is progressively increasing over time and growing the share of the urban population live in cities. The continuous number of increasing population created high demand of public service, particularly transportation services. Then, transportation services are the major issue in the cities because of multi nature of the sectors (World Bank, 2011). Cities are also locations of production, consumption and distribution, activities linked to movements of people and freight. Urban transportation is important particularly in high-density areas (Rodriguez et. al., 2006). Urban transportation has played a great role in the society and to facilitate modernization at large. It has a potential to change the lifestyle of the society from traditional to urban.

Transport has always been linked to economic development. The transport sector is also an economic factor in the production of goods and services. It contributes to the value-added of economic activities, facilitates economies of scale. An efficient transport system creates better economic opportunities and peoples are able to increase their mobility that means they will have an advantage to diversify their means of earnings. Whenever there is a transportation infrastructures exists it increase the motivation and efficiency of working class.

Economically, transport is an essential element of city development that, in turn, is a major source of national economic growth. Simply stated, poor transport inhibits growth. Furthermore, socially, transport is the means of accessibility to jobs, health education, and social services essential to the welfare of the city residents. Deteriorating transport conditions affect all city residents; they impact particularly the poor through a decline in public transport service levels, increased length of the journey to work and other essential services and the negative impacts on the environment, safety, and security that the poor are least able to mitigate (World Bank, 2001).

Urbanization in Ethiopia was begun in the 19th century but it was limited. As the result of lack peace and low level of trade and the frequent movement of headquarter by the king of feudal

nobilities. The 19th century, the Minilik's period witnessed the establishment of a number of the new settlement, by far the most important being Addis Ababa. The development of road and communication line and services sign the change of few urban areas. The Addis- Djibouti Railway line reached Addis Ababa in 1917. It is the most important and emerged in several towns. The development of transportation system, the contribution of industries and factories created job opportunities and living in city areas (Punkhoust, 1963).

Today, Addis Ababa has a different mode of the transport system. Transport, one of these components of the urban system, which is responsible for bridging the gap between areas of production and consumption, as well as creating a medium for spatial interaction, continues to be in these challenges. The lack of properly planned urban transport in Addis-Ababa is manifested through the low degree of efficiency of urban mobility that is now observed in almost all of the city center, sub-centres and other major traffic corridors (Mulu, 2015).

2.2 Transportation Activities

One of the most important characteristics of transportation activities is that the interrelationship between the transportation system and the entire socioeconomics is very strong. Transportation is an integral part of many social and economic activities and as a result, it is essential transportation services of adequate quality and capacity is provided. The quality and price of transportation services can substantial affected the spatial pattern of human activities, and by affecting this pattern as well as the quantity and the quality of various economic goods to be produced and consumed (Morlok, 1978). The function of transport can be defined as -In the cause of passenger, transport is to move people from place to place and in the cause of freight transportation, it also moves goods from place to place where it will be a greater value to both producer and consumer (Gubbins, 1996).

2.3 Classification of Transport Modes

Transport is the movement of people and goods from one location to others. Transport can also become a means to deliver from origin to destination. The mode is a means of transport that makes an objective become mobile in certain movement pathway and can operate in that way.

Based on ownership, transport mode can be divided in to:

I) Private transport

Private transport is transportation service which is not available for use by the public. It is a private mode which can operate freely and determines by its own route, as long as it did not obey the traffic rules and the privet mode will still that kind of transport until 21 century (Warpani, 1990). The advantage of private mode has security, comfort, save time, privacy, flexibility and prestige.

A mode of transport is a key that makes use of a particular type of vehicle, infrastructure, and operation. Each mode has its advantages and disadvantages and will be chosen for a trip on the basis of cost, capability, route, and speed. We know that mode choice is important since it affects how efficiently we can travel, how much urban space is devoted to transportation functions as well as the range of alternatives available to the traveler (Ortuzar & Willumsen 1999). According to Grava (2002), there are different kinds of transportation modes:

1) Bicycle

The bicycle is a respectable contemporary form of transportation, but it has many dimensions. It is frequently hard to deal with the bike option as a simple utilitarian mode and to develop from its serious service systems. Yet, the bicycle today has no known or acknowledged enemies; it is absolutely politically correct because of its nonpolluting, space-saving, and resource conversing and health-enhancing characteristics. Politicians endorse it, and there are dedicated support groups that vocally promote bicycle system as the solution for almost all cities mobility problems. The advocates are mostly right, but the world would have to be largely populated by socially responsible and physically fit persons, thinking the right thoughts, to achieve effective pure bike systems in cities.

2) Motorcycle

In the early days, a motorcycle was the first step for a person trying to gain motorized mobility at an affordable cost. Motorcycles are a legitimate means of transportation, even within cities. Those who wish to face a significant risk of accidents, weather conditions as they appear and the

ire of automobile drivers find the fluid ability to weave forward through clogged traffic a considerable advantage and even a thrill. They usually create more problems in cities and communities that they can solve. Yet, the fact that they do not always conform to general expectations is not a sufficient reason to consider exclusion or harsh restrictions. Motorcycles are still will continue for some time to be legitimate means of transportation in places where a significant cohort population cannot afford a car but is able to buy a motorcycle.

3) Automobile/ Private car

Driving a car is important for people in general because it provides prestige and the opportunity for personal control and independence (Ellaway et al, 2003). In sparsely populated areas, owning a car is even more important, since it provides the only opportunity for traveling long distances due to a lack of public transport. For older people, having more difficulties walking (to the bus stop) and cycling, driving is often the only option for independent mobility. Several studies have found that over 90% of older drivers indicate that giving up driving would restrict their independence and mobility (Harrison and Ragland, 2003). The same drivers expressed anxiety about the poor quality of public transport services. This anxiety seemed to be based on reality because 50% of those participant who already had given up driving felt public transport to be, at least in some measure, inadequate (Robbitt et al, 1996).

II) Public Transport

Public transportation is a common passenger transport service which is available for use by the general public; typically manage on a schedule, operated on established routes, and that charge a posted fee for each trip (Schofer, 2018). Public transportation in Addis is the blue-white line "taxies" which are shared minibusses, anbessa bus, higer bus and star alliance bus. Public transportation in Ethiopia is a crucial part of the solution to the nation's economic, energy, and environmental challenges - helping to bring a better quality of life. In increasing numbers, people are using public transportation and local communities are expanding public transit services. Every segment of Ethiopian society - individuals, families, communities, and businesses - benefits from public transportation (Mulu, 2015).

According to Grava (2002), most of the transportation modes can make a reasonable claim to be able to satisfy all trip purposes within the community. There are modes that respond best to selected situations with identifiable needs. With respect to users group, the options are more difficult because people tend to have differing beliefs. These range from placing comfort features first to a single-minded emphasis on affordability.

1) Taxi

The general perception may persist that taxis provide a quality service to the wealthy members of our society. The yellow taxis predominantly serve the airport passengers, and also make a significant presence at prestigious hotels (paratransit) while blue taxis serve the regular commuter traffic. To estimate the ratio of minibus taxis and small taxis out of the total volume of taxis registered in transport authority, discussions were held both with taxi association people and transport authority. In smaller places with limited public services, taxi or local car services are the backup means of mobility at one time or another. Yellow taxis are expensive and they charge for a short ride at least two or three dollar. Blue taxi is found all over Addis, they are mostly age old Lada cars, painted blue and white. Prices are negotiated at the start of the journey.

2) Mini Bus Taxi

About 8,809 minibus taxis operate in the city of Addis Ababa, which has a seating capacity, is of 12 passengers' but7, 494 minibus taxis properly working on the routs. Most of these vehicles are old in age. These minibus taxis operate on five zones and 364 routes and carry more than 1.1 million passengers per day. The minibus system provides employment opportunities to a large number of people direct and indirect. The fares are regulated by the city government; however, they are usually two to three times more expensive than that of city bus fares. The presence of shared taxi service in Addis Ababa is very high. Most of the shared taxi operators own a single vehicle generally the vehicles are operated by hiring personnel, that is, drivers and their aids. On average a minibus taxi covers about 138 km per day and makes 15 trips. Most of the passengers belong to low and medium income groups (Mulu, 2015)

3) Higer Midi Bus

About 461 higer midi buses planned in the city of Addis Ababa, which has a twenty-five seating capacity, while, 411 higer buses properly working on the routs .Most of these vehicles is out of the market in a short period of time because of their quality is very low. These higer midi buses operate on three zones and thirty seven routes and carry more than 700,000 passengers per day. The higer midi bus system provides employment opportunities to a large number of people direct and indirect (Mulu, 2015).

4) Anbessa Bus

Addis Ababa city is one of the nine autonomous regions in the Ethiopian federal system, located in the heart of Oromia region (UN-HABITAT, 2011); Anbessa city bus has been the key mode of (formal) public transport for the city and at least thirteen of the surrounding Oromia region towns for more than seven decades. It has played a significant role in integrating the culture and socio-economic life of the city and neighboring Oromia towns through covering long distances and being relatively affordable to the lower class citizens (Tsegaye, 2015). Studies suggest that, on the other hand, adequate growth and transformation has not been observed in modernizing the service delivery system in a way that it is accessible to the in need urban dwellers, (Fenta, 2014; Gebeyehu and Takano, 2007).

Particular to Addis Ababa, the Federal and City government and transport regulatory bodies take the lions share in protecting the right of users through the allocation of considerable funds to transform the sector, (Sohail et al., 2006; Sohail et al., 2004). Better accessibility of Anbessa buses could also be possible through the role of citizens and civil society groups in influencing the operator regarding the service provision. Active participation of the community, coupled by engagement of lobby groups that intend to play a role in public transport service provision influence the accessibility of the Anbessa bus service through challenging other stakeholders on different platforms and attracting the attention of media, (Sagaris, 2010, 2014). What matters in Ethiopia, however, is that the community, media, and civil society groups lack the confidence to lobby or express their views on government enterprises due to fear of negative consequences from the government that is likely to harm their immunity (Bekele and Jagne, 2002; ICG, 2009).

