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The Impact of Ministry of Transport Policies on Public Transportation in Palestine

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DEDICATION

All Thanks for who provided me with his support to achieve my work successfully.

I dedicate my simple work for the dearest people to me my father, my mother, my wife and my son. I mention, in particular, my dear wife who is a true example for a good wife. She did all her best to spare me the most suitable study condition. In fact she was a great motivation to accomplish my work. Allah bless her.

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ABSTRACT

The evaluation of the Ministry of Transport (MOT) policies regarding public transport sector and studying the impacts of these polices is an important issue. The public transport sector in the Palestinian Territories suffered in general from deregulation and the absent of enforcement on the ground in many aspects. The number of permits granted for shared-taxis was more than enough. The public transport operators charged about 50% of fares identified by the MOT. The local bus companies did not apply the conditions of the exclusive rights they have. As a result, it was necessary to conduct a study that concerns with the evaluation of the impacts of these policies and to provide the proper tools and recommendations for the MOT to help them in regulating this vital sector.

The main issues that were analyzed are: the current number of operating shared-taxis operating and the number of issued permits, the public transport fares equation and its components, and the exclusive rights awarded for bus companies and the related conditions.

The study area was Nablus Governorate. Thirty three external shared-taxis routes, which link Nablus city with the surrounding villages and towns were studied. The related data needed was calculated based on the MOT, Palestinian Central Bureau of Statistics (PCBS), and field survey. The main results of this study were:

1. A mathematical single equation linear model for calculating the number of shared-taxis on a certain route based on demand. The statistical analysis of the model was run using LimDep version 7.0 software. The exogenous (independent variables) in the model were; private cars, distance, number of services establishments, and employment.

2. The large number of shared-taxis permits granted by the MOT was analyzed. The MOT justified that the large number of permits was due to the hard economic conditions during the second Intifadah and the increase of the unemployment rate. However, the study recommended that the number of permits resumed should be based on the real demand and need.

3. The public transport service applied by the local bus companies is also studied and analyzed in this research. The results show that this service is not satisfactory. In general, the bus operators did not apply the exclusive rights conditions, the fleet in general is old, the quality of service is partially satisfactory, no clear schedule and frequency, etc. It is recommended that the MOT should regulate and ensure that bus companies apply the conditions in the exclusive rights. Therefore, MOT should warn the violating companies and re-tender the exclusive rights of the violators for competition.

4. Finally, public transport fare is another issue, which is stated and analyzed in this study. In general, the MOT fare formula is considered good. However, the fuel prices, maintenance costs, driver wages, average monthly earnings, and the cost of [rice index, should

be taken into account on the annual increase or while reviewing the public transport fares.

The study output (recommendations) is not considered worthy unless the related official bodies adopt it and follow the international procedures in regulating and organizing this vital sector (the public transport sector).

CHAPTER ONE

INTRODUCTION

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1.1 Background

Transportation has played a vital role in every aspect of ancient and modern civilization. The growth and decline of nations in history has been related to their ability to move and protect their trade and routes. In addition, the ability of a country, a region, or a city to convey persons and goods over these links providing safety, efficiency, and convenience, has also been an indication of development.

One of the most principal components of the transportation systems is public transportation, which is considered as an important element in the infrastructure for any society, as it provides mobility to a considerable share of the population. The definition of public transport varies from one location to another, depending on type of services used. Public transport is that mode of transportation which is considered as for-hire to the public. It includes buses, trains, taxis, paratransit, and shared-taxis. If public transport did not satisfy the population needs in a comfortable and suitable way, a transportation problem will float on surface, which must be faced by traffic and transportation engineers and planners.

1.2 Public Transportation in the Palestinian Territories

There are three public transportation modes in Palestinian Territories. These are buses, share-taxis, and taxis. The fleet is owned and operated by the private sector; individuals or firms. In addition, there is an illegal operation of private vehicles as shared-taxis or taxis.

Mass transport in certain cities and on long distance routes is provided by medium-sized and full-sized buses. This is supplemented by shared-taxis, which operate on such routes. Shared-taxis also operate to provide short haul services within the larger cities and from cities to surrounding villages, in addition to buses. In some cities, taxis are available for individual point-to-point transport.

No major developments in public transportation have been observed during the past few years. There were no funds assigned by the Palestinian National Authority (PNA) for the development of the public transport facilities. As public transport is owned and operated by the private sector, the PNA depends on the private sector initiatives to develop the sector. There is one exception, where the Dutch government supported the purchase of Dutch buses by Palestinian bus firms, about ten years ago. Due to the absence of the PNA power on the ground due to the continuous Israeli military occupations in the West Bank cities since 2000, there has been weak control of the PNA on public transport.

The following reasons clarify the decision of PNA to defer the development of public transport *(Abu-Eisheh, Al-Sahili, and Kobari, 2004)*:

- Public transportation agencies are privately owned
- PNA focused on physical infrastructure rather than on operation projects
- Many intercity roads are still not controlled by the PNA
- Some of public transportation development projects need public awareness

Ministry of Transport (MOT) is responsible for the regulations of public transport services. This implies, for example, that every bus and shared-taxi is required to have a permit, which specifies the route on which it must operate. The maximum number of shared-taxis to operate on a line is also regulated by the MOT. The determination of the tariff and the fares is another responsibility of the MOT. In addition, the MOT only has the right to give a certain bus company the right to operate on a certain line, which is called exclusive rights (الامتياز).

During the second Intifadah (Palestinian uprising, which started in September 2000), the considerable decline in income to most of the population has pushed the MOT to take actions to ease regulations to deal with the condition, including the reduction of permit fees and the increase of the number of granted permits. The ministry considered these measures as ways to reduce the economic burden on the taxi drivers and to absorb part of the unemployed work force.

1.3 Importance of the Research

One of the important issues nowadays for decision-makers, planners, and engineers on one hand, and inhabitants of low income and whom can be described as captive riders on the other hand, is the evaluation of the impacts of the measures and regulations relating to public transportation sector in the Palestinian Territories applied by the MOT. As a result, it is important to discuss and analyze the key issues, which represent the policy of the MOT in the public transport sector. Some of these issues are: the variables that affect the determining the number of shared-taxis needed, the impacts of issuing permits and the resulting noticeable growth of the public transport vehicles, the tariff policy for public transportation services either intra-city or external routes, the exclusive rights for bus companies to operate on a certain route, etc.

1.4 Research Objective

Observations on the ground show that there is excess capacity in the industry. The number of taxis increased significantly in the past several years because the PNA resumed granting permits after years of strict control by the Israeli authority. The resulting increase in the number of shared-taxis and taxis have caused an increase in the share of shared-taxis/taxis in traffic flow on the urban streets, as for example, in Nablus City, they reach about 60% of the total vehicles during the peak hour *(DSC and UG, 1999).*

The above mentioned problem is one of several problems related to public transportation, which require examining and assessing the general government policies for public transport.

The objective of this research is to analyze and evaluate the current policies applied by the MOT in the field of public transportation in order to guide the MOT in developing proper regulations and recommendations. This may be achieved through using the proper modeling techniques or analytical procedures. These will assist in predicting the number of shared-taxis and buses needed and comparing the results with the existing numbers. The single equation linear model technique will be used to predict the required number mainly for shared- taxis and buses. On the other hand, the evaluation of the MOT policy regulations regarding the bus companies and ensuring the application of exclusive rights conditions is an important point. Finally, the analysis of the MOT fare formula and its component's costs, proportion weight of each component, and comparing of these with other countries, like the United Kingdome and Singapore, will also be introduced.

1.5 Study Area

In order to assess the MOT public transport policies, a sample is to be considered through the selection of a study area. The case study area is selected to be Nablus Governorate. Nablus links the Northern Districts with the Central and Southern Districts of the West Bank (WB). Nablus is the second largest city in the WB after Hebron in terms of population. It is also considered as the largest commercial center. It has the largest university in the West Bank in terms of number of students. The external shared-taxi and bus routes, which link villages/towns with the center of the Governorate (Nablus City) will be studied.

1.6 Study Approach

Chapter Three shows the methodology to be followed in this research in order to achieve the objective of the study.

1.7 Definitions

Appendix A presents some important terms, which are repeatedly used in this research.

1.8 Research Outline

This report is composed of six chapters. The first chapter introduces the research, which contains a general background on public transportation, public transportation in Palestinian Territories, the research importance, objective, the study area, and the study approach. Chapter Two deals with the literature review and building an information base where a brief discussion of the related studies on public transportation is presented. Chapter Three discusses the methodology followed in order to achieve the objective of the study. Chapter Four presents the evaluation of public transport exclusive rights, fares, and permits. Chapter Five presents the main sources of the collected data. The database that will be used is of different types; socioeconomic, trip characteristics, vehicle related operation factors, etc. Chapter Six shows the assessing and analyzing the MOT policies regarding the number of permits, public transport fares calculation, and the exclusive rights provided to the current local bus companies. Finally, research conclusions and recommendations will be presented in Chapter Seven.

CHAPTER TWO

LITERATURE REVIEW

Chapter Two

LITERATURE REVIEW

2.1 Introduction

The study of impacts of MOT policies on public transport in the Palestinian Territories is the aim of this research. The policies and regulations related to public transport varied based on the governing power in Palestine, starting from British Mandates, Jordanian Rule, Egyptian Rule, Israeli Occupation, and ending by the Palestinian National Authority.

The development and management of public transport sector is a key issue in both developed and developing countries. Study and analysis of similar policies in other countries are beneficial. Many countries adopted different policies, which encourage people to use public transport modes rather than private vehicles and automobiles. The objectives of these policies aimed to fulfill transit riders need such as: regulation and order, safety, comfort, privacy, environment protection, rational fares, and maximize general utility through traffic regulations imposed by the government (i.e., on licensing, permits, tariffs, etc.),

In this chapter, a literature review of some of public transport policies, as well as the general conditions of the sector, that are implemented in the Palestinian Territories by the PNA through MOT are presented. In addition, international examples in other countries such as Jordan, United Kingdom, Australia, and Singapore, are illustrated.

The main issues in public transport policies management that will be discussed in this chapter include: licensing, permits, determination of number of shared-taxis and buses required using linear regression modeling techniques, and fares calculations.

2.2 Current Status of Public Transport in the Palestinian Territories

The transport sector is one of the most vital sectors, which are affected by the on-going political crises, and which suffered distortion and disruption in its operation *(Abu Eisheh, Al-Sahili, and Kobari, 2004)*.

During the occupation period there were regulations regarding public transport permits, licensing, and fares. For example, the bus companies have the right to operate on fixed routes, called exclusive rights (الامتياز), since Jordanian and Egyptian rules. During Israeli occupation, the permit for a shared-taxi was sold at about 25,000NIS. The fares varied based on fuel prices. After the establishing of the PNA, the permits have been awarded based on the population in each area, where, for example, for any shared-taxi mode, the permit is rented by 10,000 New Israeli Shekel (NIS) and renewed annually. The PNA formula is one shared-taxi permit for each 500 inhabitants in the service area, whether to serve a quarter within a city or a village/town connected to a city[1].

In the Palestinian Territories, the public transport sector consists mainly from three modes; buses, shared-taxis, and taxis. The following paragraphs summarize the major studies that were carried out regarding the public transport sector in the Palestinian Territories.

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[1] Interview with Eng. Mazen Abu Al-Soud, Minister's Advisor, MOT. Ramallah, Palestine.

2.2.1 Infrastructure Assessment in the West Bank and Gaza: The Transport Sector Assessment *(Abu-Eisheh, Al-Sahili, and Kobari, 2004).*

The main points that were presented in this study were: The development of public transport, description and conditions of public transport, licensing and fares, and finally regulatory framework for public transportation.

The study indicated that public transport services are regulated by the MOT. The implementation of regulations is partially applied because of the absence of PNA power on the ground due to the Israeli incursions. It described the conditions of public transport as public transport that is subject to government regulations, every bus and public taxi requires a permit, which specifies the route on which it must operate; private taxi licenses specify the city.

- Buses: The MOT used to specify the maximum allowed age of a bus as 15 years. However, due to the Intifadah conditions, this age was increased to 24 years and the ministry is not enforcing it at the present time. Several bus companies in the West Bank complained that they are loosing money in their operations. There is competition by the registered shared-taxis on the same routes, unfair competition by illegal taxis and buses, and poor management operation of some companies. The MOT believed that the mean reason for financial losses for some companies is their poor management operations.

- Shared-Taxis: The most widely used type of public transport on most routes. They duplicate the services provided by the full-sized buses. The issuing of new licenses is restricted; however, a license may be sold by one owner to another at a premium.

All shared-taxis operate on the route specified on their licenses, but for an additional charge, most shared-taxis will divert from their routes to take passenger to or from a particular point. The number of shared-taxis increased since 2000 because the MOT reduced the annual permit fees from NIS 10,000 to 2,500 nowadays.

- Taxis: Observations show that there is excess capacity in the industry. The number of taxis increased significantly in the past several years because the PNA resumed granting the permits after years of strict Israeli control. Within the city, a flat fare is normally charged, irrespective of distance. For longer journeys, fares are based on distance.

Licensing and fares. The MOT established formulas for estimating the total number of permits to issue, as well as the fare for each type of public transport. The number of permits is mainly based on population and their distribution. The formula implies that a certain number of people require a specific number of shared-taxis, private taxis, or buses. The MOT established fares for routes of each type of public transport. This fare is calculated based on a cost plus a profit for each route. The cost per kilometer is calculated for each public transport type based on fuel (diesel) consumption, vehicle registration fees, insurance, vehicle deterioration and maintenance, and driver's wage.

Regulatory framework for public transportation. Bus and taxi drivers must hold a special driving license, which is obtainable after a specified period of experience and an approved training scheme. Bus and shared-taxi fares are controlled by the government in that maximum charges are stipulated. Passengers used to be charged less than the permitted fares. However, these rates increased after the beginning of the Intifadah due to the increased cost of long travel time and maintenance.

2.2.2 Traffic System Management Studies

Several Traffic System Management (TSM) studies were undertaken between 1996 and 2000 in the main cities in the West Bank and Gaza Strip. The main findings and recommendations of those TSM studies with respect to public transportation in Jenin, Tulkarm, Qalqiliya, Nablus, Ramallah and Al-Bireh, and Gaza City are briefly presented in the following paragraphs.

Traffic System Management Study for Jenin, Tulkarm, and Qalqiliya Cities *(WSA and UG, 2000)*

The study of public transport operations in the cities of Jenin, Tulkarm, and Qalqiliya were undertaken in 2000. It was recommended that a change to the existing license rules, which restrict buses and shared-taxis to a single specified route, is essential, bus operators should be required to hold a license in respect of each bus, and a separate license in respect of each route, the bus license would not specify the routes on which the bus may be operated. The same should apply to public taxi operators.

For fare regulations, it was recommended that bus and shared-taxi fares should be abolished. At present, the majority of bus and shared-taxi operators charge fares, which are less than those permitted by the government, since they are aware that passengers are unable to afford the permitted fares. This proves that there is no need for the government to protect passengers by regulation on fares; operators who overcharge will lose business to others.

Traffic System Management Study for Nablus City *(DSC and UG, 1999)*

This study recommended that the MOT, Nablus Municipality, and licensed bus and shared-taxi operators should work together to install an effectively public transport and to meet the needs of the travelers. These include responsibility for public transport concepts and studies, holder and pooling of the members' licenses, optimization of lines and routes and adaptation to the needs of the clients, introduction of coordinated time tables, selection of best bus-stop locations, marketing for public transport, coordinated of vehicles acquisition, coordination of a suitable vehicle maintenance, and calculation and introduction of uniform fares, balanced with revenues.

Traffic System Management Study for the Cities of Ramallah and Al-Bireh *(WSA and UG, 1996)*

The Traffic Control Department in cooperation with the MOT is principally involved with the issuing of route permits and controlling fares. When a vehicle is fifteen years old, the route permit and consequently the road tax license will not be issued. The department also liaises with the police to ensure that the traffic regulations are enforced.

Each bus is licensed to operate a specific route. This has the intention of preventing bus companies from operating the route of another operator. However, an operator who has permits for more than one route is effectively prevented from using a bus on a route for which it is not licensed, even though that vehicle may be standing idle and the licensed vehicle has broken down. The charge of a road tax license varies according to the age of the vehicle (i.e., for older vehicles the charge is lower).