5) Star Alliance Bus

Alliance city bus is the only formal private mass transport service provider in Addis Ababa, established in 2011, yet limited in number and route coverage. It appears that the current challenges of mass mobility in Addis Ababa necessitate not only public owned (Anbessa) city buses but also active engagement of independent private operators and the introduction of public-private partnership models which would broaden travel choices and quality of service to the users (Abreha, 2007; Siemiatycki, 2013). This assists in filling the gap of service accessibility, technology, application of modern public transport operation, employment creation and fostering the productivity of citizens.

6) Sheger Express Bus

Sheger Express bus is one of the mass transport services providers in Adds Ababa city and it starts in 2016. When service launched at the end of May 2016, transit users waited in long lines to take advantage of a free trial service on 10 Sheger Express buses running from Mexico Square to Shiro Meda. According to Ababa City Administration Road and Transport Bureau (2017), Addis Ababa's new Sheger Express bus system is changing the face of public transport in a city where close to 60% of the population walks to their destination. With the demand for public transportation at an all-time high, the launch of Sheger Express buses promises some relief.

Features of the Sheger Express bus include ease of access for the elderly, physically challenged, pregnant women, and children, air conditioning and a GPS. Passengers can expect a faster commute, with buses arriving at limited stops about every 10 minutes. Within three years, Sheger, the bus operator, will also introduce two additional new services including the city's first school bus service and Bus Rapid Transit (BRT) system. The BRT will be a high-quality public transportation system with an aim to provide faster, more comfortable and cost-effective service through a dedicated bus lane. To ensure the development process is inclusive, and address any potential questions about the BRT's impact on Addis Ababa residents, plans are now underway to engage citizens on a wide range of issues from future disruptions to the bus logo and design of stations.

7) Public / Blue Bus

Transportation service for federal and Addis Ababa city civil servants was launched 199 and adding twenty buses from bishoftu automotive and locomotive industry of the planned 410 buses, which transport civil servants to and from work, provide a paid service for the general public during the rest of the day. Lack of transportation service has been a critical problem in Ethiopians capital city, Addis Ababa. It is very common to see people queuing up for a long time on the main roads of Addis as they try to race for time. This was particularly a source of worry for civil servants who had to report at their offices on time and provide services to clients waiting for them.

8) Light Railway

Light rail System is part of the modern mass transit system which has a vital role in the transformation of cities. Light rail can link up existing transport modes with the city centers and suburban. The Addis Ababa light rail transit is modern transportation system designed to improve mass transit and to reduce transport problem in the city. The opened line covers 11 miles from the industrial areas in the south of Addis Ababa to the center of the city and the same length from east to west. The two lines have own dedicated power grid that will be able to carry 60,000 passengers an hour when they are fully operational. The costs are 6 ETB (Ethiopian Railways Corporation, 2009). Its objectives are to provide an alternative means of public transport to the city's road-based system, speed up passenger journey times and provide a more environmentally- friendly transport option.

2.4 Factor Affecting Individual Choice for Transport

Several transport studies investigated on the relationship among the characteristics of travelers, trips and transport facilities, with the individual transport mode choice behavior. In general, they are three core characteristics that influencing the mode of transport on individual or households (Pawlly et al, 2006).

(i) Characteristics of the travelers such as traveler's background, household structure and income, vehicle ownership, and availability of vehicle choice.

(ii) Characteristics of the trips such as the purpose of the trip, time of the trip and trip distance.

(iii) Characteristics of the transport facility such as travel time, cost quality of services and parking space availability.

Several studies focus on the possible correlation between the individual choices of transport mode and these characteristics. However, these characteristics could be interrelated with each other and directly or indirectly affect the public transport demand in practice (Pawlly et al., 2004).

According to Grava (2002), the factors affecting the mode choice are influenced by two aspects:

i) Vehicle aspects, characteristics of the vehicle itself

The aspects are travel cost, travel time, comfort, easiness to use transportation mode, prestige value of a mode transport, security, and safety.

ii) Traveler aspects, characteristics of the traveler aspect itself

The aspects are a social and economic condition, travel point of view through mode characteristics, policy and facility and also surrounding environment, and trip purpose.

2.5 Empirical Review

Wilson (1967) discussed that the attempt to establish the modal split for work trips by public transport and private mode for cities in the United States of America (USA), the regression model was used to reach the mode choice in a city. The independent variables were travel time, travel cost, sex, and income level. He concludes that the travel time and travel costs are the significant variables but sex and income are insignificant variables. Mc Gillivray (1970) discussed that the mode choice model for Chicago using multinomial Logit model with utility variable such as cost, age, parking cost, travel time. The author concludes that age was found to be insignificant but travel time and parking cost are insignificant variables.

Yu (1970) discussed that the “abstract model” to establish the interaction between two similar competing public transport modes for Virginia City. The variable which was used in the study was travel time, cost, sex, income level and purpose of the trip. Time series analysis was done to calibrate the model. He concluded that the travel time and cost had a significant impact on mode choice and but sex, income level, and trip purpose were insignificant variables.

Thamizharasan and Rengaraju (1986) discussed that attempted to present the mode choice of intercity travel in Tamil Nadu among public transport systems. The variable that used for the development of the model was demographic characters and socioeconomic factors. A regression model was used to estimate the mode choice. He concluded that the variables of demographic characters and socio-economic characters had a significant effect.

Ponnuswamy (1992) discussed that the mode choice of people based on behavioral science technique such as Delphi and Trade off games for Chennai City. He was considered the parameters such as travel time, cost, comfort, safety, air pollution and noise for developing the model. He concluded that the high sensitive variables such as travel cost, travel time and comfort had a significant impact on mode choice. But safety, air pollution, and noise had an insignificant impact on mode choice. Thamizharasan et al. (1996) discussed that the mode choice between the public transport and private vehicles of household without vehicles in Trichy city. A binary Logit model was employed. The model mainly considers independent variables such as working members, age, sex, employment status, and distance. The author concluded that the variable distance had a significant effect on the mode choice. But other variables such as working members, age, sex, employment status had no significant effect on mode choice.

Koppleman and Wen (2001) discussed that mode choice between the public transport and private transport system in Atlanta.A logit model was applied. Variables which were used in the model were traveled time and travel cost. The author concludes that both travel time and travel cost had a significant impact on mode choice. Nevertheless, the disaggregate accessibility variables are not adopted in traditional aggregated travel demand forecasting. According to Axhausen & Simma (2003), elder people have more choice to used public transport and young have no enough income to buy their own car. But according to Schwanen, et al (2001) Car ownership is the more significant effect on model choice, rather than the age is not much influence factor on

the selection of the mode and he also concludes that women are less likely to use the car while men are less dependent on public transport.

According to Mintesnot and Takano (2007), the major mode choice of public transport is bus and taxi in the city of Addis Ababa. The Authors employed ordered logit model to examine the citizen perception on mode choice. The variables that used in this study are fare, convenience, and frequency. The Authors conclude that all variables are a significant influence on choice of bus transport system. According to Utami (2010), the choice of transportation mode is affected by many factors such as gender, income, Education, travel time, convenience, Accessibility, safety etc. All of these factors are related to the socio-economic and service attributes. Form this income, education, travel time and travel distance and safety are a significant effects of mode of transport choice. But accessibility was not a significant impact on choice of transport mode.

According to De Witte, et al (2013) peoples who have high social status and have higher educated has more likely to have high income and at this reason, they are using a private car to go their workplace. In contrast, the people are more educated they use public transport frequently than the car (Schwanen et al., 2001). According to Ashrafi and Neumann (2017) the factors which affecting the travel behavior of people comparatively broad. Above and beyond these factors such as urban form and transport infrastructure, one important factor is the personal aspect which has a strong effect on the modal choice. This study focused on Socio-demographic and geographic factors that influence of on the selection of mode choice in the Austrian province of Vorarlberg. The Authors applied bivariate and multinomial logit model in order to measure the influence of factors on mode selection. The Authors concludes that the household size, age, gender, income and motivation of travel have a significant impact on the modal choice.

2.6 Conceptual Framework

The conceptual framework is the blueprint of the research work that guides the researcher to conceptually understand the research and outline and operationalized the dependent and the independent variables so that the measurement, processing, analysis of the data and interpretation of the result being easy and meaningful.