Shared-taxis are also licensed by the MOT. As the case with buses, some shared-taxis are licensed to operate a specific route and to operate in accordance with an agreed time schedule. Although shared-taxis are issued with a road tax license and route permit in the same way as buses, the authority to operate as a shared-taxi (i.e., the green license plate) is more flexible. It is issued in perpetuity and becomes the property of the licensee. The driver can transfer the license plate from one vehicle to another and can sell it or hire it out to a third party.

Official fares to be charged on each bus and shared-taxi route are issued by the Inspector of Transportation. The official fare represents a maximum figure to be charged and is based on an estimations of the operators' costs plus a percentage mark-up for profit. In reality, the average of actual fares being charged, however, is 56% of the official fare.

Traffic System Management Study for Gaza City *(DSC, 1996)*

Due to the limited income levels in Gaza City, public transport services is playing a major role in satisfying the mobility needs in passenger transport of the population. In Gaza City, the public transport is served by buses and shared-taxis.

According to the statistics of the MOT, there were a total of 140 buses in Gaza Strip. Registered and licensed public buses were 35. The only registered buses served the regional connection between Gaza City and the southern communities. Private buses, in some cases, operate for public transport purposes.

As far as private buses are concerned, they do not have stations nor terminals and they regularly do not enter the city center. Private buses do not have fixed lines but most of its work is directed towards school and university students and workers in a random way.

2.3 Relevant International Public Transport Policies

2.3.1 Public Transport in London, U.K *(Transport for London, 2005)*

London Buses (LB) manages one of the world's largest urban bus networks and it is the largest public transport provider in the UK passenger carried. London Buses is responsible of service planning guidelines, network structure review, and review of the bus contracting regime report and action plan.

Bus fares are set by the Mayor of London, the declared objectives in setting fares are to meet the revenue target, to make public transport more attractive and affordable, to make fares simpler, and to make fares quicker and easier to pay. In general, the type of fare is flat, to make fare simpler, quicker, and easier. Taxi fares are usually reviewed each year with the new tariff coming into effect on the first Saturday of each April. The new tariff rates largely depend mainly on the ‘cost of living index’ and other cost per mile components, which are presented in Appendix B.

In order to be licensed for use as a taxi in London, a vehicle must pass through inspection at the Public Carriage Office (PCO) and conform with what is known as “Conditions of Fitness”, which are the criteria a vehicle must meet if it is to be used as a taxi in London. If the vehicle passes this inspection, a license is issued valid for one year. In addition, London service permits information and definitions are presented in Appendix B.

Any bus company which has the London service permit can provide bus services in Greater London for 5 years. The main requirements are: licenses, environmental standards, access and mobility, health and safety, stopping places and terminals, information, service levels, and route numbers.

2.3.2 Public Transport in Singapore *(MOT, Singapore, 2005)*

A license from the Public Transport Council (PTC), an official body in charge of public transport, is required for any bus service that charges fares. Bus fares and routes require the approval of the PTC. In addition, basic bus services are required to meet standards and specifications set by the PTC, which cover route planning and design, service efficiency, operational hours, affordability, and service information. Operational audits on the level of compliance with these standards are carried out periodically.

A comprehensive range of bus services licensed by PTC is being provided to meet diverse mobility needs of general public. One of the PTC's key functions is to regulate bus service standards to achieve high quality services. PTC has since 1994, mandated a comprehensive service standards and specifications for basic bus operators. PTC, together with Land Transport Authority (LTA), conducts regular audits to assume that the operators comply with the standards. The current standards for basic bus services are as follows: route planning and design, service efficiency, hours of operation, affordability, and service information.

The PTC usually reviews public transport fares annually. The main items that are reviewed are the consumer price index and the average monthly earnings (annual national average) over the preceding year.

2.3.3 Public Transport in Australia *(MOT, Australia, 2005)*

The Transport Operation Division as a part of the Transport Services Group in the Ministry of Transport in Australia is responsible for regulating and contracting functions for a range of transport sectors including buses and taxis. This division ensures compliance to relevant legislation, particularly the Passenger Transport Act 1990, and ensures the community can expect high quality services in accordance with accredited standards. The division also operates a number of funding schemes and contracts with service providers to ensure communities and individuals have adequate access to good transportation services.

Any person who provides a public passenger service with one or more taxis must; be an accredited operators, only use a taxi or taxis that are licensed, be affiliated with a taxi network unless exempted by the MOT, provide the service in accordance with the person’s accreditation as an operator, and provide the services in accordance with any relevant terms and conditions of the taxi license.

The Australian MOT fare formula includes flag fall, distance rate, waiting time, radio fee, and the proposed fare increase variables. The proposed percentage of increase usually depends on the year by year increase of the operating costs and the average monthly national earnings.

2.3.4 Public Transport in Jordan

The MOT in Jordan established the Public Transport Regulatory Commission (PTRC) in 2001 under the Passengers Public Transport Law No. (48) for year 2001. The Ministry's vision was to have reputable and distinguished public transport sector with high level of accuracy in its daily traffic and working plan to achieve a sustainable and economic and social development, creating a new concept of public transport, and to save more investment opportunities within this sector *(MOT, Jordan, 2005)*.

The Jordanian national strategy of MOT in the passenger transport sectors is summarized as follows *(MOT, Jordan, 2005)*:

- Improve level of service of public transport for passengers (quantity and quality) through improving and developing infrastructure in cooperation with related authorities, creating new public transport routes between governorates and within governorates, enhance existing public transport routes which suffer from lack in public transport modes, and enhance field monitoring through the establishment of the Public Transport Command and Control Center;
- Modernize the bus fleet by granting tax exemptions to operators;
- Adjust positions of the old investments companies which invested with public transport corporation previously in 1993 through a set of arrangements undertaken by PTRC;
- Encourage individual operators to merge in large companies in order to minimize operational costs and improve the level of service;
- Develop a new fare system that reflects all costs and sustainable to passengers;
- Prepare instructions aimed at classifying operators for each type of public transport sectors;
- Accelerate the merging process of taxicab offices and closely monitor existing taxicab offices in cooperation of related authorities; and

- Improve the performance of drivers through attending intensive and specialized courses at reputable colleges.

The main objectives of the PTRC are as follows *(PTRC, Jordan, 2005)*:

- Regulating and supervising public transport sector;
- Meeting the demand for public transport and its services, and provision thereof a good standard and appropriate cost;
- Encouraging competition and preventing monopolization in public transport sector;
- Encouraging investment in public transport sector in line with the objectives of economic and social development in the Kingdome; and
- Contributing to the environment conservation with the relevant institutions and entities.

The MOT approved the kilometric tariff in calculating the fare value either for taxis or buses. For example, the shared-taxis and taxis fare value in the urban areas (inside cities) is 10 fils for each 66 meter *(PTRC, Jordan, 2005).*

2.3.5 Public Transport in Lebanon *(Kaysi and Abbani, 2002)*

Tendering the public bus network is a major component of the reform plan proposed by the Lebanese Ministry of Transport (MOT) to organize the land transport sector in the country.

Generally, mass transit in Lebanon operates under complete deregulation, whereby five different types of mass transit operators compete to serve the limited patronage, which accounts for only 32% of the daily- motorized trips. These are the publicly owned Railway and Public Transport Authority (RPTA), the privately owned Lebanese Commuting Company (LCC), private minibuses, jitneys, and taxis. Within Greater Beirut Area (GBA), RPTA and LCC operate 164 and 185 buses, respectively, and these share the roads with 2000 minivans and 25000 jitneys and taxis.

2.3.6 Public Transport in Israel *(Robert & Joseph, 1999)*

The main two operators who provide the bus services are Dan and Egged Companies. Both companies, which are under the regulation of the Ministry of Transport (MOT), have established routes and timetables and as a result the traveler would adopt her or his schedule and activities to the bus schedule. They have been the recipients of substantial government subsidies. These government subsidies perpetuated the 'fixed route' type of operation.

The bus co-operatives historically operated a collection of individual routes, each authorized by a permit from the MOT. For decades, routes have been established on an 'as needed basis', as requested by municipalities, and have added to the existing operating patterns without concern for overall efficiencies. Fare policy and conditions of operations for each route are set by the MOT, while subsidy marks are set by the Ministry of Finance (MOF).

If a local authority wants a direct service to the central bus terminal in a large city, the local authority would request the bus co-operative to operate a route, the company would apply to the MOT for a permit to operate the route, and when granted, would operate it.

The Israeli transit sector is a regulated owned monopoly (Dan and Egged), which effectively covers the entire country (97 percent of all bus services provided in the country). Through regulation, other bus firms cannot enter transit markets and can compete only in a few auxiliary transit markets such as special services, tourist excursion services, or the transport of employees to large employment centers. The monopoly bus firms cannot set prices or even reduce them, cannot exit markets (even if these markets are unprofitable), and cannot set service levels and distribution (such as frequency of operation, type of vehicles, or route structures). Under present laws and regulations, all of these variables, as well as the levels of operational and capital subsidy, are set by the traffic commissioner at the MOT. The only variable over which the bus firm has a substantial degree of control is the use of input factors, mainly labor, in terms of quantity (number of employees) and returns to labor (salary level).

In 1991, a joint committee of the MOT and MOF recommended the partial introduction of some competitive elements into metropolitan transit markets in the form of putting up for tender selected clusters of routes, through each cluster would be operated by a single monopolistic operator. For various political, reasons these recommendations were never adopted.

2.4 Relevant Transport Demand Modeling Studies

In order to model the number of shared-taxis required, relevant researches and studies are presented below.

2.4.1 Linear Regression Model of the Number of Taxi-Cabs in U.S. Cities *(Schaller Consulting, 2005)*

In cities that control the number of taxicabs by law or regulation, setting the number of cabs is one of the most important decisions made by taxicab regulators and elected officials. Licensing either too many or too few cabs can have serious deleterious effects on the availability and quality of service and the economic viability of the taxi business. Yet local officials often have difficulty quantifying the demand for taxi service or tracking changes in demand.

Multiple regression modeling of the number of cabs in 118 U.S. cities identified factors that explain most of the variation in the number of taxicabs among these 118 cities and counties. The strong factors were identified :

1. The number of workers commuting by subway, which is both a direct generator of demand for cab service and also a proxy for parking costs and availability and overall urban density, factors that are not separately accounted for the model;
2. The number of no-car households; and
3. Taxi usage for airport taxi trips, which are themselves a direct measure of demand for service, and also captures demand for trips to return to the airport and local taxi trips by visitors.

2.4.2 Elasticity of Intercity Buses in the West Bank *(Al-Sahili, and Sadeq, 2004)*

This study was concerned with transportation planning in Palestine. The objective of this study was to collect and analyze information about public transport ridership behavior by using two different questionnaires for bus riders and shared-taxi riders. The study area was the Northern and Central Governorates of the West Bank. Five hundred and eighty six forms were distributed for intercity bus and shared-taxi riders, which accounted for 5 percent of riders.

Questions were about riders' characteristics, trip itself, and changing mode preference for a change in bus fare or waiting time. Results showed that ridership demand elasticity towards the change in bus fare was -1.83 for bus riders and -1.34 for shared-taxi riders. Employees and students who make frequent trips were the most sensitive to mode change based on fare change, reducing waiting time, and availability of express bus services.

2.4.3 Ridership Demand Analysis for Palestinian Intercity Public Transport *(Al-Sahili, and Sadeq, 2003)*

A research study about the intercity bus ridership demand was performed by Al-Sahili and Sadeq, was published in the Journal of Public Transportation in 2003. The intercity public transport between six governorates in the northern and central districts of the West Bank was examined. The relation between public transport demand and both operating and socioeconomic variables that influence demand was established. An on-board survey of intercity bus riders identified some of the variables that can potentially influence ridership demand. A simple linear regression equation of the ridership demand was developed using five independent variables: population of origin city, population of destination city, bus fare, percent of employees at origin city, and percent of higher education students at origin city. Ridership profiles and trip characteristics were also established.

The study results can be used to evaluate existing public transport and forecast future intercity public transport demand. Decision makers can use the results to improve public transport services and attract more riders. The study recommended that future research should be based on this simple model, include the impact of other modes on intercity demand, include all the governorates of the West Bank and Gaza Strip, and establish a comprehensive nationwide model.

CHAPTER THREE

METHODOLOGY

Chapter Three

METHODOLOGY

This chapter describes the steps that shall follow in order to achieve the objective of the study. As the objective of the study is to evaluate and assess the impacts of the MOT policies regarding public transportation in the Palestinian Territories, the methodology that is used in this study composes of:

1. Review of studies related to public transport and implemented policies in the Palestinian Territories. The International experience related to public transport policies is reviewed. This may be achieved through referring to the neighboring countries in the field of public transport, e.g. Jordan, Lebanon, and Israel. However, on the international level, some governmental public transport policies in the United Kingdome, Australia, and Singapore will be presented.

2. Data collection from different sources (MOT, PCBS, and field survey).

3. Regarding the number of shared-taxis and buses needed, the assessment of the existing number granted from the MOT with respect to the MOT formula is made first. Then the tool to specify such numbers is assessed to arrive at a decision-making tool to predict the required number. This is achieved through calculating the number of shared-taxis based on demand, then developing a mathematical linear regression model to help the MOT to predict the number of transit units needed.

4. According to fares and bus routes exclusive rights issues, they are also analyzed and assessed. The MOT policies and regulations in this regard are presented on one hand, and the international policies and regulations are also introduced on the other hand.

5. The assessing of MOT policies regarding the earlier mentioned polices with the international corresponding polices and experiences is presented. This aims at defining the deficiencies and weak points in the MOT regulations on one hand, and to provide proper recommendations on the other hand.

6. A set of proper recommendations is identified in the last chapter. These recommendations may help the MOT in regulating and organizing the public transport sector which is vital for a considerable class of the Palestinian people, through proper policies adopted on the national level.

CHAPTER FOUR

REVIEW OF PUBLIC TRANSPORT EXCLUSIVE RIGHTS, FARES, AND PERMITS

Chapter Four

REVIEW OF PUBLIC TRANSPORT EXCLUSIVE RIGHTS, FARES, AND PERMITS

4.1 Assessing of Bus Companies Exclusive rights

4.1.1 Types of Bus Companies Exclusive rights in the Palestinian Territories

The regulations applied in this regard are those set and implemented since the British mandate. The companies that were registered since the British colonialism are the same in the Jordanian rule, Egyptian rule, and Israeli occupation. In the British mandate period, the specifying of a new bus route or extending an existing route for a certain locality was based on the need and demand. The followed procedure implied that the local authority writes to the responsible department on the need. The responsible department then sends an inspector to examine the real needs of such locality, which could result in a new bus route or extending the existing one. If the inspector approves the request of the local authority, then the licensing committee invites the operating bus companies through competitive tendering. The bus companies, which were invited where those operating the surrounding routes. During the occupation period and at specific from 1980 to 1987, the Israeli authorities encouraged the bus companies to import new buses from Israel by providing a subsidy of 30,000 NIS for each bus to replace the old ones.

The general permit (exclusive rights) conditions applied during the British Mandate and the Jordanian Rule are:

1. The omnibus shall conform to and the owner shall comply with the rules made under the Road Transport Ordinance, and any ordinance or rules amending or substituted therefore, or which may be in force hereafter.

2. The permit shall not be transferable by the holder thereof to any other person, and shall be delivered up to the Local Licensing Authority at Jerusalem.

3. The omnibus operating the route shall cover the entire route on each journey, and shall not be turned about or parked at any point along the route.

4. The omnibus shall not transport any passenger other than those for whose special conveyance this permit is granted.

5. The omnibus shall carry a board marked "SPECIAL" to be fixed so as to obscure the route number of the omnibus, and the lettering on the a foreside board shall conform to that prescribed for omnibus operating under a special road service permit.

6. If, during the validation of this special road service permit, there has been a breach of, or failure to comply with one or more of the conditions prescribed herein, the Local Licensing Authority may revoke or suspend the said permit for such period as the related authority may see it.

Before the PNA period, the number of buses and shared-taxis operated was based on the demand needs. However, some villages suffered from lack of bus services. Based on estimates available for 1993, about 49% of the rural communities, within which 66% of rural population lives, have access to the bus service. In the past, Jerusalem was the main hub in the area. Intercity bus travel to Jerusalem was available from Hebron, Bethlehem, Ramallah, and Nablus. Because of travel restrictions, these services are no longer available. The number of buses in the West Bank in 1993 was 528 *(Sinha & Hamideh, 1999)*.