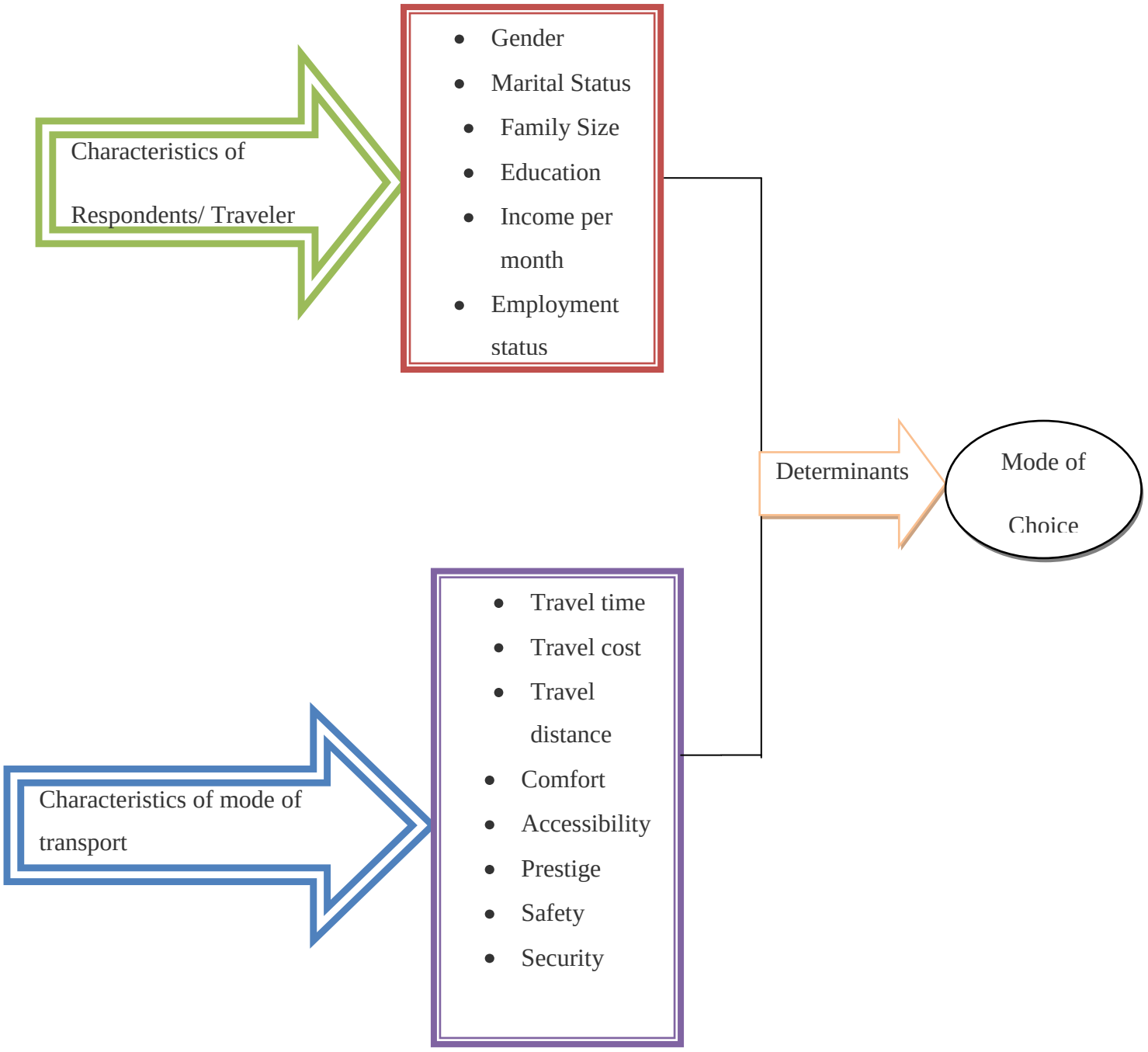

Figure 2.1: Conceptual frameworks of determinants of transport mode choice

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the Study Area

Addis Ababa is the capital and largest city of Ethiopia. It has a population of 3,384,569 according to the 2007 population census, with an annual growth rate of 3.8% (CSA, 2007). This number has been increased from the originally published 2,738,551 figure and appears to be still largely underestimated. Addis Ababa has the status of both a city and a state. It is where the African Union is and its predecessor the OAU was based. It also hosts the headquarters of the United Nations Economic Commission for Africa (ECA) and numerous other continental and international organizations. Addis Ababa is therefore often referred to as "the political capital of Africa" for its historical, diplomatic and political significance for the continent. Addis Ababa lies at an elevation of 2,300 meters (7,500 ft) and is a grassland biome, located at 9°1′48″N 38°44′24″. The city lies at the foot of Mount Entoto and forms part of the watershed for the Awash. From its lowest point, around Bole International Airport, at 2,326meters (7,631 ft) above sea level in the southern periphery, the city rises to over 3,000 meters (9,800 ft) in the Entoto Mountains to the north. For the purpose of political administration, the City is divided into 10 sub-cities and 116 Woredas.

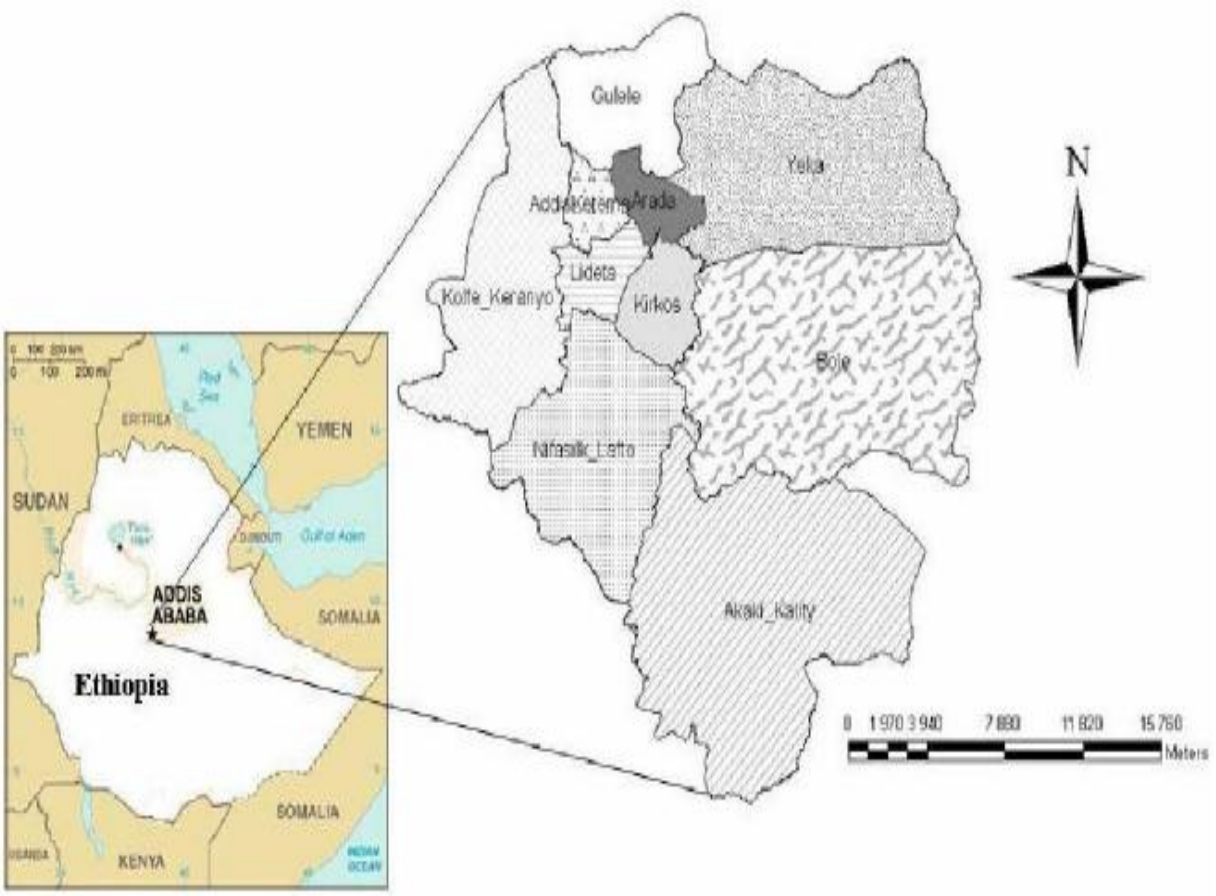

Figure 3.1: Map of Ethiopia and Addis Ababa

Source: Addis Ababa district map

3.2 Research Design and Approach

For the purpose of this study descriptive and causal research design were applied. In ordered to accomplish the proposed research with respect to the objective and the nature of research questions of the study, quantitative data collection and analytical technique was employed. Therefore, the overall congregation of the study consists of quantitative. Quantitative data analysis is all about quantifying the relationship between variables, mode choice of transportation and factors affecting such as sex, age, family size, level of income, distance etc.

3.3 Population, Sampling Technique, and Sample Size Determination

According to CSA (2007) report, the total population of Addis Ababa was 2,738,551 in 2007, out of which 1, 305,387 are males and 1, 434, 164 are females. People are live in 10 sub-cities. Kolfe Keraniyo has the largest number of people with 428, 895, followed by Yeka sub-city with 346, 664 and Bole sub-city with 308, 995. Akaki Kality sub-city has the least number of people with 181, 280. About 662, 728 households are in the city, among this 655,118 are conventional households and 7, 610 are unconventional households. Out of the total 655,118 conventional households, Kolfe Keraniyo has 97, 287 households, Yeka sub-city have 90, 195 households and Addis Ketema sub city have 52,063 households. Lideta sub-city has the least number of households which is 46, 206.

This study uses multiple stage random sampling to draw an appropriate sample household. In the first stage, due to the significant variation of owned private cars among the 10 sub-cities, the cities divide to two strata. The first group consists Kolfie Keraniyo, Kirkos, Akaki Kality, Lideta, Arada, Addis Ketema and Gulele and the second group consists of Yeka, Bole and Nifaslk Lafto sub-cities. In the second stage, two sub cities from group one and one sub cities from group two were selected randomly. Finally, from the total 239,545 households, 156 samples were selected randomly. Yemane (1967) provides the following simplified formula. Accordingly, the required sample size at 95 % confidence level with degree of variability and level of precision equal to 8% is used to obtain a required sample that represents a true population.

$$n = \frac{N}{1 + N(e^2)}$$

Where n= Sample size

N= Population Size

e= Level of precision considered as (8%)

$$n = \frac{239{,}545}{1+239{,}545(0.08^2)} \quad = 156$$

Accordingly, the distribution of sample size with the size of the sub-cities is presented in Table 3.1.

Table 3.1: Sample households by sub cities

Total number of household heads		Sample Households Heads
Sub Cities	**Total Households**	
Kolfe Keraniyo Sub City	97, 287	63
Yeka Sub City	90, 195	59
Addis Ketema Sub City	52,063	34
Total	239,545	156

Source: own sampling 2018

3.4 Data Collection Techniques

This research applies both primary and secondary data sources. The primary data needed to achieve the design object is obtain through structured questionnaires (both closed ended and open-ended questions) and interviews with the participant are illustrates. Household survey is a typical method to collect primary data from the participant. Household survey was carried out through face to face interview of the participant and enumerators. The secondary data source for this study is published and unpublished documents that related to transport mode. Those are books, articles, journals, scientific reports; minister of transport authority is considering being important to the study.

3.5 Method of Data Analysis

To achieve the objective of this study, both descriptive and econometric methods of data analysis were applied. Descriptive statistics such as frequency, percentage and cross tabulation were used to characterize the demographics of households in the study area. Econometric analyses were employed to identify factors that affect mode of transportation choice in household level by using multinomial logit model.

3.5.1 Model Specification

Discrete choice models can be used to analyze and forecast a decision maker's choice of one alternative from a finite set of mutually exclusive and collectively exhaustive alternatives. Such models have several applications since many behavioral responses are discrete or qualitative in nature; that is, they correspond to choices of one or another of a set of alternatives (Koppelman and Bhat, 2006).

3.5.2 Basic Construct of Utility Theory

Koppelman and Bhat (2006), Utility is an indicator of value to an individual. Generally, we think about utility as being derived from the attributes of alternatives or sets of alternatives; e.g., the total set of groceries purchased in a week. The utility maximization rule states that an individual will select the alternative from his/her set of available alternatives that maximizes his or her utility. Further, the rule implies that there is a function containing attributes of alternatives and characteristics of individuals that describes an individual's utility valuation for each alternative. The utility function, U, has the property that an alternative is chosen if its utility is greater than the utility of all other alternatives in the individual's choice set. Alternatively, this can be stated as alternative, 'i', is chosen among a set of alternatives, if and only if the utility of alternative, 'i', is greater than or equal to the utility of all alternatives 2, 'j', in the choice set, C. This can be expressed mathematically as:

If $U(X_i, S_t) > U(X_{j,} St)\ \forall_j \Rightarrow I > j\ \forall j \in C$

Where U ( ) is the mathematical utility function,

X_i, X_j are vectors of attributes describing alternatives i and j, respectively (e.g., travel time, travel cost, and other relevant attributes of the available modes),

St is a vector of characteristics describing individual t that influence his /her preferences among alternatives (e.g., household income and number of automobiles owned for travel mode choice),

I > j means the alternative to the left is preferred to the alternative to the right, and

$\forall_j$ means all the cases, j, in the choice set.

That is if the utility of alternative i is greater than or equal to the utility of all alternatives, j; alternative i will be preferred and chosen from the set of alternatives, C.

The primary implication of this ranking or ordering of alternatives is that there is no absolute reference or zero points, for utility values. Thus, the only valuation that is important is the difference in utility between pairs of alternatives; particularly whether that difference is positive or negative. Any function that produces the same preference orderings can serve as a utility function and will give the same predictions of choice, regardless of the numerical values of the utilities assigned to individual alternatives. It also follows that utility functions, which result in the same order among alternatives, are equivalent.

3.5.3 The Multinomial Logit Model

According to Koppelman and Bhat (2006), the mathematical form of a discrete choice model is determined by the assumptions made regarding the error components of the utility function for each alternative. There are good theoretical and practical reasons for using the normal distribution for many modeling applications.

The MNP presents a difficult computational problem relative to the logit. The probit likelihood function is often flat near its optimum. In this case, the MNP model may produce arbitrary parameter estimates within the tolerance of the estimation procedure (Keane, 1992; Alvarez and Nagler, 1998). A typical sample identification strategy is to include one alternative specific variable in each utility. While this often helps, this restriction does not guarantee convergence at a global optimum within the tolerance of the software. The MNP likelihood simply presents a difficult optimization problem because even with restrictions it is still relatively flat and because it generally requires numerical approximation for the multivariate integrals. The logit does not require numerical integration and almost always converges to a global optimum. However, in the case of choice models, the normal distribution assumption for error terms leads to the Multinomial Probit Model (MNP) which has some properties that make it difficult to use in choice analysis more than 2 alternatives. The mathematical structure of Multinomial Logit Model (MNL) is given as choice probabilities of each alternative as a function of the systematic portion of the utility of all the alternatives. The general expression for the probability of choosing an alternative ‘i’ (i = 1, 2... J) From a set of J alternatives are:

$$\Pr(i) = \frac{\exp(V_i)}{\sum_{j=1}^{J} \exp(V_j)}$$

Where Pr (i) is the probability of the decision-maker choosing alternative i and

V_j is the systematic component of the utility of alternative j.

Assumptions of the Multinomial Logit model

When you choose to analyse your data using multinomial logistic regression, part of the process involves checking to make sure that the data you want to analyze can actually be analyzed using multinomial logistic regression. You need to do this because it is only appropriate to use multinomial logistic regression if your data "passes" five assumptions that are required for multinomial logistic regression to give you a valid result. Before we introduce you to these six assumptions, do not be surprised if, when analyzing your own data using SPSS Statistics, one or more of these assumptions is violated (i.e., not met). This is not uncommon when working with real-world data rather than textbook examples, which often only show you how to carry out a multinomial logistic regression when everything goes well! However, don't worry. Even when your data fails certain assumptions, there is often a solution to overcome this. First, let's take a look at these six assumptions (Laerd statistics, 2014).

Assumption 1: Your dependent variable should be measured at the nominal level

Assumption 2: You have one or more independent variables that are continuous, ordinal or nominal (including dichotomous variables). However, ordinal independent variables must be treated as being either continuous or categorical. They can not be treated as ordinal variables when running a multinomial logistic regression in SPSS Statistics.

Assumption 3: There should be no multicollinearity. Multicollinearity occurs when you have two or more independent variables that are highly correlated with each other. This leads to problems with understanding which variable contributes to the explanation of the dependent variable and technical issues in calculating a multinomial logistic regression.

Assumption 4: There needs to be a linear relationship between any continuous independent variables and the logit transformation of the dependent variable.

Assumption 5: There should be no outliers, high leverage values or highly influential points.

3.5.4 Maximum Likelihood Methods

The method of maximum likelihood is the most common procedure used for determining the estimators in a simple multinomial logit model. Stated simply as the maximum likelihood estimators are the values of the parameter for which the observed sample is most likely to have occurred (ben -akiva and lerman 1985). The method requires a sample of individual mode choice of decision makers along with the data regarding the traveling mode chosen and the attribute of that particular mode. The basic formulation of the method that involves the maximization of the likelihood function is shown below.

$$L = \prod_{m=1}^{M} P(t_m, m)$$

Where,

L the likelihood the model assigns to the vector of available alternatives

M the total number of available alternatives many alternatives present in the set of available alternatives

t_m is the mode observed to be chosen in an alternatives m; and

$P(t_m, m)$ is the probability for choosing an alternative m

The most widely used approach to maximize the logarithm of L rather than L itself. It does not change the value of the parameter estimates since the logarithm function is strictly monotonically increasing. Thus the likelihood function is transformed to log-likelihood function and it gives as

$$L1 = \prod_{m=1}^{M} \log [P(t_m, m)]$$

3.5.5 Variable Definition and Hypothesis

Accessibility: In metropolitan areas where mass transit is available, it offers an attractive alternative to other means of commuting (Koslowsky, 1995). Accessibility of transport mode depends on the development of transport planning. Some of the areas are covered by public transport because they are high-density areas as a result of good planning. But for the low-density area, the availability of public transport is less and the only mode is private motorized transport. For the fast growing countries, the public transport planning is exceptionally well even in the low-density area because they have the financial means to develop the public transport. Making public transport more attractive and responsive to the needs of citizens will give more accessibility to the citizens besides reducing the congestions (Rosa and Maca, 2001).

Income: In richer countries, the developments of public transport are good resulting in some of the people do not know how to drive because they do not have the need for driving license and car. Lower-income countries tend to have the highest vehicle ownership and mileage growth rates, higher-income countries are experiencing low or negative growth (Litman, 2006) country like Ethiopia, people who are high income tend to use car with driver and do not use public transport but the middle and lower income people, the only choice is public transportation such as bus, taxi, train etc. as the main transport.

Travel time: Every single time is very valuable and for some people, every minute can produce a lot of money. According to TTI, the average driver waits in traffic 54 hours per year (Sherman, 2000). This is the bad impact on drivers as their time is wasted. According to Koslowsky (1995), direct negative effects of commuting are obvious and include hours lost from work and/or leisure activities. If the traveler can use other solution to avoid congestion, they can reduce their hours lost from congestions.

Travel cost: It is the one of the issues that can be highlighted when people are commuting. Every single travel will need cost but the difference is the high cost or low cost and it depends on

the type of travel and the distance of travel. Private driving will need more cost when comparing with public transport sharing. Normally, public transports are cheaper than the private car. According to TTI, travelers in very large metropolitan regions lose $700 per year in wasted gas and time (Sherman, 2000).

Security: refers to measures taken by a mass transit system to keep its passengers and employees safe, to protect the carrier's equipment, and to make sure other violations do not occur. This includes the enforcement of various rules and regulations, human and video surveillance, the deployment of a transit police force, and other techniques. Private care is more secure than mass transport system.

Hypothesis testing

1. **Ho**: Comfort, Accessibility, safety, security …all independent variables are not contribution to the choice of transport mode.

   H1: Comfort, Accessibility, safety, security …all independent variables are a contribution on the choice of transport mode.

2. **Ho**: There is no gender difference for choosing transport mode.

   H1: Gender has a significant effect on the choice of transport mode.