During the PNA period, the only additional step was to expand the service on same routes to benefit the villages that lack bus services. In the second Intifadah, the bus companies were negatively affected and the number of buses in service was noticeably reduced. In 2003, the bus companies tried to re-operate again and therefore bus services are becoming better. The number of buses in the PNA period increased from 528 in 1993 to 576 in 2004[1].

The MOT improved bus services through the new regulations regarding organizing bus service coverage so that all villages and towns can benefit from such service. The MOT policy is based on expanding the existing routes but not to construct new routes. As a result, this required the creation of a new formula for calculating the number of buses and taxis needed on each route.

The general direction of the MOT nowadays, and when the political conditions get better, is to make new tenders for new routes. This will create a climate of competition between the companies to improve the quality and the level of service for the local communities. Moreover, the patronage to the public transit modes will increase. The exclusive rights of the bus routes then will not be described as private monopoly[2].

Taking into account that about one third of the currently operated buses are illegally operated (the age of them is more than 15 years), the MOT encouraged the bus companies to renew the fleet and replace the old buses through importing second hand buses from Israel. In addition, the MOT arranged with the Netherlands government to import 75 small-size buses and the European Union will subsidize this agreement by about 35% of the total cost[1].

The MOT is looking towards merging the bus companies that are operating in the same region and sharing the same route in one company, so they can compete with other companies operating on the same route but from another area. For example, there are now seven bus companies operating on Nablus-Jenin route, either on the route between Nablus and Jenin Governorates, or having Nablus and Jenin as part of a route serving other communities. Five of them are from Jenin Governorate and two from Nablus Governorate. The MOT idea is to merge the five companies in one company so it can be competitive with the other two companies, but this issue is still debatable[2].

4.1.2 International Bus Service Competition Procedure

Transit system and buses in particular, generally suffer from severe financial problems that affect their sustainability and level of service. In the attempt to revive these systems, public authorities in various parts of the world have recently moved towards more private sector participation,

[2] Interview with Eng. Ramadan Al-Kilani, Head of Department of Transport, MOT. Ramallah, Palestine.

which could improve cost efficiency. This participation can take different forms depending on the roles of each sector in the provision and production of public transport. Focus is given to one specific strategy, namely, competitive tendering, because of its successful application worldwide and its sustainability.

The regulatory forms of mass transit services include public and private monopolies, deregulation, regulated competition, and competitive tendering services. Each of these models has advantages and disadvantages, and each may be suitable for specific environments based on political, economical, and social conditions *(Kaysi and Abbany, 2002)*.

1. Public and Private Monopolies

Public monopoly gives one public operator the exclusive rights for designing, owing, and operating all transit services, without any competition from other operators. This single operator could also be a privately owned company (in which case the setup is called private monopoly) that works under regulatory rules set by the transit authority. In the case of Palestine, this type can be representative by the routes which, are served by one bus company; i.e., the route which links between An-Najah National University and the center of Nablus City as Al-Tamimi Bus Company has the exclusive rights of operating.

2. Unregulated Systems

Also called "Open Market", an unregulated market presents no restrictions on transit operators, except those related to safety concerns, environmental issues, vehicle maintenance, and general business and traffic laws. Towards this end of organizational strategies, competition between different operators exists in the market, particularly to attract more riders and increase the revenues.

3. Regulated Competition

This system preserves the competitive aspect of deregulated markets, with additional rules regarding fares, level of service, entry to the system (through a license), and operated routes. These rules could enable the government to create an integrated network with sufficient coordination between different operators.

4. Competitive Tendering

Competitive tendering "Contracting Out" falls midway between public or private monopolies and full deregulation techniques. It enables the introduction of competition for the market, while keeping certain levels of public control over fares, service quality, and coordination between different operators.

Competitive tendering has been recently widely applied in many cities around the world, such as London, Copenhagen, and Stockholm. The experiences revealed many benefits in as far as cost savings, improved quality of service, network expansion, congestion reduction, improvements in safety and environmental measures, and enhanced customer satisfaction. In London, for example, 15 years after the initiation of the competitive tendering process, operating costs dropped by 47% due to lower labor costs and more efficient operation.

Competitive tendering requires a number of transport policies and legislatives reforms in order to successfully achieve its objectives.

Moreover, the transit authority needs to decide on two major aspects of the tendering process:

- Who bears the revenue risk/what type of contract to adopt?
- How to design the contract?

Appendix C shows a detailed information about the regulatory forms of mass transit services.

4.2 Identification of Fares

4.2.1 Calculation of Fares in the Palestinian Territories

The fare structure is regulated by MOT for bus companies not registered in Jerusalem. The fare structure for buses is zonal, that is, based on the distance traveled or location of alighting and boarding stations. On the other hand, for shared-taxis the fare is flat. The MOT usually sets the values of public transport fares for both buses and shared-taxis based on one kilometer riding (kilometric tariff). This tariff is reviewed and calculated normally every six months based on the fuel prices (especially diesel). MOT generally follows a number of steps in calculating tariff for a certain route of distance in km, average speed in km/hr, and time in hours. Table 4.1 summarizes the fare calculation procedure for the bus mode. The shared-taxi mode is also calculated by the same procedure. The main differences between the bus and the shared-taxis are the values of average speed, trip time, and the number of riders (passengers). Tables 4.2 and 4.3 present the MOT procedure for calculating the daily operating costs in (NIS) for buses and shared-taxis, respectively.

Table 4.1: General Procedure for Calculating Bus Fares

Route name: ----------
Distance (km): ----------
Average speed (km/hr): ----------
Trip time (one direction) in hours = Distance / Average speed
Total trip time in both directions (hr) = 2* (trip time + waiting time + access time + boarding/alighting time)
Average daily bus work hours (hr): --------
Number of trips per day = average daily hours/ total trip time
Cost of one kilometer = 1.35*(daily cost/((number of trips/day)*distance)), profit percentage is 35%
Rider tariff = (cost of one kilometer*distance)/number of riders), the average number of riders is usually 25
The cost per kilometer per rider = rider tariff /distance

Source: MOT, 2005

Table 4.2: Average Daily Bus Operating Cost (based on 10 years in operation)

Item	Cost (NIS)
Depreciation	0106.0
Insurance	36.12
Fuel	300.0
Maintenance	114.0
Income Tax	1.65
Value Added Tax (VAT)	8.27
Drivers wages	83.33
Overheads expenses	30.0
Parking, garage, etc.	40.0
Different registration expenses	1.67
Total Daily Cost	**721.04NIS**

Source: MOT, 2005

Table 4.3: Average Daily Shared-Taxi Operating Cost (based on 7 years in operation)

Item	Cost (NIS)
Depreciation	41.1
Insurance	16.4
Fuel	100.0
Maintenance	31.82
Income Tax	3.36
Value Added Tax (VAT)	6.28
Item	**Cost (NIS)**
Drivers wages	83.33
Overheads expenses	9.67
Parking, garage, etc.	17.5
Permit	6.85
Total Daily Cost	**318.23NIS**

Source: MOT, 2005

4.2.2 International Procedure of Calculation Fares

Transit fare represents an important source of revenue for transit agencies. They affect the present and potential ridership of transit systems and strongly influence public attitudes towards transit services. The amount of fare revenue required is dependent on financial policies, which are, in turn determined by the objective of maximizing the number of passengers or the transit agency's revenue. The primary objective varies from place to place and also depends on the ownership (private or public) of transit system *(Yu, 1982).*

The elasticity of transit fare varies with trip purpose, income level, and current level of transit services. Fore example, in the United States, many studies showed that transit demand is fare inelastic when transit fares changed a small amount. In general, the average transit fare elasticity ranged from -0.20 to -0.40 for the system wide ridership *(Yu, 1982).*

The fare elasticity is the percentage of change in transit travel demand divided by the percentage of change in the fare level. Fare structures can be classified into two major categories: one is related to distance traveled, and the other is independent of travel length. Using distance as a criterion, there are two possible fare structures: zone fares and graduate fares.

Zonal fare systems provide for a varying cost to the rider depending on zonal changes. A transit system may be broken down into a set of service zones. A rider traveling within one zone will pay the same price, no matter how far within that zone he or she travels. However, if a passenger makes cross-zone trips, the cost of the trip will be increased in proportion to the distance between zones. The main advantage of this fare structure is that it provides attraction at low price for certain types of trips, such as those within the Central Business District (CBD), while collecting higher revenue for longer trips.

The graduate fare structure is obtained by dividing transit lines into sections and determining fares on the basis of the number of sections the passenger travels. Since a section is usually smaller than the size of a zone, the sectional fare structure is more closely related to travel distance than the zonal fare system. However, graduate fares are more complicated to compute, collect, and control than zonal fares.

The transit ride also can be flat fare or no fare. In a flat fare system, there is one fare for all trip lengths. Sometimes, however, fare for different age brackets and certain citizen groups may be enforced. Although the flat fare is the simplest possible fare structure, it does not in any way reflect the quantity and cost of service the rider receives.

However, in cities with limited geographic size, travel distances are relatively uniform, so that the convenience of the flat fare far out-weighs the inequality related to its lack of correlation with trip length. A no-fare structure means that there is no direct charge for riding a transit vehicle, but money will have to be taken from other sources (i.e., taxes) to pay for the service. A no-fare or low fare system is desirable if it is the objective of the community to increase transit ridership.

Each fare structure has its advantages and disadvantages. Table 4.4 shows a comparison among flat, zonal, and graduated fare structures. However, the fare for a trip between any two points on a transit line for all three cases can commonly be expressed by: $F = F_b + K_{n,}$

Where

F = fare to be paid, F_b = base fare, K = increment in price to be paid for crossing a zone or a section, and n = number of zone or section boundaries crossed. Obviously, for a flat fare $K = 0$, so that $F = F_b$ for all trips, and for no-fare, both F_b and $K = 0$, so $F = 0$.

Table 4.4: Transit Fare Structure Characteristics in the United States

Characteristics	Type of Fare		
	Flat	**Zonal**	**Graduated**
Equity	Poor	Good	Excellent
Passenger attraction	Poor	Good	Excellent
Revenue collected	Variable	Good	Excellent
Simplicity of collection	Excellent	Fair-Good	Poor
Simplicity of control	Excellent	Fair	Poor
Simplicity for passengers	Excellent	Fair-Good	Poor
Route length	Short (<3.0 miles or 4.83 km)	Medium	Long
Travel distance	Short	Variable	Variable

Source: Yu, 1982

4.2.3 Singapore Fare Review Mechanism

The current fare review model is formulated based on the price-cap model commonly used to regulate monopolies. The underlying principle behind such a model is that it replicates market discipline to maximize efficiency and keeps cost at its lowest. In this model, any increase in public transport fares for the year cannot exceed the amount determined by a fare adjustment formula. The Public Transport Operators (PTO) will therefore have to be more efficient and productive if they wish to increase their profits *(MOT, Singapore, 2005)*.

In 1998, the Public Transport Council deregulated taxi fares, allowing the taxi companies to set their own fares. This provides more flexibility for operators to respond to change in market conditions, to implement differential pricing to balance supply and demand different times of day, and to introduce and set prices for innovative services.

The final fare formula proposed by the PTC and approved by the MOT is: Maximum Fare Adjustment = Price Index – 0.3%

Where Price Index = 0.5CPI + 0.5WI, and 0.3% is the productivity extraction to be used for the next 3 years (from 2005-2008). CPI refers to the change in consumer price index over the preceding year, and WI refers to the change in average monthly earnings (annual national average) over the preceding year, adjusted for any change in the employer's contribution rate.

4.2.4 Australia Fare Formula

The MOT in Australia adopted the following formula to calculate taxi fare *(MOT, Australia, 2005)*:

$$Average\ \ fare = (A + (8.8 \times B) + C + D)r$$

Where:

A = the flag fall, currently 2.90 Australian Dollar

B = the distance fare, currently 1.005 Australian Dollar

C = the waiting time for one minute, 24 Australian Dollar per hour or 40 cents per minute

D = the radio fee, 60 cents

r = the proposed fare increase (based on the year on year increase in the operating costs and national average monthly earnings).

The 8.8 average trip kilometer used in the formula was based on observation of the average distance traveled by taxis in the city of Canberra with their meters on.

4.3 Number of Permits of Shared-Taxi and Buses (Fleet Vehicle)

4.3.1 Palestinian Procedure in Determining the Fleet Vehicle

Based on the MOT formula, the number of taxis and buses required to operate on a certain route depends mainly on population that the route serves. Table 4.5 shows the number of shared-taxis and buses based on MOT formula which adopts the population as the only factor.

Table 4.5: The Inhabitants for Each Vehicle of Public Transport Modes

Public Transport Mode	Inhabitants
Big size bus	5,000
Small size bus	2,500
Shared-taxi	500
Taxi	1,000

Source: MOT, 2005

In general, the number of licensed vehicles (whom drivers and owners paid for licensing fees) noticeably decreased especially during the second Intifadah because of hard conditions imposed by the Israelis. However, the number of permits awarded from the MOT increased since the unemployment rate increased.

In order to examine the validity of the above indicated MOT of population-only based policy to define the number of permits, the calculated number of permits based on demand is regressed on a number of variables. The resulting formula could replace the population-only formula and could be used to forecast the future number of shared-taxis and buses. A linear model is proposed to model the number of shared-taxis and buses within a supply-demand framework. After the model is estimated, then the second step is to check and examine the model (model validation) and this requires gathering data from other neighboring governorates like Tulkarm. The final step is to forecast the model in the future (e.g., 2010).

The single equation model is simply composed of one equation. The left hand side represents the dependent variable and the right hand side includes the exogenous variable. The system considers the shared-taxi and bus service variables. With the purpose of the model directed towards designing a model that could be used in forecasting, this modeling approach attempts to capture the variations in these variables.

The statistical analysis will be performed using LimDep version 7.0 software. The specific coefficient estimation results are assessed using the t-statistic (when determining if the coefficient estimate is significantly different from zero, the t-statistic is simply the ratio of the estimated coefficient to its standard error). The results of this test with regard to the right-hand-side and endogenous variables (shared-taxi and bus service variables) can be stated with high confidence that there is a significant interaction between these two variables.

In order to calculate the fleet vehicle, a representative sample of 33 external licensed routes (shared-taxis and buses) were included. The operating and socioeconomic characteristics of each routes were gathered. The 33 licensed external routes serve about 45 localities in Nablus

Governorate. These routes represent also the different geographic locations and directions in Nablus Governorate, as well as different levels of socioeconomic characteristics for inhabitants.

4.3.2 Mathematical Procedural Calculation of the Number of Shared-Taxis and Buses (Fleet Vehicle)

The existence of a bus route will depend mainly on the demand for bus travel. In the United States, the demand for bus travel is a function of several variables, including the nonresidential size and density, the density of residential areas, the distance between nonresidential cluster and the residential areas, average auto ownership, the service provided by the bus system, and the fares involved *(Yu, 1982)*. The actual configuration for a route, once it has been decided that the demand exists for it, should be determined by the overall system service, the geography of the area, streets and highways available for bus use, and other competing transit services in the area.

Once it has been decided where a route will be located, it becomes necessary to decide how often bus service will be provided. For a given demand, it is possible to determine the service frequency required. The frequency of the service required can be determined by the following relationship *(Yu, 1982)*:

$$T.U(N_f) = f \times T_t \tag{1}$$

Where

T.U (N_f) = number of transit units (fleet size)

f = service frequency (T.U/Hour), $f = \frac{1}{h_w}$, and $h_w = \frac{60 * c_v * \alpha}{P}$

Where

h_w = headway in minutes

c_v = number of spaces per vehicle (i.e., c_v for a shared-taxi is 7, and 55 for a bus (50 seats + 5 standing))

α = load factor, $\alpha = \frac{P}{C_o}$, where P = passenger demand, and C_o = vehicle capacity (i.e., α for a shred-taxi is 1, while for a bus ranges from 0.50 to 1.0)

T_t = Total trip time, $T_T = 2(\frac{V}{d} + t_t)$

Where

V = average speed, assumed 50 and 30 km/hr for shared-taxi and bus, respectively. These values were measured based on the average speeds of shared-taxis and buses in the study area.

d = distance (route) length in km in one direction

t_t = terminal time, measured as 3 and 6 minutes for shared-taxi and bus, respectively. The terminal time values were assumed based on the average waiting time of shared-taxis and buses during peak hours/periods in the study area.