3. **Ho**: Income and transport cost is not a significant effect on the choice of transport mode.

   H1: income and transport cost is a significant effect on the choice of transport mode.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Descriptive Summary Results

As the nature of this study is a cross-sectional design, both open and closed-ended questions were distributed to 156 people, among those 143 participants fill the questionnaire and turn, while 13 participants did not return the questionnaire. The cross tabulation tables below reflects the emphasize information about the factors that affect choice of mode of transportation.

Table 4.1: Private car ownership

Category		Frequency	Percent
Private Car owners	**Yes**	15	10.00%
	No	128	90.00%

Source: Own survey result (2018)

The table above 4.1 indicates that car ownership of the participants, Out of the total 143 participants 128(90%) had no their own private cars but there is only 15(10%) of them had private car owned.

Table 4.2: Mode of transport chosen by participants

Mode of Transport	Frequency	%
Private car	15	10.5%
Minibus Taxi	77	53.8%
Bus	36	25.2%
Train	15	10.5%
Total	143	100.0%

Table 4.2 indicates mode of transportation chosen by participants, out of the total 143 participants, 53.8% of the participants were used minibus taxi, 25.2% of the participants were used bus and 21% of the participants were used both private car and train.

Table 4.3: Cross Tabulation between Educational level of Travelers and use/choice of transport mode

Education Level		Choice of Mode of Transport				Total
		Private car	Minibus taxi	Bus	Train	
Grade level (1-12)	Frequency	0	6	2	1	9
	%	0%	66.7%	22.2%	11.1%	100%
Diploma	Frequency	2	17	21	8	48
	%	4.2%	35.4%	43.8%	16.7%	100%
Degree and Masters	Frequency	11	50	13	6	80
	%	13.8%	62.5%	16.2%	7.5%	100%
PhD and above	Frequency	2	4	0	0	6
	%	33.3%	66.7%	0%	0%	100%
Total	Frequency	15	77	36	15	143
	%	10.5%	53.8%	25.2%	10.5%	100%

χ^2 (9)= 24.87, p = 0.003

Source: Own survey result (2018)

As shown in table 4.3 from the total of 9 participants whose educational level is grade level (1-12) are 6(66.7%) of the participants were used minibus taxi, 2(22.2%) were used bus and only 1(11.1%) used train transportation mode in different activities. Out of 48 participants those educational level is diploma are 21(43.8%), 17(35.4%), 8(16.7%) and 2(4.2%) of the participants were used bus, mini taxi, train and private car respectively. From 48 participants whose educational level is degree and masters are 50(62.5%) of them were used taxi, 13(16.2%) used

bus, 11(13.8) used private car and 6(7.5%) used train transport mode. There are 6 participants whose education level is PhDs and above, out of this 4(66.7%) of the participants were used taxi and 2(33.3%) of them used private car.

As from the p-value, there is a difference in transport mode choice due to variation/ difference in educational level

Table 4.4: Cross-Tabulation between status of Employment and Choice of Transport Mode

Employment Status	Statistics	Choice of Mode Transport				Total
		Private car	Minibus taxi	Bus	Train	
Employed	Frequency	15	61	34	13	123
	%	12.2%	49.6%	27.6%	10.6%	100%
Unemployed	Frequency	0	16	2	2	20
	%	0.0%	80%	10%	10%	100%
Total	Frequency	15	77	36	15	143
	%	10.5%	10.5%	53.8%	25.2%	10.5%

χ^2 (3)= 18.64, p = 0.005

Source: Own survey result (2018)

The above table 4.4 shows employment status of participants who were used mode of transportation, from 123 employed participants 61(49.6) were used minibus taxi, 34(27.6%) were used bus, 13(10.6%) used train and 15(12.2%) were used private car. From a total of 20 participants who are unemployment 16(69.6%) was used minibus taxi. The participants those are unemployed were used bus and train are equal values.

Employed people have more chance to choice transport mode than unemployed people. The participants who are employed use/ choice minibus taxi, bus, private car and train respectively. Unemployed people use/choice minibus taxi, bus and train but not uses private car.

We can say there is a difference in mode of transport choice among employed and unemployed participants.

Table 4.5: Cross-tabulation between Purpose of Travel and Choice of Transport Mode

		Choice of Mode of Transport				
			Minibus			
Purpose	**Statistics**	**Private car**	**taxi**	**Bus**	**Train**	**Total**
Working	Frequency	12	60	27	10	109
	%	11%	55%	24.8%	9.2%	100%
others	Frequency	3	17	9	5	34
	%	8.8%	50%	26.5%	14.7%	100%
Total	Frequency	15	77	36	15	143
	%	10.5%	53.8%	25.2%	10.5%	100%

χ^2 $(_3)$= 26.95, p = 0.025

Source: own survey result (2018)

According to the above table 4.5 the participants who used transport for working purpose was 109. From this 60(55%) of the participants were used minibus tax, 27(24.8%) were used bus, 12(11%) were used private car and 10(9.2%) were used train. There are 34 participants who are uses transport mode for other activities, among this 17(50%) were used minibus taxi, 9(26.5%) were used bus, 5(14.7%) were used train and 3(8.8%) were used private car

The result indicates that most of the people were used/ choice transport mode for the purpose of working activities. Majority of the participants were used/choice minibus taxi transport mode to full fill their daily activities and train is a list choice of transport mode.

P-value indicates that there is a difference in mode of transport choice for working activities and other activates.

Table 4.6: Cross-tabulation between Income and Choice of Transport Mode

Income (ETB/Month)	Statistics	Choice of Mode of Transport				Total
		Private car	Minibus taxi	Bus	Train	
< 2000 birr	Frequency	2	9	4	1	16
	%	12.5%	56.3%	25%	6.3%	100%
2000−3500	Frequency	1	24	16	10	51
	%	2.0%	47.1%	31.4%	19.6%	100%
3501−5000	Frequency	0	19	11	1	31
	%	0%	61.3%	35.5%	3.2%	100.0%
>5000	Frequency	12	25	5	3	45
	%	26.7%	55.6%	11.1%	6.7%	100%
Total	Frequency	15	77	36	15	143
	%	10.5%	53.8%	25.2%	10.5%	100%

χ^2 (9) = 30.999, p = 0.000

Source: Own survey result (2018)

Table 4.6 indicates choice of transport mode of the participants regarding to their monthly income. Out of 16 participants who had less than 2000 birr income per month was 9(56.3%), 4(25%), 2(12.5%) and 1(6.3%) were used minibus taxi, bus, private car and train mode of transportation respectively. There are also 51 participants who had 2000-3500 birr per month were used minibus taxi, bus, train and private car with 24(47.1%), 16(31.4), 10(19.6) and 1(2%) respectively. Similarly, out of 45 participants who had more than 5000 birr income per month used minibus taxi, private car, bus and train for transportation services with 25(55.6%), 12(26.7%), 5(11.1%) and 3(6.7) respectively.

The participants were used/choice minibus taxi, bus and train transport mode if their income level is less than 3500 birr per month. In other hand the participants were used/choice private care when their income level is more than 5000 per month.

As shown p-value, there is a significance difference in mode of transport choice because of their income level.

Table 4.7: Cross-tabulation between Family size and Choice of Transport Mode

Family size	Statistics	Choice of Mode of Transport				Total
		Private car	Minibus taxi	Bus	Train	
1	Frequency	10	13	7	4	34
	%	29.4%	38.2%	20.6%	11.8%	100%
2-4	Frequency	4	54	25	9	92
	%	4.3%	58.7%	27.2%	9.8%	100%
More than 5	Frequency	1	10	4	2	17
	%	5.9%	58.8%	23.5%	11.8%	100.0%
Total	Frequency	15	77	36	15	143
	%	10.5%	53.8%	25.2%	10.5%	100%

χ^2 $(_6)$= 17.85, p = 0.007

Source: Own survey result (2018)

Based on the above table 4.7 out of 34 participants who had only 1 family member 13(38.2%) of the participants used minibus taxi followed by private car bus and train with value 10(29.4%), 7(20.6%) and 4(11.8%) respectively. The participants who had 2- 4 family members are 92, out of this 54(58.7%) of the participants were used minibus taxi, 25(27.2%) were used bus, 9(9.8%) were used train and 4(4.3%) were used private car for their daily movement. There are 17 participants who had more than 5 family members, among this 10(58.8%) were used minibus taxi, 4(23.5%) were used bus, 2(11.8%) were used train and only 1(5.9%) of participants used private care.

The participants were used/choice minibus taxi and private car when their family member is less than 2. When the family members were increased, participants were used/choice public transport like minibus taxi, bus and train for daily movements.

As shown the P-value show, family size is a significant impact of the choice of mode of transport system.

Table 4.8: Cross-tabulation between Age of Traveler and Choice of Transport Mode

Age category	Statistics	Mode of Transport				Total
		Private car	Minibus taxi	Bus	Train	
20−30	Frequency	2	8	7	1	18
	%	11.1%	44.4%	38.9%	5.6%	100%
31−40	Frequency	7	9	7	7	30
	%	23.3%	30%	23.3%	23.3%	100%
41−50	Frequency	4	50	15	6	75
	%	5.3%	66.7%	20%	8%	100%
>50	Frequency	2	10	7	1	20
	%	10%	50%	35%	5%	100%
Total	Frequency	15	77	36	15	143
	%	10.5%	53.8%	25.2%	10.5%	100%
χ^2 ($_9$) = 21.54, p = 0.010						

Source: Own survey result (2018)

Table 4.8 shows the age of participants, out of 18 participants who have 20 up to 30 age group were used minibus taxi, bus, private car and train with the value of 8(44.4%), 7(38.9%), 2(11.1%) and 1(5.6%) respectively. The majority number of participants in this study was age group between 31 up to 40 years old. Out of this 50(66.7%) of the participants were used mini taxi, 15(20%) were used bus, 6(8.0%) were used train and 4(5.3%) of the participants were used private car. Out of 30 participants whose age group between 41 up to 50 years old, 9(30%) was used minibus taxi. Surprisingly, there are equal number of participants were used bus and train with 7(23.3%) in age group between 41 up to 50 years old.