By following the previous procedure, then the number of transit units (fleet vehicle, either shared-taxis or buses) can be calculated based on the demand. When the patronage of a given route is low, policies are usually set to determine minimum headways. Most bus routes operate at least once every hour or every 30 min. Also, headways are set as a multiple of either

7.5 or 10 min to make coordination between different routes at transfer points feasible *(Yu, 1982)*.

In general, it is good idea to keep the fleet size slightly larger than the demand to account for vehicle breakdowns and accidents that might occur.

For the earlier mentioned 33 external routes, to calculate the number of shared-taxis required, a number of steps should be followed. The number of passengers per hour (demand, P) is counted either in peak hours or peak periods, then the headway is calculated based on a number of variables among which is the demand. The service frequency of the shared-taxis is then calculated based on the headway. The total trip time is composed from two part: the distance and the average speed part, and the other is the terminal time. Finally, the number of transit units needed on a certain route then will be calculated by multiplying the service frequency by the total trip time.

CHAPTER FIVE

DATA COLLECTION

Chapter Five

DATA COLLECTION

5.1 Introduction

The collection of data, which is related to the main issues in this study; permits, fares, bus companies exclusive rights, and number of shared-taxis and buses, was conducted through several resources. The data of permits, fares, and exclusive rights issues were mainly gathered from the MOT. The data needed in developing the mathematical linear regression models was gathered mainly from the MOT, PCBS, and field survey. Figure 5.1 shows the study area map, which has a representative sample of 33 external shared-taxis and buses routes operated between Center of Nablus Governorate (Nablus City) and the surrounding villages/towns.

The development of the model is to express the number of shared-taxis and buses through using the single-equation linear model. The prediction of the number of shared-taxis and buses requires establishing a database. This database must be sufficient, reliable, and logical to obtain reasonable results. After the model is estimated, then the second step is to check and examine the model (model validation) and this requires gathering data from other neighboring governorates like Tulkarm. The final step is to forecast the model in the future (e.g., 2010). In addition, the

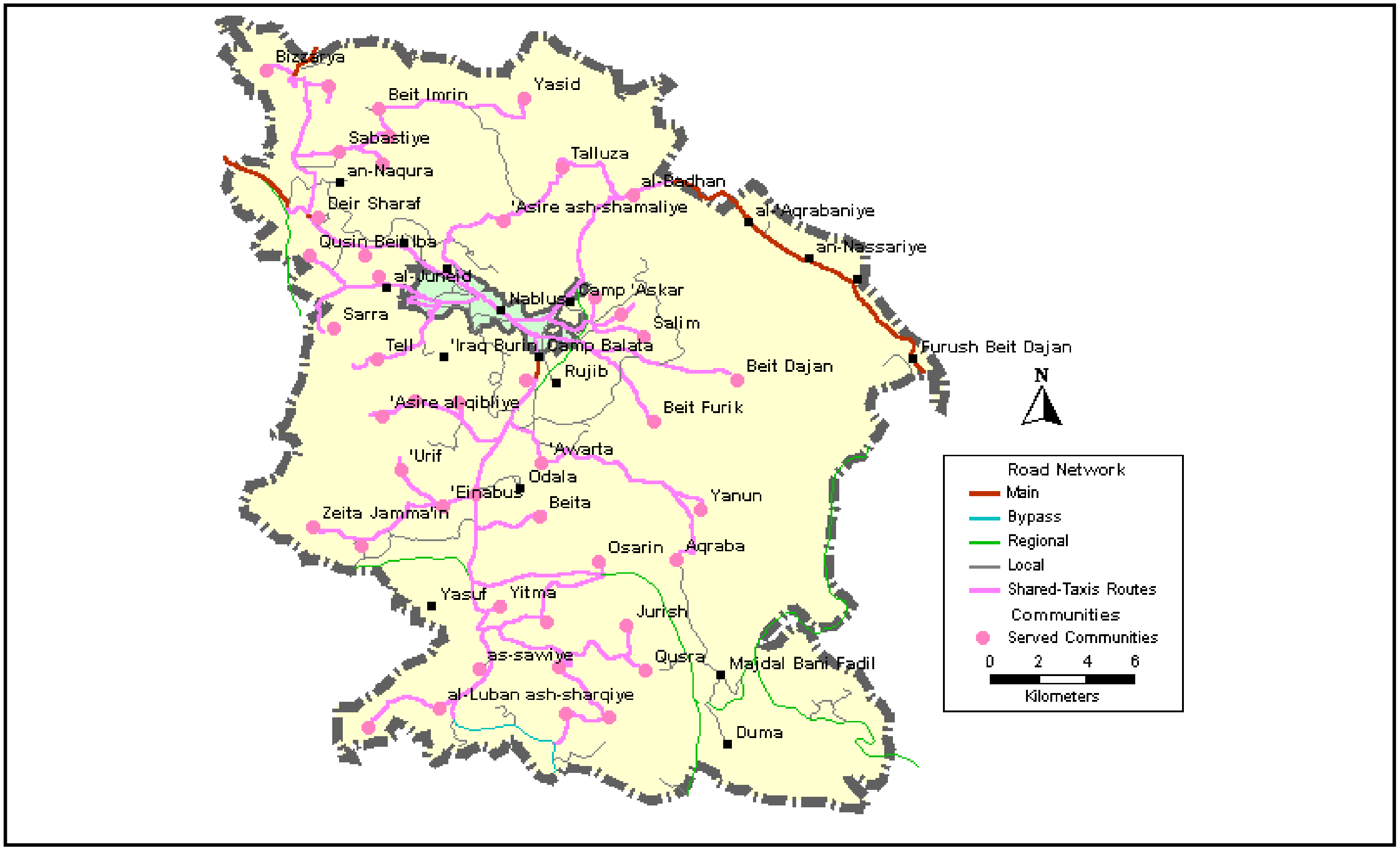

Figure 5.1: The Study Area Map

shared-taxi fare value is included in the database since it is one of the important independent variables. The components that form the fare equation are included. The number of shared-taxis permits corresponding to each governorate in the West Bank is tabulated. Finally, the bus companies, which have the right of operating on these external routes and the corresponding localities that these companies served. Appendix D includes forms regarding public transportation regulations (e.g., bus special road service permit, permit conditions, shared-taxi permit form, and driver ID form).

The prediction of the number of taxis and buses through mentioned model is developed to predict the likely outcome of a particular set of policies or events. The data requirements for calibrating such models depends on sufficient available data and surveys especially tailored to the need of such models. However, data collection is a very critical and serious procedure. Studies have to deal with whatever data that are already available. Even where special surveys can be done, existing data are frequently used to provide background information to the proposed model.

5.2 Sources of Data

The data collected in this study can be classified according to their source, nature, and characteristics into three types, as listed below:

1. Ministry of Transport

2. PCBS (Palestinian Central Bureau of Statistics)

3. Field survey data

5.2.1 Ministry of Transport Data

Data records of the operating number of shared-taxis and buses on the external licensed routes in the Nablus Governorate were collected from the Ministry of Transport (MOT) for the year 1999. The selection of 1999 to be the base year was based on the last updated data in MOT records. These records somewhat represent the reality since the year 1999 was the last year before the Second Intifadah in which public transport modes became interrupted. These data were obtained from the Department of Licensing in the MOT. The data included the existing number of shared-taxis and buses operated on those external routes between Nablus City and surrounding villages and towns within the governorate. Data is presented in Table 5.1.

From Table 5.1 it is clear that the number of buses in the licensed routes is less than that for shared-taxis.

5.2.2 Palestinian Central Bureau of Statistics Data

The (PCBS) was entrusted by the PNA to lead the implementation of needed statistics for planning. The census covered all of Palestinian Territories except the part of Jerusalem, which were annexed by Israel in 1967.

Table 5.1: Shared-Taxis and Buses Operating in Nablus Governorate

No.	Route (Permit)	Existing Operating Shared-Taxis*	Existing Operating Buses*
1	Nablus-Qusin-Sarra	3	2
2	Nablus-Salim	2	1
3	Nablus-Bezariya-Burqa	14	2
4	Nablus-Yasid	4	2
5	Nablus-Beit Imrin	6	3
6	Nablus-Nisf Igbel	1	1
7	Nablus-Sabestiya	5	2

No.	Route (Permit)	Existing Operating Shared-Taxis*	Existing Operating Buses*
8	Nablus-Ijnesinya	1	1
9	Nablus-Badan-Talluza	4	2
10	Nablus-Dier Sharaf	8	1
11	Nablus-Asira shamalya	20	2
12	Nablus-Biet Iba	4	2
13	Nablus-Beit Wazan	2	2
14	Nablus-Til	10	2
15	Nablus-Beit Dajan	5	2
16	Nablus-Kufr Qalil	4	2
17	Nablus-Froush Beit Dajan	5	1
18	Nablus-Madama	3	2
19	Nablus-Beit Fourik	20	1
20	Nablus-Burin-Asira qiblya	7	3
21	Nablus-Awarta	9	3
22	Nablus-Hiwwara	4	3
23	Nablus-Einabous-Urif	6	2
24	Nablus-Beita	9	4
25	Nablus-Zeita-Jammain	9	2
26	Nablus-Aqraba	5	3
27	Nablus-Yutma	3	2
28	Nablus-Qabaln	12	2
29	Nablus-Qusra	2	1
30	Nablus-Qaryout-Jaloud-Telfit	10	1
31	Nablus-Al-Sawya	5	2
32	Nablus-Lubban-Amorya	4	1
33	Nablus-Azmout-DeirAl-Hatab	10	2

*Source: MOT, 2005

The PCBS published the 2000 final report, which described the population demographics and their activities in Gaza Strip and the West Bank and taking into consideration the annual growth and predicted scenarios of the population growth in the following 20 years *(PCBS, 2000)*.

As mentioned before, the study considers the year 1999 as the base year. Thus all collected data were based on year 1999. All variables used in both models and gathered from the PCBS for the 33 observations are presented in Table 5.2.

Table 5.2 includes socio-economic characteristics, which are anticipated to be used in modeling analysis. These include population, private cars, services establishments, trade and services establishments, employment, taxi fare, and income. Moreover, the distance between Nablus and localities in the governorate (route length) was measured in kilometer (km). Employment was calculated as 0.47 of population over 15 years in each locality based on labor force survey report by PCBS in 2000, which estimates the labor force in Nablus Governorate as 47% of population above 15 years old (inside employment; people 15 years or older who have the ability to be employed). Fare and income were measured in New Israeli Sheqel (NIS).

5.2.3 Field Surveying

In order to calculate the number of shared-taxis and buses required to operate on the 33 external routes, which linked

Table 5.2: Input Database Variables Used in he Model (Base Year 1999)

No.	Route	Population of Destination Village/ Town	Private Cars at Destination Village/ Town	Route Length (km)	No. of Services Establishments at Destination Village/ Town	Trade & Services Establishments at Destination Village/ Town	Employment at Destination Village/ Town	Route Shared-Taxi Fare (NIS)	Average Income (NIS) at Destination Village/ Town
1	Nablus-Qusin-Sarra	3739	134	9.0	37	94	772	4	1834
2	Nablus-Salim	4109	85	6.7	12	50	851	3	1981
3	Nablus-Bezariya-Burqa	4992	94	15.8	43	136	1090	5	1457
4	Nablus-Yasid	1852	31	23.5	15	38	398	5	1634
5	Nablus-Beit Imrin	2324	80	16.5	18	61	163	5	1737
6	Nablus-Nisf Igbel	409	10	15.0	4	9	521	5	1396
7	Nablus-Sabestiya	2344	77	13.5	30	89	546	4	1468
8	Nablus-Ijnesinya	452	10	15.3	6	10	107	4	1449
9	Nablus-Badan-Talluza	4123	151	14.9	46	119	896	4	1690
10	Nablus-Dier Sharaf	2229	72	8.0	21	50	494	3	1598
11	Nablus-Asira shamalya	6267	163	6.0	70	204	1431	3	1432
12	Nablus-Biet Iba	2641	113	6.9	12	56	604	3	1537
13	Nablus-Beit Wazan	905	52	5.9	13	20	206	3	1598
14	Nablus-Til	3814	106	9.1	36	123	766	3	1681
15	Nablus-Beit Dajan	2901	50	11.0	21	56	621	4	1992
16	Nablus-Kufr Qalil	2014	60	5.0	10	29	403	3	1748
17	Nablus-Froush Beit Dajan	937	11	13.0	2	4	206	4	1831
18	Nablus-Madama	1340	32	12.0	15	32	281	4	1568
19	Nablus-Beit Fourik	4064	130	9.4	55	248	1745	4	1659
20	Nablus-Burin-Asira qiblya	3919	66	13.5	34	88	828	4	1560
21	Nablus-Awarta	4688	113	9.6	24	91	950	4	1670
22	Nablus-Hiwwara	4680	214	9.0	47	223	983	4	1615
23	Nablus-Einabous-Urif	4087	147	14.4	39	118	807	4	1764
24	Nablus-Beita	7090	154	14.0	45	224	1409	4	1604
25	Nablus-Zeita-Jammain	6248	150	17.9	45	183	1342	4	1861
26	Nablus-Aqraba	6407	135	20.6	37	171	1184	6	1654
27	Nablus-Yutma	2410	44	15.7	16	49	494	4	1795
28	Nablus-Qabaln	5859	103	18.6	43	192	1111	5	1640
29	Nablus-Qusra	3589	110	24.5	24	95	627	6	1956
30	Nablus-Qaryout-Jaloud-Telfit	4770	109	24.3	36	108	995	6	1814
31	Nablus-Al-Sawya	1860	48	17.4	12	30	394	5	1770
32	Nablus-Lubban-Ammorya	2018	30	21.4	15	53	463	5	1759
33	Nablus-Azmout-Deir Hatab	4025	101	9.2	30	62	846	3	1986

Source: PCBS, 2000, except Route length and Shared-taxi fare which were provided by MOT

Nablus City with the surrounding villages/towns, a field surveying study was conducted to account for the real demand, and as a result, to find the fleet vehicle required. In addition, the examining of the model, testing the validation of it, and forecasting the number of shared-taxis in the future, required the execution of another field survey in the neighboring governorates (e.g., Tulkarm). The aim of the survey was to find out the exact demand, then calculating the actual headway and frequency. The results then will be compared with the predicted values resulting from the model.

Field data demand was calculated for the 33 routes (lines) in Nablus Governorate. Several visits were performed to shared-taxis and buses terminals for the 33 external routes. The field survey period was one month. Interviews with drivers and buses were conducted. A set of questions were asked about number of passengers per peak hour or periods, number of existing operating shared-taxis and buses, service frequency, headway, average number of bus riders, the distance traveled, the average speed, the average terminal time, the average trip time, and the existing of any other public transport modes operating on the same route. Tables 5.3 and 5.4 show the calculated demand-based number of shared-taxis and buses following the mathematical procedure presented in Section 4.3.2 in Chapter 4.

To test the validation of the models, the external shared-taxi routes data in Tulkarm Governorate was collected, and the demand-based number of shared-taxis were also calculated. Table 5.5 presents such data for Tulkarm Governorate.

Table 5.3: Input Database Variables Used in the Mathematical Procedure for Calculating Number of Shared-Taxis

No.	Route	Spaces per Vehicle (Cv)	Load Factor (α)	P (pass/hr) (measured)	Headway, hw (min)	Service Frequency, f (shared-taxis/hr)	Distance, d (km)	Average Speed, v (km/hr)	Traval time, $t_t = d/v$, (min)	Terminal time, t_r (min)	Total trip time, $T_t = t_t + t_r$ (min)	Calculated Shared-Taxis
1	Nablus-Qusin-Sarra	7	1	35	12	5	9	50	10.8	3	27.60	2
2	Nablus-Salim	7	1	40	11	6	6.7	50	8.0	3	22.08	2
3	Nablus-Bezariya-Burqa	7	1	63	7	9	15.8	50	19.0	3	43.92	6
4	Nablus-Yasid	7	1	35	12	5	23.5	50	28.2	3	62.40	5
5	Nablus-Beit Imrin	7	1	21	20	3	16.5	50	19.8	3	45.60	2
6	Nablus-Nisf Igbel	7	1	10	42	1	15	50	18.0	3	42.00	1
7	Nablus-Sabestiya	7	1	56	8	8	13.5	50	16.2	3	38.40	5
8	Nablus-Ijnesinya	7	1	10	42	1	15.3	50	18.4	3	42.72	1
9	Nablus-Badan-Talluza	7	1	21	20	3	14.9	50	17.9	3	41.76	2
10	Nablus-Dier Sharaf	7	1	52	8	7	8	50	9.6	3	25.20	3
11	Nablus-Asira shamalya	7	1	210	2	30	6	50	7.2	3	20.40	10
12	Nablus-Biet Iba	7	1	60	7	9	6.9	50	8.3	3	22.56	3
13	Nablus-Beit Wazan	7	1	45	9	6	5.9	50	7.1	3	20.16	2
14	Nablus-Til	7	1	110	4	16	9.1	50	10.9	3	27.84	7
15	Nablus-Beit Dajan	7	1	75	6	11	11	50	13.2	3	32.40	5
16	Nablus-Kufr Qalil	7	1	70	6	10	5	50	6.0	3	18.00	3
17	Nablus-Froush Beit Dajan	7	1	30	14	4	13	50	15.6	3	37.20	2
18	Nablus-Madama	7	1	90	5	13	12	50	14.4	3	34.80	7
19	Nablus-Beit Fourik	7	1	220	2	31	9.4	50	11.3	3	28.56	14
20	Nablus- Burin-Asira qiblya	7	1	114	4	16	13.5	50	16.2	3	38.40	10
21	Nablus-Awarta	7	1	46	9	7	9.6	50	11.5	3	29.04	3
22	Nablus-Hiwwara	7	1	35	12	5	9	50	10.8	3	27.60	2
23	Nablus-Einabous-Urif	7	1	33	13	5	14.4	50	17.3	3	40.56	3
24	Nablus-Beita	7	1	25	17	4	14	50	16.8	3	39.60	2
25	Nablus-Zeita-Jammain	7	1	63	7	9	17.9	50	21.5	3	48.96	7
26	Nablus-Aqraba	7	1	33	13	5	20.6	50	24.7	3	55.44	4
27	Nablus-Yutma	7	1	22	19	3	15.7	50	18.8	3	43.68	2
28	Nablus-Qabaln	7	1	75	6	11	18.6	50	22.3	3	50.64	9
29	Nablus-Qusra	7	1	15	28	2	24.5	50	29.4	3	64.80	2
30	Nablus-Qaryout-Jaloud-Telfit	7	1	21	20	3	24.3	50	29.2	3	64.32	3
31	Nablus-Al-Sawya	7	1	12	35	2	17.4	50	20.9	3	47.76	1
32	Nablus-Lubban-Ammorya	7	1	16	26	2	21.4	50	25.7	3	57.36	2
33	Nablus-Azmout-DeirHatab	7	1	60	7	9	9.2	50	11.0	3	28.08	4

Table 5.4: Input Database Variables Used in the Mathematical Procedure for Calculating Number of Buses

No.	Route	Spaces per Vehicle (Cv)	Load Factor (α)	P (pass/hr) (measured)	Headway, hw (min)	Service Frequency, f (Buses/hr)	Distance, d (km)	Average Speed, v (km/hr)	Traval time, $t_t = d/v$, (min)	Terminal time, t_r (min)	Total trip time, $T_t = t_t + t_r$ (min)	Calculated Buses
1	Nablus-Qusin-Sarra	55	0.5	83	20	3	9	30	18.0	6	48.00	2
2	Nablus-Salim	55	0.5	88	19	3	6.7	30	13.4	6	38.80	2
3	Nablus-Bezariya-Burqa	55	0.5	70	24	2	15.8	30	31.6	6	75.20	3
4	Nablus-Yasid	55	0.5	35	47	1	23.5	30	47.0	6	106.00	2
5	Nablus-Beit Imrin	55	0.5	60	28	2	16.5	30	33.0	6	78.00	2
6	Nablus-Nisf Igbel	55	0.5	28	59	1	15	30	30.0	6	72.00	1
7	Nablus-Sabestiya	55	0.5	56	29	2	13.5	30	27.0	6	66.00	2
8	Nablus-Ijnesinya	55	0.5	10	165	1	15.3	30	30.6	6	73.20	1
9	Nablus-Badan-Talluza	55	0.5	55	30	2	14.9	30	29.8	6	71.60	2
10	Nablus-Dier Sharaf	55	0.5	28	59	3	8	30	16.0	6	44.00	2
11	Nablus-Asira shamalya	55	0.5	55	30	3	6	30	12.0	6	36.00	2
12	Nablus-Biet Iba	55	0.5	83	20	3	6.9	30	13.8	6	39.60	2
13	Nablus-Beit Wazan	55	0.5	83	20	3	5.9	30	11.8	6	35.60	2
14	Nablus-Til	55	0.5	83	20	3	9.1	30	18.2	6	48.40	2
15	Nablus-Beit Dajan	55	0.5	80	21	2	11	30	22.0	6	56.00	2
16	Nablus-Kufr Qalil	55	0.5	80	21	8	5	30	10.0	6	32.00	4
17	Nablus-Froush Beit Dajan	55	0.5	55	30	1	13	30	26.0	6	64.00	1
18	Nablus-Madama	55	0.5	220	8	2	12	30	24.0	6	60.00	2
19	Nablus-Beit Fourik	55	0.5	30	55	2	9.4	30	18.8	6	49.60	2
20	Nablus- Burin-Asira qiblya	55	0.5	50	33	2	13.5	30	27.0	6	66.00	2
21	Nablus-Awarta	55	0.5	52	32	2	9.6	30	19.2	6	50.40	2
22	Nablus-Hiwwara	55	0.5	55	30	3	9	30	18.0	6	48.00	2
23	Nablus-Einabous-Urif	55	0.5	55	30	2	14.4	30	28.8	6	69.60	2
24	Nablus-Beita	55	0.5	83	20	2	14	30	28.0	6	68.00	2
25	Nablus-Zeita-Jammain	55	0.5	55	30	1	17.9	30	35.8	6	83.60	2
26	Nablus-Aqraba	55	0.5	45	37	1	20.6	30	41.2	6	94.40	2
27	Nablus-Yutma	55	0.5	50	33	1	15.7	30	31.4	6	74.80	1
28	Nablus-Qabaln	55	0.5	35	47	1	18.6	30	37.2	6	86.40	1
29	Nablus-Qusra	55	0.5	33	50	1	24.5	30	49.0	6	110.00	1
30	Nablus-Qaryout-Jaloud-Telfit	55	0.5	38	43	1	24.3	30	48.6	6	109.20	1
31	Nablus-Al-Sawya	55	0.5	32	52	1	17.4	30	34.8	6	81.60	1
32	Nablus-Lubban-Ammorya	55	0.5	28	59	1	21.4	30	42.8	6	97.60	1
33	Nablus-Azmout-DeirHatab	55	0.5	30	55	3	9.2	30	18.4	6	48.80	2

Table 5.5: Calculated External Licensed Routes and the Related Data in Tulkarm Governorate

No.	Route	Population	Employment	Income (NIS)	Private Cars	Distance to Tulkarm (km)	No. of Services Establishments	Trade & Services Establishments	Calculated Buses	Calculated Shared-Taxis	Shared-Taxi Fare (NIS)
1	Tulkarm-Kufr Al Labad	3254	754	1696	39	9	14	50	0	4	2
2	Tulkarm-Anabta	5898	1522	1499	185	9.5	50	156	0	5	2
3	Tulkarm-Zeita	2535	633	1339	84	9	21	69	0	3	2.5
4	Tulkarm-Qiffin	7056	1562	1620	181	18	39	166	1	2	4.5
5	Tulkarm-Nazleh Sharqyya	2045	477	1698	65	15	22	42	2	2	3.5
6	Tulkarm-Bal'a	5888	1293	1650	126	9	42	143	1	4	2.5
7	Tulkarm-Der Gosoun	7631	1800	1547	252	7	48	164	1	4	2
8	Tulkarm-Attil	8393	1950	1628	301	10	65	235	1	3	2.5
9	Tulkarm-Kafryyat	5740	1370	1625	192	17	55	135	0	3	4
10	Tulkarm-Feroun	2574	639	1439	65	4	21	59	0	3	1.5

Source: MOT, PCBS, and Field Survey

The previously mentioned data was collected considering 1999 as a base year. Regarding buses for Tulkarm Governorate, there are only 3 bus routes, which connect Tulkarm City with the surrounding communities.

5.3 Components of the Fare Equation

In order to calculate the public transport fare either for shared-taxis or buses, it is essential to know the costs of a set of elements in the fare structure as suggested by the MOT. The fare structure composed of two parts: the operational costs include depreciation, insurance, fuel, maintenance, income tax, value added tax, drivers wages, overheads expenses, parking, garage, and finally different registration expenses.

The second part consists of the characteristics of the route, which include length, average speed, and trip time. The fare value then can be calculated from both parts as previously mentioned in Chapter 4.

5.4 Number of Shared-Taxi Permits

The number of permits granted by the MOT in the West Bank Governorates is presented in Table 5.6 These data are gathered from the MOT. The year corresponding to these permits is end of 2004 (December 2004). The population corresponding to each governorate is also included. Finally, the number of population corresponding to each one of shared-taxi mode is also included in the Table.

5.5 Bus Companies Operating in the Study Area

There are twelve bus companies, which serve the 33 routes in the study area. Table 5.7 presents these companies and the corresponding villages/towns served from that route.

Table 5.6: Number of Shared-Taxi Permits, Population, and the Number of Population Corresponding to One Shared-Taxi Mode (Dec. 2004)

Governorate	No. of Permits	Population	Inhabitants Per Permit
Jenin	557	246,685	443
Tubas	32	45,168	1412
Tukarm	428	162,936	381
Qalqiliya	93	90,960	978
Salfit	23	60,132	2614
Nablus	**991**	**317,331**	**320**
Ramallah	1158	270,678	234
Jericho	76	40,909	538
Bethlehem	474	169,190	357
Hebron	951	506,641	533
Total	**4783**	**1,910,630**	**Average (399)**

Source: MOT, 2005

Table 5.7: Operating Bus Companies and the Corresponding Served Localities in the Study area

No.	Bus Company	Served Localities
1	Nimer Al-Tamimi	Till, Kufr Qallil, Huwwara, Jama'in, Quseen, Sarra
2	Abdel Al-Raheem Al-Tamimi	Beita, Al-Sawya, Al-Lubban Al-Sharqeya
3	Al-Hilal	Der Al-Hatab, Azmout, Salim, Beit Fourik
4	Shalou (Al-Waleed)	Wad Al-Badan, Al-Fare'a, Talluza, Asira Al-Shamalyya
5	Jama'in	Jama'in, Zeita
6	Beita	Beita
7	'Urif	'Urif, Einabous
8	Aqraba	Awarta, Aqraba, Yanoun
9	Al-Mashareeq	Asira Al-Qebliya, Madama, Qabalan, Aqraba, Majdal Bani Fadel, Doma, Qusra, Jureesh, Qariut, Usareen, Tilfeet, Jalud
10	Yasid	Nisf Jubel, Yasid
11	Burqa	Burqa, Bezzarya
12	Al-Nahda	Yasid, Beit Imrin, Nisf Jubel, Ijnesenya, Sabastya

Source: MOT, 2005

CHAPTER SIX

POLICY VARIABLES ANALYSIS

Chapter Six

POLICY VARIABLES ANALYSIS

6.1 Fleet Vehicle Model (Number of Shared-Taxis)

One of the important advantages of the mathematical models is that during their formulation, calibration, and use, the planner can learn much, through experimentation, about the behavior and internal relations within the system under scrutiny.

This section assesses the method used in determining the needed number of shared-taxis compared with demand-based methods. Moreover, it examines whether the number of shared-taxis can be successfully modeled, and then predicted. The proper mathematical regression modeling technique is identified and used to predict the number of shared-taxis based on data which was collected from different sources (MOT, PCBS, and field survey). The single equation linear model is used. The LimDep version 7.0 software is used to run the statistical analysis. The estimation of the model, validation, and forecasting is discussed in this section.

The first part of this section deals with the calculation of the number of demand-based shared-taxis, then comparing the results with the MOT formula results through drawing the relation between the number of demand-based and MOT shared-taxis. Finally the predicting of the number of shared-taxis based on demand and through regression analysis by applying single equation linear model using the LimDep version 7.0 software.

The second part of this section will check and examine the validity of the model through examining the number of shared-taxis on different routes in neighboring governorates (e.g., Tulkarm). Then forecasting of the number of shared-taxis based on the expected values of the independent variables in the future (e.g., 2010) is also presented.

6.1.1 Number of Demand-Based Shared-Taxis

The MOT formula in determining the number of shared-taxis for a certain route depends completely on the population as the only variable. The MOT specified that one shared-taxis is required for each 500 inhabitants. However, the existing number of shared-taxis operating on reality is different from the formula number. Table 6.1 presents the existing and the calculated (based on MOT formula) number of shared-taxis for Nablus Governorate for 1999.

To examine such relation between the existing and calculated number of shared-taxis, Figure 6.1 illustrates a plot of the latter with respect to the former. It shows that the relation is weak, as the coefficient of determination indicates that only about 37% of the data is explained. This implies that neither of the MOT formula nor the existing number of shared-taxis presents the real need of that mode. From this point, it is necessary to find an alternative procedure for estimating the number of shared-taxis

Table 6.1: A Comparison Between the Existing and Calculated* No. of Shared-Taxis for Nablus Governorate (1999)

No.	Route	Existing No. of Shared-Taxis	No. of Shared-Taxis (MOT Formula)
1	Nablus-Qusin-Sarra	3	7
2	Nablus-Salim	2	8
3	Nablus-Bezariya-Burqa	14	10

No.	Route	Existing No. of Shared-Taxis	No. of Shared-Taxis (MOT Formula)
4	Nablus-Yasid	4	4
5	Nablus-Beit Imrin	6	5
6	Nablus-Nisf Igbel	1	1
7	Nablus-Sabestiya	5	5
8	Nablus-Ijnesinya	1	1
9	Nablus-Badan-Talluza	4	8
10	Nablus-Dier Sharaf	8	4
11	Nablus-Asira shamalya	20	13
12	Nablus-Biet Iba	4	5
13	Nablus-Beit Wazan	2	2
14	Nablus-Til	10	8
15	Nablus-Beit Dajan	5	6
16	Nablus-Kufr Qalil	4	4
17	Nablus-Froush Beit Dajan	5	2
18	Nablus-Madama	3	3
19	Nablus-Beit Fourik	20	8
20	Nablus- Burin-Asira qiblya	7	8
21	Nablus-Awarta	9	9
22	Nablus-Hiwwara	4	9
23	Nablus-Einabous-Urif	6	8
24	Nablus-Beita	9	14
25	Nablus-Zeita-Jammain	9	12
26	Nablus-Aqraba	5	13
27	Nablus-Yutma	3	5
28	Nablus-Qabaln	12	12
29	Nablus-Qusra	2	7
30	Nablus-Qaryout-Jaloud-Telfit	10	10
31	Nablus-Al-Sawya	5	4
32	Nablus-Lubban-Ammorya	4	4
33	Nablus-Azmout-DeirHatab	10	8
Total		**216**	**227**

* Based on the MOT Formula

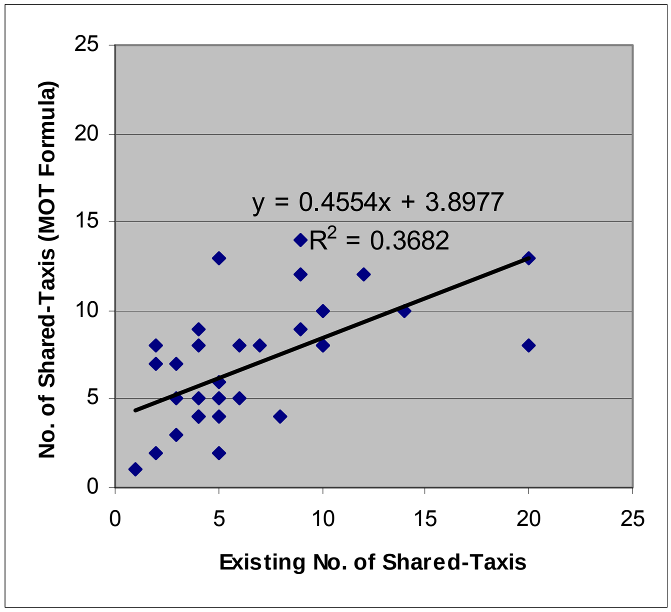

Figure 6.1: The Relation between Existing and Calculated (Based on MOT Formula) Number of Shared-Taxi in Nablus Governorate (1999)

needed. Based on the international standards, the number of transit units including shared-taxis are calculated based on real demand (number of passengers per hour). This is achieved through conducting field surveys studies, which may take one month as an example to determine the real need for such route. After the demand is determined and the number of fleet vehicle is measured, then the route's future need may be evaluated semiannually or annually.