As age of the participants increase, they are use/choice taxi and bus transport mode respectively. The participants' age are below 30 and above 50 years old gave less priority to used train and private car.

We can say there is a difference in mode of transport choice in different age categories. So, age is a impact for choice of different transport mode.

Table 4.9: Cross-tabulation between Transportation Cost and Choice of Transport Mode

Transport cost		Choice of Mode of transport choice			
		Minibus taxi	Bus	Train	Total
3−6 birr	Frequency	23	29	4	56
	%	41.1%	51.8%	7.1%	100.0%
7−10 birr	Frequency	33	5	5	43
	%	76.7%	11.6%	11.6%	100.0%
>10 birr	Frequency	21	2	6	29
	%	72.4%	6.9%	20.7%	100.0%
Total	Frequency	76	36	15	127
	%	59.8%	28.3%	11.8%	100.0%

χ^2 (6) = 35.2, p = 0.000

Source: Own survey result (2018)

The table above shows, 29(51.8%) of participants were choice bus, 23(41.1%) were choice minibus taxi and 4(7.1%) were choice train form the total of 56 participants who had paid 3-6 birr per day. There are 33(76.7%) of the respondents were used/ choose minibus taxi from the total of 43 participants who had paid 7-10 birr per day. Surprisingly, bus and train had equal number of participants with 5(11.6%) from the total of 43 participants who had paid 7-10 birr per

day. There are 21(72.4%) of participants were choice minibus taxi, 6(20.7%) of the participants were choice train and only 2(6.9%) of the participants were choice from the total of 29 participants who had paid more than 10 birr per day.

The participants were used/choice minibus taxi even though their transport cost is increasing per day. As indicates in the p-value, there is a difference in mode of transport choice in different transportation cost.

Table 4.10: Cross-tabulation between Distance and Choice of Transport Mode

Travel Distance	Statistics	Mode of Transport				Total
		Private car	Minibus taxi	Bus	Train	
< 2 Km	Frequency	0	2	0	0	2
	%	0%	100%	0%	0%	100%
2−5 Km	Frequency	0	17	7	3	27
	%	0%	63%	25.9%	11.1%	100%
5−10 Km	Frequency	7	46	5	10	68
	%	10.3%	67.6%	7.4%	14.7%	100.0%
>10 Km	Frequency	8	12	24	2	46
	%	17.4%	26.1%	52.2%	4.3%	100%
Total	Frequency	15	77	36	15	143
	%	27.7%	53.8%	25.2%	10.5%	100%

χ^2 (9) = 40.76, p = 0.000

Source: Own survey result (2018)

The above table 4.10 indicates that there are 2(100%) of the participants were used taxi from the total of 2 participants who had traveled 2 kilo meters. This shows that people are used minibus taxi for short distance than long distance. There are 17(63.0%) of the participants were used minibus taxi, 7(25.9%) of the participants were used bus and 3(11.1%) of the participants were used train from the total of 27 participants who had traveled 2-5 kilometers. Peoples did not used private car for short distance.

There are 46(67.6%) of the participants were used minibus taxi, 10(14.7%) participants were used train, 7(10.3%) of the participants were used private car and 5(7.4%) of the respondents were used bus form the total of 68 participants who had traveled 5-10 kilometers. Finally, there are 24(52.2%) of participants were used bus, 12(26.1%) of the participants were used minibus taxi, 8(17.4%) of the participants were used private car and only 2(4.3%) of the participants used train from the total 46 participants who had traveled more than 10 kilometers.

To sum up, people were used bus transport mode for long distance and they are use/choice minibus taxi for short distance and p-value indicates that there is a difference in mode of transport choice in different travel distance.

Table 4.11: Characteristics of Transport Mode considered by Users when choosing transport mode

Factors	Frequency	Percentage
Comfort	22	15.4%
Accessibility	44	30.8%
Safety	20	14.0%
Security	40	28.0%
Prestige	17	11.9%
Total	143	100.0%

Source: Own result (2018)

As table 4.11 indicated out of 44(30.8%) of the participants were agreed that accessibility has the top factors to choice transport mode followed by security, comfort, safety and prestige with 40(28%), 22(15.4), 20(14%) and 17(11.9%) respectively. So, accessibility is the most important factor to choice transport mode in Addis Ababa.

4.2 Factors Affecting the Use/Choice a Transport Mode: Econometric Estimation Result

Multinomial logistic regression was employed for investigating the relationship between how the modes of choice of transportation depend on the determinants in the context of Addis Ababa.

In any statistical model, if the nature of the variable is categorical or non-numeric with having more than one level, then dummy variable approach should be used. Therefore for this study, the dependent variable mode of choice of transport has four levels. Actually, there is no scientific logic for setting reference group, but it may be better if it has the common sense of understanding. Hence in our study Bus can be considered as a reference by assuming the above logic. Finally, Maximum likelihood estimation technique was used to estimate the coefficients and their probability value and odds ratio is reported (see table 4.12)

Model selection criteria

The model fitting information reflects that intercept-only model have 382.549 Akaki information criteria and the final fitted model have AIC of 312.00. As we know the minimum the better so that the final will be the most parsimonious model and everything was made on this model.

Model adequacy checking

The model goodness of fit of the data was checked by both Pearson and deviance residuals. Actually, the Pearson residual uses a chi-square of grouped variables in each binary logistic regression. A Pearson residual value less than in absolute value to consider as lacks goodness of fit. Since the p-value greater than 0.05 it indicates that the model is good in fit.

1) Econometric Result of Traveler's Characteristics

Table 4.12: Econometric result of parameter estimates of traveler's characteristics

Choice		B	Wald	Sig.	Exp(B)
	Intercept	-80.314	30.612	0.000	
	Age	0.41	6.53	0.000	1.5
	Family	-0.58	3.68	0.000	0.56
	Income	0.001	18.22	0.000	1.001
	[Gender=1]	2.291	6.715	0.070	9.88
	[Gender=] (**Ref.)**				
	[Marital status=single]	-0.010	0.195	0.062	0.99
	Marriage	-0.094	0.069	0.052	0.91
	Widowed	-0.003	0.603	0.120	0.997
	Divorce (Ref)	0[b]	.	.	.
	Occupation=Grade level	0.833	2.632	0.000	2.3
	Diploma	-0.582	24.804	0.000	0.559
	Degree	1.303	0.568	0.010	3.683
	PhD and above (Ref)	0[b]	.	.	.
	Employment	1.379	2.194	0.000	3.971
Minibus taxi	Unemployment (Ref)	0[b]	.	.	.
	Intercept	-30.071	226.705	0.000	
	Age	-1.65	10.909	0.000	0.192
	Family	1.275	10.909	0.000	3.58
	Income	0.004	47.898	0.000	1.004
	[Gender=1]	0.424	6.668	0.069	1.528
	[Gender= Ref]	0[b]	.	.	.
	[Marital status=single]	0.002	0.019	0.890	1.002
	Marriage	0.021	0.034	0.855	1.021
	Widowed	-0.001	0.21	0.080	0.999
	Divorce (Ref)	0[b]	.	.	.
	Education= Grade level	0.01	2.776	0.000	1.01
	Diploma	0.20	2.78	0.000	1.02
	Degree	0.16	1.112	0.000	1.17
	PhD and above (ref)	0[b]	.	.	.
Private car	Employment	1.377	2.347.	0.000	3.96
	Unemployment (Ref)	0[b]	.	.	
	Intercept	57.316	6.855	0.009	
	Age	2.236	41.386	0.000	9.36
	Family	2.131	6.136	0.000	8.43
	Income	-0.002	20.601	0.000	0.998
	[Gender=1]	-8.577	6.211	0.073	0
	[Gender=2] (Ref)	0[b]	.	.	.
	[Marital status=single]	-1.386	0.185	0.080	0.25
	Marriage	-0.248	0.36	0.100	0.78
	Widowed	-4.605	0.245	0.210	0.01
	Divorce (Ref)	0[b]	.	.	.
	Education = Grade level	1.506	2.263	0.012	4.51
	Diploma	-0.942	3.535	0.011	0.39
	Degree	2.150	4.187	0.005	8.59
	PhD and above (Ref)	0[b]	.	.	
	Employment	-2.120	2.98.	0.001	0.12
Train	Unemployment	0[b]	.	.	

* The reference category is bus. This parameter is set to zero because it is redundant

The fitted model becomes:

- ❖ Comparison of minibus taxi and bus

Age: The odds of the Age of the Participants those of who uses/choose minibus taxi have 1.5 times more than those of who uses/choose bus .In other words, as compared to bus users in the log scale the rate of change of choosing minibus taxi is 0.41, when the age of the participants increase in a year keeping other variables citrusbaribus. Since age is statistically significant at a ($p>0.01$), it has a great contribution to the choice of mode of transportation. Finally, we can conclude that when age in years goes on a year the preference of mode of transportation become minibus taxi rather than bus.

Therefore result is similar to the finding of Ashrafi and Neumann (2017) and According to Axhausen & Simma (2003) which may because of elder people has the chance to provide enough income to buy their own car. But it is different to the finding of Schwanen et al (2001), Thamizharasan et al (1996) and Mc Gillivray (1970). So Age is inconsistent for the choice of transport mode.