The step by step procedure is presented in Section 4.3.2 of the methodology in order to calculate the fleet vehicle (no. of transit units either shared-taxis or buses) based on demand.

6.1.2 Statistical Analysis of Shared-Taxis Using Single-Equation Model

The statistical analysis was applied on a data of 33 observations gathered and collected for the external routes approved by the MOT, which link Nablus City with the surrounding villages and towns within Nablus

Governorate. The data includes population (POP), employment (EMP), number of private cars (CAR), distance in km (DIS), trade and services establishments (TRD and SRV), average monthly household income in NIS (INC), shared-taxi fares in NIS, calculated number of shared-taxis, calculated number of buses, and finally the calculated service frequency for both shared-taxis and buses. Table 6.2 shows the routes and the related data including the above mentioned variables. The average household income is calculated based on the average number of persons in the household in each locality, then multiplying this figure by 270 NIS, which represents the average monthly income per one person, *(World Bank, 2000*). The service frequency is calculated based on generally observed average speeds of 50 and 30 km/hr for shared-taxis and buses, respectively. The total trip time is composed of two components: distance/speed and terminal time, measured as 3.0 and 6.0 minutes for shared-taxis and buses, respectively.

The statistical analysis is performed using the LimDep version 7.0 software. LimDep is an econometric software developed by William H. Greene, the author of Economic Analysis *(UCLA Academic Technology Services, 1998)*. This software provides parameter estimation for linear and nonlinear regression models and qualitative and limited dependent models for a cross section, time series, and panel data. The name LimDep is derived from Limited Dependent models. The user's manual of LimDep provides a good overview for the user of the various modeling techniques. The package provides the linear regression model computations including least squares coefficient vector (b), estimates of standard errors of regression coefficient estimates, R-squared for the regression, analysis of variance for the regression, and F-statistic for the joint test that all slopes are zero.

Table 6.2: Input Database for the 33 Observations in the Study Area

No.	Route	Communities Served	Calculated Shared-Taxis	Population	Private Cars	Distance to Nablus (km)	No. of Services Establishments	No. of Trade & services Establishments	Employment	Calculated Buses	Shared-Taxi Fare (NIS)	Average Household monthly Income (NIS)	Shared-Taxi Service Frequency (Taxi/Hour)	Bus Service Frequency (Bus/Hour)
1	Nablus-Qusin-Sarra	Sarra, Qusin	2	3739	134	9	37	94	772	2	4	1834	5	3
2	Nablus-Salim	Salim	2	4109	85	6.7	12	50	851	2	2.5	1981	5	3
3	Nablus-Bezariya-Burqa	Bezariya, Burqa	6	4992	94	15.8	43	136	1090	3	4	1457	8	2
4	Nablus-Yasid	Yasid	5	1852	31	23.5	15	38	398	2	5	1634	5	1
5	Nablus-Beit Imrin	Beit Imrin	2	2324	80	16.5	18	61	163	2	4	1737	3	2
6	Nablus-Nisf Igbel	Nisf Igbel	1	409	10	15	4	9	521	1	4	1396	1	1
7	Nablus-Sabestiya	Sabastiya	5	2344	77	13.5	30	89	546	2	2.5	1468	8	2
8	Nablus-Ijnesinya	Ijnesinya	1	452	10	15.3	6	10	107	1	3	1449	1	1
9	Nablus-Badan-Talluza	Badan,Talluza	2	4123	151	14.9	46	119	896	2	4	1690	3	2
10	Nablus-Dier Sharaf	Dier Sharaf	3	2229	72	8	21	50	494	2	2.5	1598	2	3
11	Nablus-Asira shamalya	Asira shamalya	10	6267	163	6	70	204	1431	2	4	1432	30	3
12	Nablus-Biet Iba	Biet Iba	3	2641	113	6.9	12	56	604	2	2	1537	3	3
13	Nablus-Beit Wazan	Beit Wazan	2	905	52	5.9	13	20	206	2	2	1598	2	3
14	Nablus-Til	Til	7	3814	106	9.1	36	123	766	2	2.5	1681	15	3
15	Nablus-Beit Dajan	Beit Dajan	5	2901	50	11	21	56	621	2	4	1992	10	2
16	Nablus-Kufr Qalil	Kufr Qalil	3	2014	60	5	10	29	403	4	2	1748	4	8
17	Nablus-Froush Beit Dajan	Froush Beit Dajan	2	937	11	13	2	4	206	1	5.5	1831	2	1
18	Nablus-Madama	Madama	7	1340	32	12	15	32	281	2	2.5	1568	12	2
19	Nablus-Beit Fourik	Beit Fourik	14	4064	130	9.4	55	248	1745	2	2.5	1659	30	2

No.	Route	Communities Served	Calculated Shared-Taxis	Population	Private Cars	Distance to Nablus (km)	No. of Services Establishments	No. of Trade & services Establishments	Employment	Calculated Buses	Shared-Taxi Fare (NIS)	Average Household monthly Income (NIS)	Shared-Taxi Service Frequency (Taxi/Hour)	Bus Service Frequency (Bus/Hour)
20	Nablus- Burin-Asira qiblya	Burin, Asira qiblya	10	3919	66	13.5	34	88	828	2	4	1560	15	2
21	Nablus-Awarta	Awarta	3	4688	113	9.6	24	91	950	2	2.5	1670	6	2
22	Nablus-Hiwwara	Hiwwara	2	4680	214	9	47	223	983	2	2.5	1615	5	3
23	Nablus-Einabous-Urif	Einabous, Urif	3	4087	147	14.4	39	118	807	2	4	1764	4	2
24	Nablus-Beita	Beita	2	7090	154	14	45	224	1409	2	4	1604	3	2
25	Nablus-Zeita-Jammain	Zeita, Jammain	7	6248	150	17.9	45	183	1342	2	4	1861	8	1
26	Nablus-Aqraba	Aqraba, Yanoun	4	6407	135	20.6	37	171	1184	2	5	1654	4	1
27	Nablus-Yutma	Yutma	2	2410	44	15.7	16	49	494	1	2.5	1795	3	1
28	Nablus-Qabaln	Qabaln	9	5859	103	18.6	43	192	1111	1	4	1640	10	1
29	Nablus-Qusra	Qusra Jureesh	2	3589	110	24.5	24	95	627	1	7	1956	2	1
30	Nablus-Qaryout-Jaloud-Telfit	Qaryout, Jaloud, Telfit	3	4770	109	24.3	36	108	995	1	5	1814	2	1
31	Nablus-Al-Sawya	Al-Sawya	1	1860	48	17.4	12	30	394	1	4	1770	1	1
32	Nablus-Lubban-Ammorya	Lubban, Ammorya	2	2018	30	21.4	15	53	463	1	4.5	1759	2	1
33	Nablus-Azmout-DeirHatab	Azmout, Deir Al-Hatab	4	4025	101	9.2	30	62	846	2	2.5	1986	8	3

Source: MOT, PCBS, and Field Survey

6.1.2.1 Model Estimation Results

Various trials had been run to examine the most appropriate variables that could be used to express the number of shared-taxis per route. The dependent variable is always considered based on the demand-based calculated number of shared-taxis operating on the routes, which had been given permits from the MOT.

After numerous trials and tests to examine the appropriateness to include the independent variables, the most appropriate variables associated with the number of shared-taxi model were found to be private cars, distance, services establishments, and employment. Table 6.3 shows the results of applying a model using LimDep software. Appendix E shows the statistical analysis trials output applied on the input data variables using the software.

By referring to the results in Table 6.3, the correlation between the dependent variable (number of shared-taxis) and each of independent variables was examined. The final model is:

$$\text{Number of shared-taxis} = 3.414 - 0.0613*CAR - 0.1221*DIS + 0.1975*SRV + 0.00328*EMP \quad (1)$$

Table 6.3: Main Findings of Single-Equation Model (Shared-Taxis)

Variable	Coefficient	t-ratio	P (T>t)
Constant	+3.414	+2.921	0.0068
CAR	-0.0613	-5.014	0.0000
DIS	-0.1221	-1.952	0.0610
SRV	+0.1975	+4.128	0.0003
EMP	+0.00328	+1.976	0.0581

N = 33 $R^2 = 0.672$ $F_{sta} = 14.33$

The adjusted R^2 is 0.625, indicating that the model explains about 63 percent of the variance from the mean. The F-statistic is 14.33, which means a good correlation between the dependent and independent variables in the 33 observations. The confidence level in this model is 94 percent or better.

The coefficient of private cars is -0.0613, indicating that an increase of 100 in private cars is associated with decrease of about 6 in number of shared-taxis in the observed villages and towns surrounding Nablus City. The coefficient of distance is -0.1221, indicating that an increase of distance by 10.0 km is associated with a decrease of about 1 shared-taxi linking the villages/towns with Nablus. The coefficient of services establishments is +0.1975, indicating that an increase of services by 10 is associated with an increase of about 2 in number of shared-taxis. And finally the coefficient of employment is +0.00328, indicating that an increase of 1000 in employees is associated with an increase of 3 in number of shared-taxis. The t-statistic values for all variables are more than or equal 2, which is very good.

The sign of the coefficients of the above independent variables seems to be logical. The private cars has a negative sign indicating that the increase of private cars will result in decrease of using public transport shared-taxis in travel. Distance variable has a negative sign, which could mean that as the distance between the village/town increases, the possibility to travel to the City decreases which is rational. The services establishments variable has a positive sign indicating that the increase in the number of services will increase the cooperation between the village/town and the city and as a result increasing the number of trips. Finally, the employment has a positive sign indicating that the increase in employment could result in increase on travel demand and consequently increase in the number of shared-taxis.

6.1.2.2 Elasticities

Based on the single equation model estimation results, elasticities are calculated with regard to the predicted number of shared-taxis. All exogenous variables are tested in this regard; private cars, distance, services, and employment. To compute elasticity, the reduced form for the shared-taxi is first identified, then for the j^{th} coefficient, elasticity E_j is calculated based on the expression *(Abu-Eisheh and Mannering, 2002)*:

$$E_{j_j} = \frac{\partial Shared-Taxi}{\partial Zj} * \frac{\overline{Zj}}{\overline{\overline{Shared-Taxi}}} \qquad (2)$$

Where Z_j is the exogenous variable for which the elasticity is to be calculated (i.e., employment, distance,…). Table 6.4 summarizes the elasticities values for all variables of shared-taxi based on the average values for the independent variables. Private car elasticity can also be calculated in the following manner:

$$E_{car} = -0.0613 * \frac{90}{4} = -1.37$$

Since the absolute value of E_{car} is greater than one, then private car is elastic. The value -1.37 indicates that, with everything else held constant, a 1% increase in private cars results in a 1.37% decrease in number of shared-taxis. The elasticity value of the private car variable indicates that this variable is critical and important in determining using the shared-taxi mode in the travel. For distance, elasticity was calculated as

$$E_{dis} = \frac{\partial Shared - Taxi}{\partial dis} * \frac{\overline{dis}}{\overline{\overline{Shared - Taxi}}}$$

As the first item represents the coefficient value (from Table 6.2) = -0.1221, average distance and average shared-taxi equal 14 and 4, respectively (from Table 6.3), then;

$$E_{dis} = -0.1221 * \frac{14}{4} = -0.43$$

The elasticity of distance variable is (inelastic) since the absolute value of E is less than one. The value -0.43 indicates that, with everything else held constant, a 1% increase in distance results in a 0.43% decrease in the number of shared-taxi. Following the same procedure, the elasticity values can be computed and the results are presented in Table 6.4.

Table 6.4: Elasticity Values for Shared-Taxi

Variable	Average Value	Elasticity Value
Shared-Taxi	4	
CAR	90	-1.37 (elastic)
DIS	14	-0.43 (inelastic)
SRV	28	+1.40 (elastic)
EMP	743	+0.61 (inelastic)

The distance and employment variables are inelastic. For instance, a 1 % reduction in distance will result in only 0.43% increase in number of shared-taxis, i.e., the distance variable is not sensitive. For employment variable, a 1% increase in employment will result in only 0.61% increase in number of shared-taxis, i.e., the employment variable is not sensitive.

The private car and services establishments variables are elastic. For instance, a 1 % reduction in private cars will result in 1.37% increase in number of shared-taxis, i.e., the private car variable is sensitive. For services establishments variable, a 1% increase in services will result in 1.40% increase in number of shared-taxis, i.e., the services establishments variable is sensitive.

6.1.3 Model Validation and Application

6.1.3.1 Introduction

After the model is specified, it may then be applied to produce predictions of the number of shared-taxis. However, the model must be validated before it can be applied for forecasting purposes. Validating a model essentially means comparing its predictions with observations, and determining to what extent the two agree. It is important to note that validation must be performed on another set of observations than that, which was used to calibrate the model.

Indeed, successful calibration means, by definition, that the model reproduces well the observed values used in the calibration *(Oppenheim, 1995).*

Once the model is validated, it may then be used for the purpose of forecasting, or predicting shared-taxi demand under future conditions.

6.1.3.2 Validation of the Model

The validity of the model is checked through applying the mathematical equation resulted from statistical analysis on a data set gathered and collected for external routes in Tulkarm Governorate.

Table 6.5 and Figure 6.2 represent the relation and correlation between the calculated shared-taxis and the predicted shared-taxis after applying the model for Tulkarm Governorate.

Table 6.5: Testing the Validity of the Model in Tulkarm Governorate (Number of Shared-Taxis, 1999)

No.	Route	Private Cars	Distance to Tulkarm (km)	No. of Services Establishments	Employment	Predicted Number of Shared-Taxis	Calculated Number of Shared-Taxis
1	Tulkarm-Kufr Al Labad	39	9	14	754	5	4
2	Tulkarm-Anabta	185	9.5	50	1522	6	5
3	Tulkarm-Zeita	84	9	21	633	3	3
4	Tulkarm-Qiffin	181	18	39	1562	3	2
5	Tulkarm-Nazleh Sharqyya	65	15	22	477	4	2
6	Tulkarm-Bal'a	126	9	42	1293	7	4
7	Tulkarm-Der Gosoun	252	7	48	1800	2	4
8	Tulkarm-Attil	301	10	65	1950	3	3
9	Tulkarm-Kafryyat	192	17	55	1370	5	3
10	Tulkarm-Feroun	65	4	21	639	5	3

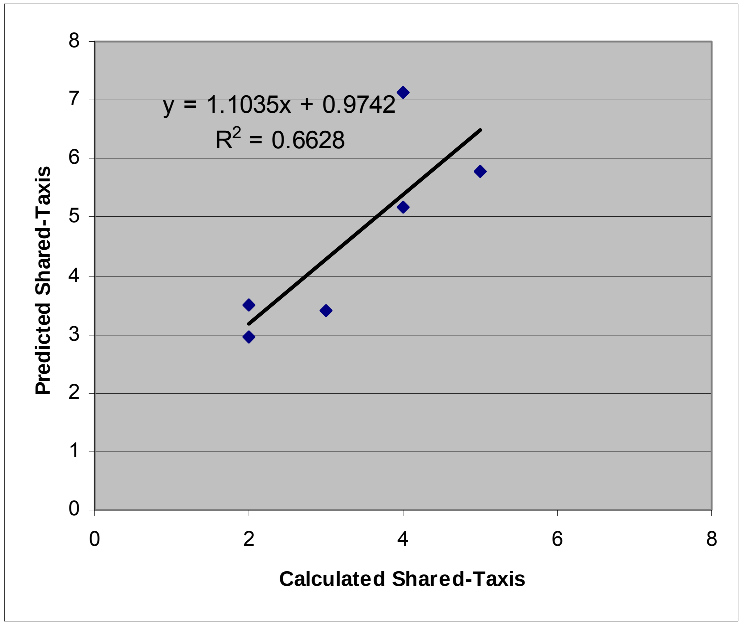

Figure 6.2: Calculated and Predicted Number of Shared-Taxi Relation in Tulkarm Governorate

From Figure 6.2, it is clear that the coefficient of determination (R2) has a relatively good value of 0.662.

6.1.3.3 Testing the Correlation Between the Model and the MOT Formula

The validity of the model is checked through applying the mathematical equation resulted from statistical analysis on a data set gathered and collected for external routes in Nablus, and Tulkarm Governorates.

Tables 6.6 and 6.7, and Figures 6.3 and 6.4, represent the relation and correlation between the number of shared-taxis based on MOT formula (one shared-taxi for each 500 inhabitants), and the predicted Shared-taxis after applying the model. From Figures 6.3 and 6.4, it is clear that the relation between the number of shared-taxis based on demand and the number of shared-taxis based on the MOT formula is somewhat weak,

Table 6.6: Testing the Validity of the Model in Nablus Governorate (Number of Shared-Taxis, 1999)-Compared with the MOT Formula

No.	Route	Private Cars	Distance to Nablus (km)	No. of Services Establishments	Employment	Predicted No. of Shared-Taxis	No. of Shared-Taxis (MOT)
1	Nablus-Qusin-Sarra	134	9	37	772	4	7
2	Nablus-Salim	85	6.7	12	851	3	8
3	Nablus-Bezariya-Burqa	94	15.8	43	1090	8	10
4	Nablus-Yasid	31	23.5	15	398	3	4
5	Nablus-Beit Imrin	80	16.5	18	163	1	5
6	Nablus-Nisf Igbel	10	15	4	521	3	1
7	Nablus-Sabestiya	77	13.5	30	546	5	5
8	Nablus-Ijnesinya	10	15.3	6	107	2	1
9	Nablus-Badan-Talluza	151	14.9	46	896	4	8
10	Nablus-Dier Sharaf	72	8	21	494	4	4
11	Nablus-Asira shamalya	163	6	70	1431	11	13
12	Nablus-Biet Iba*	113	6.9	12	604	0*	5
13	Nablus-Beit Wazan	52	5.9	13	206	3	2
14	Nablus-Til	106	9.1	36	766	5	8
15	Nablus-Beit Dajan	50	11	21	621	5	6
16	Nablus-Kufr Qalil	60	5	10	403	2	4

No.	Route	Private Cars	Distance to Nablus (km)	No. of Services Establishments	Employment	Predicted No. of Shared-Taxis	No. of Shared-Taxis (MOT)
17	Nablus-Froush Beit Dajan	11	13	2	206	2	2
18	Nablus-Madama	32	12	15	281	4	3
19	Nablus-Beit Fourik	130	9.4	55	1745	11	8
20	Nablus- Burin-Asira qiblya	66	13.5	34	828	7	8
21	Nablus-Awarta	113	9.6	24	950	3	9
22	Nablus-Hiwwara	214	9	47	983	2	9
23	Nablus-Einabous-Urif	147	14.4	39	807	3	8
24	Nablus-Beita	154	14	45	1409	6	14
25	Nablus-Zeita-Jammain	150	17.9	45	1342	5	12
26	Nablus-Aqraba	135	20.6	37	1184	4	13
27	Nablus-Yutma	44	15.7	16	494	4	5
28	Nablus-Qabaln	103	18.6	43	1111	7	12
29	Nablus-Qusra*	110	24.5	24	627	0*	7
30	Nablus-Qaryout-Jaloud-Telfit	109	24.3	36	995	4	10
31	Nablus-Al-Sawya	48	17.4	12	394	2	4
32	Nablus-Lubban-Ammorya	30	21.4	15	463	3	4
33	Nablus-Azmout-DeirHatab	101	9.2	30	846	5	8

* The predicted value (0) is resulted from the equation, the minimum value must be (1)

Table 6.7: Testing the Validity of the Model in Tulkarm Governorate (Number of Shared-Taxis)-Compared with the MOT Formula

No.	Route	Private Cars	Distance to Tulkarm (km)	No. of Services Establishments	Employment	Predicted Number of Shared-Taxis	Number of Shared-Taxis (MOT)
1	Tulkarm-Kufr Al Labad	39	9	14	754	5	7
2	Tulkarm-Anabta	185	9.5	50	1522	6	12
3	Tulkarm-Zeita	84	9	21	633	3	5
4	Tulkarm-Qiffin	181	18	39	1562	3	14
5	Tulkarm-Nazleh Sharqyya	65	15	22	477	4	4
6	Tulkarm-Bal'a	126	9	42	1293	7	12
7	Tulkarm-Der Gosoun	252	7	48	1800	2	15
8	Tulkarm-Attil	301	10	65	1950	3	17
9	Tulkarm-Kafryyat	192	17	55	1370	5	11
10	Tulkarm-Feroun	65	4	21	639	5	5

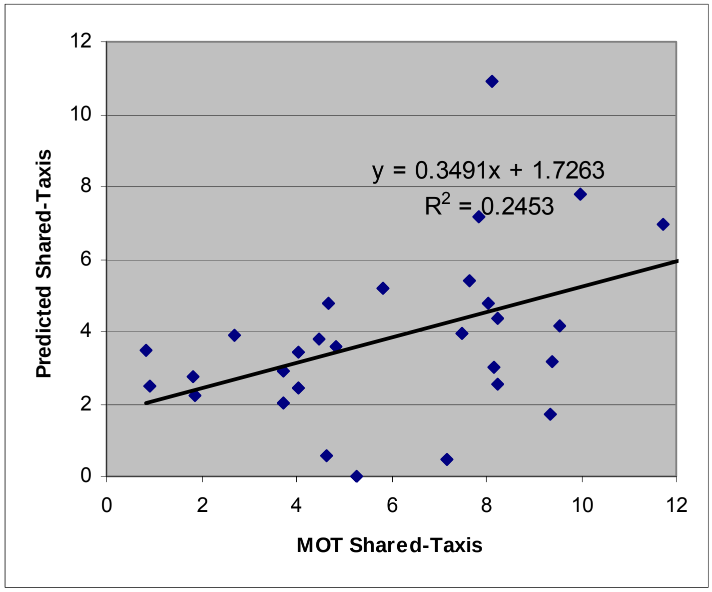

Figure 6.3: MOT and Predicted Number of Shared-Taxi Relation in Nablus Governorate

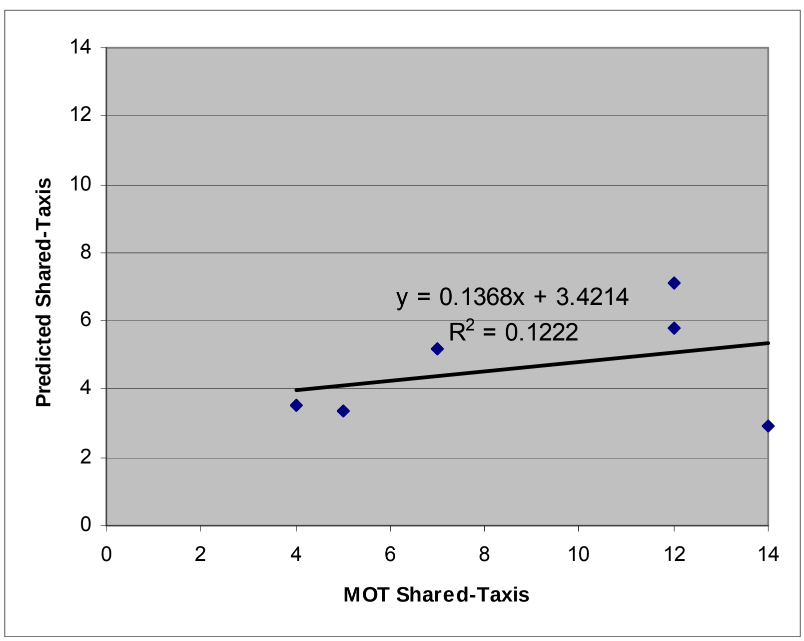

Figure 6.4: MOT and Predicted Number of Shared-Taxi Relation in Tulkarm Governorate

which means that the MOT formula needs to be reviewed and modified since it depends mainly on the population variable. It is not reasonable to accept one-variable equation, and as a result, the other socioeconomic variables should be taken into consideration. The coefficient of determination R2 is 0.245 and 0.122, for Nablus and Tulkarm Governorates, respectively.

This weak relation may be explained through the dependency of the MOT formula on one variable only (population), which represents 1/4 of the number model variables (assuming that the employment variable expresses population variable indirectly). As a result, the model can be used as a policy decision-making tool by the MOT in order to check its formula and to take into account the other socioeconomic and other related variables like the distance variable.

6.1.3.4 Model Forecasting (Testing Accuracy)

Forecasting is the heart of the planning process since it provides the planner with a considerable information that could help in predicting the future conditions. Predicting and forecasting the number of shared-taxis uses the projected private cars, distance, services establishment, and employment in the target year for the external routes, which link the surrounding villages/towns with Nablus City or any other city. The model will then project the future need of shared-taxis and in the target year (i.e., 2010).

Table 6.8 presents the results of forecasting the number of shared-taxis, in the year 2010. The results of the model are rationale, logical, and acceptable. This forecasted number of shared-taxis can be used as a policy

Table 6.8: Forecasting the Number of Shared-Taxis Using the Model (2010)

No.	Route	Private Cars	Distance to Nablus (km)	No. of Services Establishments	Employment	Predicted No. of Shared-Taxis
1	Nablus-Qusin-Sarra	157	9	49	1127	6
2	Nablus-Salim	100	6.7	16	1242	4
3	Nablus-Bezariya-Burqa	110	15.8	57	1591	11
4	Nablus-Yasid	36	23.5	20	581	4
5	Nablus-Beit Imrin	94	16.5	24	238	1
6	Nablus-Nisf Igbel	12	15	5	761	4
7	Nablus-Sabestiya	90	13.5	40	797	7
8	Nablus-Ijnesinya	12	15.3	8	156	3
9	Nablus-Badan-Talluza	177	14.9	61	1308	7
10	Nablus-Dier Sharaf	84	8	28	721	5
11	Nablus-Asira shamalya	191	6	93	2089	16
12	Nablus-Biet Iba*	132	6.9	16	882	0*
13	Nablus-Beit Wazan	61	5.9	17	301	3
14	Nablus-Til	124	9.1	48	1118	8
15	Nablus-Beit Dajan	59	11	28	907	7
16	Nablus-Kufr Qalil	70	5	13	588	3
17	Nablus-Froush Beit Dajan	13	13	3	301	3
18	Nablus-Madama	37	12	20	410	5

No.	Route	Private Cars	Distance to Nablus (km)	No. of Services Establishments	Employment	Predicted No. of Shared-Taxis
19	Nablus-Beit Fourik	152	9.4	73	2548	16
20	Nablus-Burin-Asira qiblya	77	13.5	45	1209	10
21	Nablus-Awarta	132	9.6	32	1387	5
22	Nablus-Hiwwara	251	9	62	1435	4
23	Nablus-Einabous-Urif	172	14.4	52	1178	5
24	Nablus-Beita	180	14	60	2057	9
25	Nablus-Zeita-Jammain	176	17.9	60	1959	9
26	Nablus-Aqraba	158	20.6	49	1729	7
27	Nablus-Yutma	52	15.7	21	721	5
28	Nablus-Qabaln	121	18.6	57	1622	10
29	Nablus-Qusra	129	24.5	32	915	2
30	Nablus-Qaryout-Jaloud-	128	24.3	48	1453	7
31	Nablus-Al-Sawya	56	17.4	16	575	3
32	Nablus-Lubban-Ammorya	35	21.4	20	676	5
33	Nablus-Azmout-DeirHatab	118	9.2	40	1235	7

decision-making tool to help the MOT in determining the future needs of granting permits of shared-taxis.

The annual increase of the independent variables in the model for the target year 2010 are assumed as:

1. Private cars: 1.45%, based on Abu-Eisheh and Mannering, 2002,
2. The services establishments: 2.6%, based on PCBS, 2004, and
3. Employment: 3.5%, based on Abu-Eisheh and Mannering, 2002.

6.1.4 Number of Buses

Various trials had been run to examine the most appropriate variables that could be used to express the number of buses per route. The dependent variable is always considered based on the demand-based calculated number of buses operating on the routes, which had been given permits from the MOT.

By referring to results in Appendix E, the correlation between the dependent variable (number of buses) and each of independent variables was examined. The coefficient of determination (R^2) value was weak, the t-statistics values less than 2, and the sign of coefficients was not logical.

The existing of limited number of buses serving each routes, the overlapping between more than one company from one side and shared-taxis from other side, and many localities are served by one bus. All these previous reasons could explain the weak correlation between the number of buses and the other independent variables.

6.2 Assessing the Bus Routes Exclusive rights

6.2.1 Introduction

The public transport sector is characterized by a general lack of competition. This is due to difficult procedures in establishing new transit companies, under utilization of vehicles, and a poor level of service. The public transport operators are facing economic problems. Vehicles receive minimum maintenance. Although the fleet is old, with an average of 15 years, operators do not have the economic resources to replace them. According to MOT regulations, buses are not allowed to provide service when they 15 years of age, but their operating permits could be extended each six months during a maximum period of 5 years[3].

The MOT has been very lenient with transit operators by extending their operating permits. However, a large percentage of the current bus fleet in the Palestinian Territories is 20 years old, which means that they would be out of service. In addition, the MOT decided in early 2006 to put out of service for about 282 buses because they are more than 20 years of age[3].

In this regard, the MOT needs a plan to deal with the situation that would facilitate loans from local or foreign banks or would provide subsidy through grants from donor countries. The MOT has gone through such experience. In 1996, 75 buses were acquired by the MOT with assistance form the Netherlands and were provided to private operators on a exclusive rights basis *(Sinha and Hamideh, 1999)*.

[3] Interview with Eng. Mazen Abu Al-Soud, Minister's Advisor, MOT, Ramallah, Palestine.

6.2.2 Evaluation of Current MOT Policy Regarding Bus Routes Exclusive rights

Reform is needed in the public transport sector, this does mean that the competition should be made public. It is necessary to introduce new or revised franchise and operating conditions of the public transport service provided by the private sector. The regulations should encourage increased competition and should allow transit companies to innovate in providing service for various market segments. At the same time, the MOT should enforce routes, schedules, and periodic maintenance.

A reporting system should be instituted to monitor information on passengers, revenues, operating expenses, and other items. Such a management information system would allow the MOT to maintain the service provided, to determine deficiencies, and to introduce adequate measures as required based on performance indicators.

The reform process mentioned earlier may be achieved through the application of the exclusive rights regulations on the current bus companies operators based on the conditions of their operating permits. This monitoring process is very important since the current exclusive rights (permits) can be described as regulated private monopoly since all bus operators have an exclusive rights of operating on 4their exclusive rights routes under regulatory rules set by the transit authority (MOT). The inspector in the MOT is responsible for monitoring the application of such regulations. If any transit company is found to be foreshortening in its duties, and discordant to instructions, regulations, specifications, and exclusive rights conditions, the inspector notify them for three times of three months interval between each written alert. The MOT has the right to revoke the company exclusive rights and to re-tender this route again.

The above mentioned procedure is to be followed for an existing exclusive rights. However, for a new route exclusive rights (permit), the tendering process is usually announced in the official newspaper. The evaluation of the applicants shall be based on certain criteria regarding experience of the company, good performance and record, fleet characteristics, quality and level of service, financial situation, etc. The following section represents the international procedure in evaluation any tendering process regarding bus route exclusive rights (permit). This type of competition can be described competitive tendering.

6.2.3 International Criteria in Evaluation the Competition in Bus Service

Competitive tendering has been recently widely applied in many cities around the world, such as Helsinki, London, Copenhagen, and Stockholm. The experience revealed many benefits in as far as cost savings, improved quality of service, network expansion, congestion reduction, improvement in safety and environmental measures, and enhanced customer satisfaction.

In Helsinki, for example, the official body responsible for the regional public transport services is Helsinki Metropolitan Area Council (YTV). YTV has set the following targets for competitive tendering reduction the cost of transport, improvement in service level, added impetus to the increase in productivity gained from using operators, etc,.