Family Size: The odds of use/choice of minibus taxi for Participants having one more family size is 0.56 times less than for uses/ chooses bus. Similarly as compared to bus users the mode of transportation when the family has one more family size, in the log scale the rate of change of preferring minibus taxi was decrease by 0.58 keeping the effect of other determinants holding constant. Hence family size is statistically significant with a probability value of ($p<0.01$). From this, we can generalize as a family has a great impact on the mode of transport choice. The result is related to the finding of Ashrafi and Neumann (2017). If there are a large numbers of family sizes there may be choice deferent transport mode because people have their own perception to choice different transport mode. This shows family size is a consistent factor for mode choice.

Income: Those of who have more income have1.001 times higher the odds of choosing minibus taxi than those of who choose bus. As income increased, the Participants were used mini bus than bus. Therefore income plays a great role in choosing a transportation mode with a probability value of $p<0.01$. This result is similar to the finding of Ashrafi and Neumann (2017). The Participants had more income had more chance to use/choice different transport mode. But

this finding was not similar to Wilson (1967) so, income is consistent factor for choice of mode of transport.

Education: The odds of use/ choice minibus taxi the participants who had diploma are 0.559 times less than the participants who had PhD and above education level than bus. Education had a significant effect on mode of transport choice. It is positive and significant at 1% level of significance. The significant effect of education on the mode of transport choice confirms the importance of education in increasing the capacity of choice transport mode. Education also affect in relation to income, people which have lower education level tend to have lower income also, so it affects them on lack of owning private vehicle, that is why they prefer to choose local bus while education level is high to increase people have to get more money and know the quality of transport mode. This study in line with Utami (2010), so education is consistent factors for the mode of transport choice.

Employment status: The odds of participants who had jobs were choosing minibus taxi is 3.97 times more than those of who had not jobs than bus. Participants use/choice minibus taxi those had good jobs because if participants had good job those of them had provided more income. It is a significant effect at 1% level. This result is not similar to the finding of Thamizharasan et al (1996) which indicated occupation is inconsistency. Similar interpretations for both private car and train transport mode. To sum up, age, family size, income, education level and occupation are significant influence of mode of transport choice but gender and marital status are insignificant variables.

2) Characteristics of trip (mode of Transport)

Table 4.13: Econometric result of parameter estimates of mode of transport characteristics

Choice		B	Wald	Sig.	Exp(B)
	Intercept	-80.314	30.612	0.000	
	Transport cost	0.888	5.398	0.000	2.43
	Travel distance	-2.313	0.586	0.000	0.099
	Travel time	0.632	9.629	0.000	1.881
	[Comfort= 1]	-1.195	5.87	0.000	0.303
	[Comfort= 2]	-1.158	3.766	0.000	0.314
	[Comfort= 3]	-2.813	3.809	0.000	0.06
	[Comfort= 4]	-2.957	3.196	0.000	0.052
	[Comfort= 5]	0[b]	.	.	.
	[Accessibility= 1]	0.231	3.974	0.000	1.26
	[Accessibility= 2]	-5.389	7.76	0.000	0.416
	[Accessibility= 3]	-2.216	5.128	0.000	0.05
	[Accessibility= 4]	-3.394	3.43	0.000	0.69
	[Accessibility= 5] (Ref)	0[b]	.	.	.
	[Safety= 1]	-0.161	2.702	0.010	0.851
	[Safety= 2]	-0.07	2.702	0.000	0.932
	[Safety= 3]	-0.426	7.892	0.005	0.653
	[Safety= 4]	-0.026	9.145	0.002	0.974
	[Safety= 5] (Ref)	0[b]	.	.	.
	[security= 1]	2.46	4.352	0.000	1.02
	[security= 2]	-8.544	10.78	0.000	0.108
	[security= 3]	3.27	4.652	0.000	8.813
	[security= 4]	3.465	2.06	0.000	2.764
	[security= 5] (Ref)	0[b]	.	.	.
	[prestige= 1]	-3.016	0.465	0.410	0.049
	[prestige= 2]	-3.319	0.321	0.318	0.036
	[prestige= 3]	-2.033	0.304	0.300	0.131
Taxi	[prestige= 4]	-3.817	0.029	0.250	0.022

	[prestige= 5] (Ref)	0[b]	.	.	.
Private car	Intercept	-30.071	226.705	0.000	
	Transport cost	0.829	353.698	0.000	2.29
	Travel distance	-3.219	223.204	0.000	0.04
	Travel time	1.544	81.934	0.000	4.684
	[Comfort= 1]	0.438	2.714	0.000	1.22
	[Comfort= 2]	-2.996	11.187	0.014	0.05
	[Comfort= 3]	-4.476	22.897	0.000	0.12
	[Comfort= 4]	1.654	6.002	0.001	5.23
	[Comfort= 5] (Ref)	0[b]	.	.	.
	[Accessibility= 1]	-1.523	9.131	0.000	0.218
	[Accessibility= 2]	-0.400	.513	0.000	0.67
	[Accessibility= 3]	-0.236	7.291	0.000	0.79
	[Accessibility= 4]	1.480	3.1331	0.016	4.495
	[Accessibility= 5](Ref)	0[b]	.	.	.
	[Safety= 1]	-0.248	5.023	0.000	0.78
	[Safety= 2]	0.020	2.487	0.000	0.98
	[Safety= 3]	-3.912	2.457	0.000	0.02
	[Safety= 4]	1.138	1.258	0.000	3.12
	[Safety= 5] (Ref)	0[b]	.	.	.
	[security= 1]	0.196	8.88	0.003	1.695
	[security= 2]	-2.963	6.057	0.000	0.22
	[security= 3]	-3.711	5.729	0.000	0.012
	[security= 4]	-0.31	6.493	0.000	0.84
	[security= 5] (Ref)	0[b]	.	.	.
	[prestige= 1]	0.001	0.059	0.070	1.002
	[prestige= 2]	0.020	0.119	0.100	1.02
	[prestige= 3]	0.095	0.554	0.213	1.10
	[prestige= 4]	0.021	0.515	0.203	1.021
	[prestige= 5] (Ref)	0[b]	.	.	.
Train	Intercept	57.316	6.855	0.009	
	Transport cost	-2.072	3.437	0.008	0.126
	Travel distance	-1.879	6.312	0.000	0.153

	Travel time	-5.009	4.004	0.009	0.006
	[Comfort= 1]	-1.966	3.501	0.000	0.14
	[Comfort= 2]	-1.832	2.885	0.000	0.16
	[Comfort= 3]	-5.521	7.812	0.000	0.004
	[Comfort= 4]	-0.151	8.821	0.000	0.86
	[Comfort= 5] (Ref)	0[b]	.	.	.
	[Accessibility= 1]	0.737	6.376	0.000	2.09
	[Accessibility= 2]	1.178	5.247	0.000	3.25
	[Accessibility= 3]	-1.022	2.65	0.006	0.36
	[Accessibility= 4]	-1.427	3.155	0.000	0.24
	[Accessibility= 5] (Ref)	0[b]	.	.	.
	[Safety= 1]	0.002	3.517	0.000	1.002
	[Safety= 2]	0.277	4.326	0.000	1.32
	[Safety= 3]	0.871	2.7	0.000	2.39
	[Safety= 4]	00019	5.594	0.018	1.02
	[Safety= 5]	0[b]	.	.	
	[security= 1]	1.269	4.564	0.000	3.56
	[security= 2]	-0.030	5.785	0.000	0.97
	[security= 3]	1.306	13.125	0.000	3.69
	[security= 4]	-0.357	3.916	0.010	0.7
	[security= 5] (Ref)	0[b]	.	.	.
	[prestige= 1]	-0.494	0.177	0.314	0.61
	[prestige= 2]	-0.579	0.016	0.400	0.56
	[prestige= 3]	-1.469	0.77	0.120	0.23
	[prestige= 4]	-6.908	2.972	0.085	0.001
	[prestige= 5] (Ref)	0[b]	.	.	.

* The reference category is bus. This parameter is set to zero because it is redundant.

Significant at ***=1%, **=5% and *=10%

* Comfort, accessibility, security, safety and prestige, 1= v. unimportant, 2= unimportant, 3= neutral, 4= important, 5= v. important.

Travel cost: the odds of those of the participants, who paid high cost, choose/uses minibus taxi was 2.43 times more than the participants choose/use bus. Travel cost had a significant impact on mode of transport choice at 1% level of significance. Because people have choice low or fair cost accordingly their income and time. In Addis Ababa people are choice Sheger and alliance bus rather than private car or Anbessa bus and higer bus because of time and fair cost. This study is allied to Wilson (1967), Yu (1970) and Ponnuswamy (1992) this indicates travel time and travel cost is consistency for mode choice.

Travel time: Travel time had a significant impact on mode of transport choice at 1% level of significance. People had choice/used fast transport mode according to time. People are choice minibus taxi rather than bus because of taxi has only 12 set chair and it did not take long time in one station. This study is allied to Wilson (1967), Yu (1970) and Ponnuswamy (1992) this indicates travel time and travel cost is consistency for mode choice.

Travel Distance: The odds of choice minibus taxi, Participants had traveled a long distance was 0.099 times less than those of use/choose bus. Travel distance similar to travel time, it had a significant influence on the mode of transport choice at 1 % significant level. When Peoples' workplace and home are far, they may be choice long-distance travel modes like train and buses relative to accessibility rather than taxi and minibus taxi. This result is consistent with the finding of Thamizharasan et al, (1996),

Comfort: The odds of those of the participants who gave less priority to comfort are 0.3 times lower to prefer minibus taxi than bus as compared to the odds of participants who gave priority to comfort. In other words, those of who need comfort are preferred minibus taxi. It is a significant effect on mode of transport choice at 1% level of significance. Therefore, this result is similar and consistent with the finding of Ponnuswamy (1992).

Accessibility: the odd of those of the participants' who gave less priority to accessibility are 0.26 times lower than to choice minibus taxi than the odds of choice bus as compared to those of who gave priority to accessibility. This means peoples are preferred to the minibus taxi than bus if there are a high number of taxi accesses. Accessibility is a significant influence at 1% of significant level**.** Most of the time people have choice transport mode which has more access. Taxi is more access in Addis Ababa and the majority of people may have choice taxi and

minibus taxi. This result is not constant to the finding of Utami (2010) because in developed countries has more access in all transport mode.

Safety and Security: As compared to those of who gave priority to safety, participants who gave less priority to safety have 0.932 times lowered to choose minibus taxi than bus. In addition to this participant who gave less priority to security has 0.07 times less to choose taxi than bus. To conclude those of who needs both safety and security prefers to minibus taxi. Safety and security are important determinate for the mode of transportation since both have a probability value of $p<0.01$. the result of safety is similar to the finding of Ponnuswamy (1992). But security is not similar to the finding of Ponnuswamy (1992). So safety is consistency but security is not consistency factor to choice transport mode. The same fashion for private car and train mode of transport.

Generally Gender, marital status and prestige of the participants are not factors for the choice of transportation mode, while all other variables have a contribution to the choice of transportation mode.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

Recently, Addis Ababa transport authority design a strategy of different transportation mode to facilities working activities and to support the economy and transformation plan. Transport is one of the basic sectors supporting people daily activities, without any movement it is difficult to full fills daily activities. People have choice different transport mode for different activities even though there are high demand of transport in Addis Ababa. Based on such background, this study aimed to identify the major factors that influence the choice of mode of transport in the city .

The analysis of secondary data in chapter two illustrates that factors affecting choice of transport mode like private car, bus, taxi and train in several literature. The aim of using primary data was to identify the important determinants of choice of transport mode in Addis Ababa, which are based on the socioeconomic/ traveler characteristics and tip characteristics of the people.

In order to identify the important factors, descriptive statistics and multinomial logistic regression were employed. Many variables were analyzed in the descriptive statistics, while 15 variables were included in the econometric model. Out of the 15 variables hypothesized to influence on the choice of transport mode, 13 variables are found to significantly impact on the choice of transport mode at a different significant level. To begin with, age, family size, income, education, and occupation traveler characteristics and travel time, travel distance, travel cost, comfort, accessibility, security and safety from trip or mode of transport related characteristics were among variables that are found to be statistically significant.

5.2 Conclusion

The main objective of this study is to identify the determinants of choice of transport mod in Addis Ababa. In ordered to test the hypothesis, multinomial logistic regression was specified and applied with the mode of transport choice as a function of series of characteristics. In this case, the dependent variable is the function of socio-economic or demographic factors; traveler and trip-related characteristics. About 15 independent variables were specified from these series of characteristics and used in the econometric model. Important relationships were found in this analysis, which demonstrated the mode of transportation choice relates to one or more of the variables specified as a function of series characteristics or attributes.

From the finding of the study the researchers comes to the following conclusions. Transportation service is sensitive to the characteristics and performance of each mode of transportations. The following variables like Accessibility, travel cost, travel time, travel time and income level are the most determining factors of modes choice. From the different modes of transportations in Addis Ababa city Minibus taxi is the most useable/ chosen transport mode in the city even if its travel cost is high as compared to other public transport.

5.2 Recommendation

There is no comprehensive study that has been conducted in Addis Ababa on the determinants of choice of transport mode. The main objective of this study is to identify the factors that effect the choice of transport mode.

Depending on the finding of this study, to minimize the force that push to use/choice discomfort, unsafe and unsecure mode of transportations there are some recommendation:

- ✓ The government and concerned stakeholders should introduce transport services that improve the comfort, accessibility, security and safety of travelers.
- ✓ Government should be encouraging private sectors to participate in mass transportation services to increase accessibility in all transport modes.
- ✓ The stock holders should manage over transport system like higer and Anbessa bus in their safety and comfort to make competitive to others transport mode.
- ✓ To shorten travel time, the government and any stakeholders should be investing on infrastructures that reduce traffic jams.

Since the present study is at micro level, it can be suggested that further study has to be carried out at macro /national level to comprehend the factors affecting on choice of transport mode in Ethiopia to come up with a consolidated and representative policy measures that can comprehensively improve the effect positively.

REFERENCE

Aryu Utami Dawi, (2010), research on factor affecting mode of transport choice in working activity, Yogyakarta City, Indonesia

Dipl.-Ing. Hans-Martin Neumann, AIT Austrian Institute of Technology Center for Energy, Giefinggasse 2, 1210 Vienna, AT, hans-martin.neumann@ait.ac.at

Ellaway, A., Macintyre, S., Hiscock, R. & Kearns, A. (2003) In the driving seat: psychosocial benefits from private motor vehicle transport compared to public transport. Transportation Research Part F: Traffic Psychology and Behaviour 6(3), 217-231

Eriksson L. (2008), Pro-environmental Behavior: The Importance of Attitudinal Factors, Habits, and Transport Policy Measures, Department of Psychology, Umea University, Sweden, 7-8,

Gavin C. Cawley, Nicola L. C. Talbot and Mark Girolami. (2006), Sparse multinomial logistic regression via Bayesian L1 regularisation. NIPS'06 Proceedings of the 19th International Conference on Neural Information Processing Systems, Canada.

Gordon, Peter and harry w. Richardson. (1989). Counting Nonwork Trips- the missing link in Transportation, land use and urban policy 48(9), 6-12

Harrison, A. & Ragland, D.R. (2003), Consequences of driving reduction or cessation for older adults. Transportation Research Record (1843), 96-104

Jean-Paul Rodrigue (2017), New York: the geography of transport system

Joe Castiglione, Mark Bradley, and John Gliebe. (2015), Activity-Based Travel Demand Models: A Primer, Resource Systems Group, Inc. White River Junction, Vermont.

Joseph L. Schofer. "Mass transit". Encyclopædia Britannica. Encyclopædia Britannica.

Mackett, N. Paulley et al. (2004), The Demand for Public Transport: A practical Guide, Crowthorne, UK,.

Ministry of Federal Territories and Urban Wellbeing, “Greater KL/KV comprises 10 local authorities,” 2011, http://app.kwpkb .gov.my/greaterklkv/overview/.

Mintesnot Gebeyehu and Shin-ei Takano (2007), Diagnostic Evaluation of Public Transportation Mode Choice in Addis Ababa, *Journal of Public Transportation*, 10(4), 2007, Addis Ababa, Ethiopia.

Mokhtarian P.L. (2005), What affects commute mode choice: neighborhood physical structure or preferences toward neighborhoods? *Journal of Transport Geography*. 13: 83-99

McGillivray, Robert G. (1970), "Demand and Choice Models of Modal Split." *Journal of Transport Economics and Policy*: 192-207.

Mulu Eshete (2015), Public transportation system: the case of Addis Ababa. Published Master's Thesis, Addis Ababa University.

N. M. Shariff, "Private vehicle ownership and transportation planning in Malaysia," in International Conference on Traffic and Transportation Engineering, 2012, Singapore.

N. Paulley, R. Balcombe, R. Mackett et al. (2006), "The demand for public transport: the effect soffares, quality of service, income and car ownership," Transport Policy, 13(4), 295–306.

Rabbitt, P., Carmichael, A., Jones, S. & Holland, C. (1996), When and why older drivers give up driving. AA Foundation for Road Safety Research, Basingstoke, Hampshire.

Racca, David P., and Edward C. Ratledge. (2004). Project Report for "Factors That Affect and/or Can Alter Mode Choice." Delaware Transport Institute and State of Delaware Department of Transport.

Road Transport Department, "Statistics for Motorcar Registrations," from Road Transport Department Malaysia, 2010, http://portal.jpj.gov.my/en/statistik-pendaftaran-motokar.

Rodriguez, Jean-Paul, Comtois, Claude and Slack, Brian (2006), the Geography of Transport Systems: Jean-Paul Rodrigue, Claude Comtois and Brian Slack, New York,

Schwanen T. and Steg, L. (2003) Can public transports compete with the private car? IATSS Research 27(2), 27-35

ThamizhArasan, V., V. R. Rangaraju, and K. V. Krishna Rao. (996). Trip characteristics of travelers without vehicles. *Journal of Transportation Engineering*, 76–8.

USATHAMIZHARASAN, V and Rengaraju, V R, (1986). A methodology of approach for intercity travel demand modeling. Indian Roads Congres (Seyedeh R. Ashrafi, BSc, University of Vienna, Department of Geography and Regional, 14, 23-33,

Wilson, A.A Statistical Theory of Spatial Distribution Models. 1967.

World Bank (2011), Retrieved December 20, 2013 from

Ying So and Warren F. Kuhfeld. (2010), Multinomial Logit Models. MR-2010G.

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTTRANSPORT/EXTURBANTRANSPORT/0, menuPK: 341455~pagePK: 149018~piPK: 149093~theSitePK: 341449, 00.html

Appendix 1

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Age	.411	2.436
	Family	.771	1.297
	Education	.490	2.043
	Occupation	.742	1.347
	Income	.535	1.868
	Trnaportcost	.625	1.601
	Distance	.534	1.874
	Travletime	.622	1.609
	Purpose	.873	1.146
	Comfort	.625	1.600
	Accessibility	.672	1.487
	Safety	.506	1.978
	Security	.694	1.442
	Prestige	.630	1.588
	Gender	.823	1.214
	Marital status	.510	1.960

a. Dependent Variable: Choice

Model fitting information

Model Fitting Information

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	382.549	394.401	374.549			
Final	312.000	774.204	.000	374.549	152	.000

Goodness of fit

Pseudo R square

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	.000	384	1.000
Deviance	.000	384	1.000