In tendering invitation, YTV specifies certain requirements regarding the operator, the bus fleet, and the service quality. Appendix F shows the detailed requirements regarding the YTV criteria in evaluation the competition in bus service.

The MOT should adopt the general conditions of this type of competition of mass transit services. The criteria of evaluation of applicants and the weighted of the factors included can be determined based on conditions, which present the reality in the Palestinian Territories. The arrangements regarding the competition process may be more beneficial and successful if the MOT consulted specialized experts or consultants.

6.3 Assessing the Ministry of Transport Public Transport Fares Formula

6.3.1 Introduction

The fare structure for public transport modes in the Palestinian Territories is regulated by the MOT. The fare structure is zonal for buses, that is, based on the distance traveled or the location of alighting and boarding stations. No card system is followed in the area and no discounts are given for frequent riders except students.

The bus companies operators usually do not charge fares that are specified by the MOT. They charge fares which are on average 50% less than those set by the MOT. The passenger-kilometer revenue for bus companies was estimated in the range 3 to 6 cents *(Sinha and Hamideh, 1999).*

Similar to the operation of buses, the fare structure of shared-taxis is specified by the MOT. On the average, actual public shared-taxi fares are 25% higher than bus fares. Fares are mainly flat, since shared-taxi drivers charge fares regardless of distance. Depending on the demand in specific periods of the day, shared-taxis may ask for lower fares from passenger traveling the entire route.

6.3.2 Ministry of Transport Fare Formula

The MOT established fares for routes of each type of public transport. This fare was calculated based on a cost plus profit for each route. Table 6.9 shows the values of the components included in the MOT fare formula and the proportion weight of each item for a shared-taxi and a bus based on the average daily operating costs[4].

Table 6.9: MOT Fare Formula Components, Values, and the Proportion Weight of Each Item

No.	Fare Component	Shared-Taxi* (NIS)	Component Weight (%)	Bus** (NIS)	Component Weight (%)
1	Depreciation	41.1	12.92	106.0	14.70
2	Insurance	16.4	5.16	36.12	5.01
3	Fuel (Diesel)	100	**31.41**	300.0	**41.61**
4	Maintenance	31.82	10.0	114.0	15.81
5	Income Tax	3.36	1.06	1.65	0.23
6	Value Added Tax	6.28	1.98	8.127	1.15
7	Drivers Wages	83.33	**26.18**	83.33	**11.56**
8	Overheads Expenses	9.67	3.04	30.0	4.16
9	Parking, garage, traffic violation	17.5	5.50	40.0	5.55
10	Permit fees	6.85	2.15	0.0	0.0
11	Miscellaneous	1.92	0.60	1.67	0.23
	Total	**318.23 NIS**	**100%**	**721.04 NIS**	**100%**

Source: MOT, 2005
* Based on 7 years in operation
* Based on 10 years in operation

[4] Interview with Eng. Mazen Abu Al-Soud, Minister's Advisor, MOT, Ramallah, Palestine.

From Table 6.9, the fuel and driver wages are the main two components in the shared-taxi operating costs, that is, they should be highly considered in the shared-taxi fare formula. For bus, operating costs, the fuel, maintenance, and the driver wages form the main important items that should be highly considered in the bus fare formula. The permit fees in bus column is zero since bus companies do not pay for their bus routes exclusive rights. The total values in the last row in Table 6.9 present the total average daily operating cost for a shared-taxi and a bus, respectively. This figure is then used to calculate the passenger-kilometer fare parallel with other variables like; distance, average speed, trip time, average daily work hours, daily number of trips, average number of riders (7 for shared-taxi and 25 for bus), and the profitability percentage (35% based on MOT regulations).

The MOT follows a number of steps and assumptions in calculating the fare per passenger-kilometer:

- Average daily work hours for shared-taxi and bus is assumed 10 hours
- $Daily\ number\ of\ trips = \dfrac{Average\ daily\ hours}{Total\ trip\ time}$
- $Cost\ of\ one\ kilometer = 1.35 \times \left(\dfrac{Daily\ operating\ cost)}{2 \times Daily\ no.\ of\ trips \times distance}\right)$, assuming profit percentage is 35%
- $Rider\ tariff = \left(\dfrac{Cost\ of\ one\ kilometer \times Distance}{Average\ no.\ of\ riders}\right)$, assuming the average number of riders is 25 for buses and 7 for shared-taxis.

- $The\ rider\ tariff\ \ per\ kiometer = (\frac{Rider\ tariff}{Dis\tan ce})$, NIS per Passenger per Kilometer.

By referring to the above steps in calculating the kilometric fare, it is concluded that the distance variable plays an important role, i.e., the fare value varies based on the length of the route. As a result, the kilometric fare decreases as the distance increases which is logical. Table 6.10 shows the variability of the kilometric fare value in relation with distance, these values represent the bus kilometric fare that calculated by the MOT.

Table 6.10: MOT Distance-Based Bus Fare Values

No.	Distance Intervals (KM)	Fare Per Kilometer (NIS)
1	1	1.56
2	2	0.83
3	3	0.54
4	4	0.46
5	5	0.39
6	6-7	0.31
7	8	0.28
8	9	0.26
9	10	0.24
10	11	0.23
11	12	0.22
12	13	0.21
13	14-15	0.2
14	16	0.19
15	17-19	0.18
16	21-21	0.17
17	22-25	0.16
18	26-31	0.15
19	32-39	0.14
20	40-50	0.13

Source: MOT, 2005

The MOT usually reviews the fare formula every six months based on the fuel (diesel) prices, which form the main component (item). In other countries like Singapore, the Public Transport Council (PTC) instituted a mechanism to ensure that volatile fuel prices do not have a significant effect on public transport fares *(MOT, Singapore, 2005)*.

In addition, in India, fore example, the Association of State Road Transportation Undertakings (ASRTU) found that the cost of labor and fuel formed the major cost elements, which when not properly reflected in the fare structure, caused serious financial imbalance in the State Transportation Units (STU) *(Tata Energy Research Institute, India, 2002)*. Appendix F shows some relevant international countermeasures regarding public transport fare regulations applied in United Kingdom, Singapore, India, and Australia.

6.4 Overall Assessment of MOT Policy Variables

6.4.1 Number of Shared-Taxis and Buses

As mentioned earlier, the MOT depends only on one variable in determining the number of shared-taxis needed; the population variable, but it is not reasonable to accept an equation of only one variable. As a result, another socioeconomic variables should be taken into consideration. However, the international standards and experiences indicate that the number of shared-taxis should be calculated based on demand. This assumption (demand-based) is more accurate since it expresses the real needs of a certain route or community.

Moreover, the mathematical linear regression equation produced in this study can be used as a decision-making policy tool to help the MOT in predicting the future needs, and the number of operating permits that should be issued. In addition, the mathematical linear equation's independent variables represent the socio-economic characteristics of the population in addition to the distance variable.

The relation between the demand-based number of buses and the independent variables was weak. The existing number of operating buses in the study area is limited. The competition between the bus and the shared-taxi is strong. One bus serves more than one locality. The fleet is generally old.

Another important point is the permit fees. The permit fees should be related to the economic conditions of population. As a result, the MOT shall charge the original permit fees (10,000 NIS) instead of the current fees (2,500 NIS) if the economic conditions are improved. This procedure will contribute in decreasing the request for issuing new shared-taxi permits and consequently the number of operating shared-taxis will be dramatically decreased[5].

6.4.2 Exclusive rights of Bus Routes

Reform and revision is needed regarding the current franchise regulations applied. The public transport sector is served currently on the basis of private monopoly. The contract period is not identified, and the monitoring process is weak in general. The fleet is almost old and the average age is 15 years. The service frequencies, schedules, fares, etc, are not identified and not respected by the local bus companies. Generally, no actions are applied towards shortening and violating companies.

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[5] Interview with Eng. Ramadan Al-Kilani, Head of Department of Transport, MOT, Ramallah, Palestine.

The direction nowadays in the world is towards the competition tendering in providing public transport services. This type of contracts contribute in improving the quality and level of services, and make fares affordable. The period of this contract is identified normally from 3 to 5 years. The regulating official body usually consults specialized experts in evaluation the technical and financial bids. The evaluation criteria is usually based on good performance and record, the quality of service, fleet average age, financial and taxation records, etc. The exclusive rights is revoked and the bus route is re-tendered if the related bus company failing in providing the public service based on the conditions of operating permits.

6.4.3 Public Transport Fares

The current fare formula applied by the MOT is considered good, and the internal components of the formula (fuel, driver wage, maintenance, etc,.) are approved internationally. The local bus companies charge fares of about 50% of that approved by the MOT in order to attract riders. The MOT should monitor the fare charging process and should ensure that real fares are charged. The quality of service regarding bus companies is usually based on revenues, as a result the application of the real charge will encourage the bus companies to improve the level of services provided. The fares are charged based on distance (per kilometer) as it is generally applied in the world.

Internationally, the public transport fares are usually related to fuel prices and the average monthly earnings. The MOT usually review and revise the public transport fares based on fuel prices. In addition, if the MOT desires to keep the public transport fares affordable and unchanged, this is possible through subsidization of the bus companies by an amount equal to the rate of increase in fuel prices. This policy is applied currently in Singapore on the basis of fuel equalization fund.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

Chapter Seven

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

7.1.1 General Conclusions

1. Public transport in the West Bank and Gaza Strip is provided by buses and shared-taxis. The main service they provide is between rural areas, intercity, and intracity. Intercity public transport service is available only in a few main cities. Many rural communities do not have any public bus transportation. Intra-city public transport service is available in only few main cities.

2. Buses and shared taxis are allowed to provide services in the Palestinian Territories according to a franchise system established during the British Mandate, Jordanian Rule of the West Bank, and the Egyptian Rule of Gaza Strip, and the Israeli Occupation. Permits regulate the operation of each bus company and number of shared-taxis by defining their service routes, and fares. For buses they also regulate the frequency of trips and schedule. The exclusive rights along specific routes are generally exclusive.

3. After the establishing of the PNA period, the permits have been awarded based on the population in each area. The PNA formula is one shared-taxi permit for each 500 inhabitants, one large bus permit for each 5000 inhabitants, and one small bus permit for each 2500 inhabitants in the service area, whether to serve a quarter within a city or a village/town. According to bus service exclusive rights, the

additional step during the PNA period was to expand the service on same routes to benefit the villages that lack bus services.

4. The MOT established fares for routes of each type of public transport modes. This fare is calculated based on a cost plus a profit for each route. The cost per kilometer is calculated for each public transport type based on fuel (diesel) consumption, vehicle registration fees, insurance, vehicle depreciation and maintenance, and driver wages.

5. This study introduced an appropriate number of solutions and recommendations through focusing on the problems regarding the regulations of the public transport sector in the Palestinian Territories. This is achieved through studying the current situation for a number of important issues like, number of permits issued, the fare, and the bus routes exclusive rights.

6. The evaluation of the MOT polices for the earlier mentioned three issues was performed through assessing the current situation, presenting what is followed internationally, then comparing both procedures in order to define deficiencies and weak points from one hand, and to provide proper recommendations and results on the other hand.

7.1.2 Number of Shared-Taxis and buses

1. The results illustrated that the number of demand-based shared-taxis can be predicted through using the single equation linear model. The relation between the results from the simplified model and the MOT is presented. The coefficient of determination value was around 0.25 (i.e., represents about 25% of the relation), which means that the MOT

formula is not applicable comparing with the model results. As a result, it is concluded that the number of demand-based shared-taxis is more practical and applicable in calculating the number of transit units needed (i.e., shared-taxis).

2. The independent variables that were used in the simplified model are classified as socioeconomic characteristics in addition to the distance variable. The main exogenous variables that mostly affected the number of shared-taxis were private vehicles, distance, number of service establishments, and employment. Employment expresses the population variable indirectly. The simplified model could be used to help the MOT in predicting the number of shared-taxis required.

3. The statistical analysis results illustrated that the relation between the number of demand-based buses and the independent variables was weak. The coefficient of determination explained about 40% of the relation, the t-statistics values were less than 2, and the sign of coefficients was not logical.

4. If the permit fees still as is, the request for issuing new shared-taxi permits is to be increased and as a result, the number of shared-taxis will increase. On the other hand, if the MOT charges the original permit fees (i.e., 10,000NIS), the request for issuing new shared-taxis shall be decreased.

7.1.3 The Exclusive rights of the Bus Companies

1. Bus permits (exclusive rights) regulate the operation of each bus company and define their service route, number of vehicles, stops, fare, frequency of trips, and schedule. The bus service along a specific

routes is generally exclusive. There is a strong competition between buses and shared-taxis, but shared-taxis became more predominant during 1990's.

2. Public bus service is entirely operated by the private sector. The existing bus companies are operating without any coordination between them in the service they provide. Fleet management is minimal and many of these companies do not have workshops for maintenance[6].

3. The public transport sector is characterized by a general lack of competition. This is due to difficult procedures for establishing new transit companies. The fares charged are often less than those set by the MOT to attract passengers. As a result, the revenues do not always cover the operating expenses.

4. Not surprisingly, the bus service operators are facing economic problems. Vehicles receive minimum maintenance. Although the fleet is old, with an average of 15 years, bus operators do not have the economic resources to apply them.

5. According to franchise regulations, buses are not allowed to provide service when they reach 15 years of age, but their operating permits could be extended each six months during a maximum period of 5 years.

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[6] Interview with Eng. Mazen Abu Al-Soud, Minister's Advisor, MOT, Ramallah, Palestine.

7.1.4 Public Transport Fares

1. The fares charged by the public transport operators are often less than those set by the MOT to attract passengers. The public transport fares are about 50% of those setting by the MOT. The fares are zonal for buses (based on distance), and flat for shared-taxis (irrespective of distance).

2. The MOT calculated the daily operating costs for buses based on 7 years in operation and based on 10 years in operation for the shared-taxis. The MOT calculated the fares based on passenger-kilometer tariff. In general, the actual shared-taxis fares are 25% higher than buses fares.

3. The MOT fare formula is considered to be reasonable. The fuel prices, maintenance costs, and driver wages are the main components in the formula, which have the maximum proportion weights. These components should be highly appreciated while reviewing and setting fares. Another components, which should be taken into consideration are the consumer price index and the average national monthly earnings or annual earnings.

7.2 Recommendations

7.2.1 General Recommendations

1. The study recommendations may help the MOT in reviewing its regulations and policies regarding public transport, and can motivate decision-makers and planners to set the proper regulations, plans, and policies.

2. It is recommended that the MOT should take effective measures in the short term to improve the public transport services as part of a comprehensive long-term transport plan. These measures are essential, as public transport is the only mode of transport for a majority of the Palestinian population with far reaching social and economic implications.

3. In order to establish development strategy and necessary policies to enhance public transport through changes in the competition and structure of the passenger transport industry, operating practices, and legislation. The MOT and the municipalities should play a more active role in the planning and supervision of public transport services, in order to arrive at efficient, reliable, and affordable public transport system.

4. Financial and technical support is suggested to be one of the priorities in the sub-sector. As the public transport is already facing economic hardship, it is essential to provide financial and technical support to maintain its existence.

5. An official body as part of the MOT similar to the Public Transport Regulatory Commission (PTRC) in Jordan should be established with the aim of: regulating and supervising public transport services, meeting the demand for public transport services, granting licenses and revoking any of them in case of violations of laws and regulations, and determining public transport fares, etc.

6. The public service quality, level of service, reduction of fares, and increase competition between operators can be achieved if the MOT

changes the mass transit regulations from private monopoly to competitive tendering.

7.2.2 Recommendations for Number of Shared-Taxis and Buses

1. It is recommended that while the MOT granting a number of additional permits, other variables should be taken into consideration besides the population like private vehicles, distance, number of services establishments, and employment. This consideration will help the MOT in predicting the existing conditions, and as a result planning for the future needs.

2. The number of shared-taxis issued shall be based on demand as it is followed internationally. This means that a detailed study through the transport inspector should be performed in order to check and examine the real need.

3. It is recommended that future researches should study all items related to bus transit. This implies the study of real correlation between the demand-based number of buses and the related independent variables. In addition, building up a mathematical model, which has strong coefficient of determination and acceptable values of t-statistics, is essential.

4. It is recommended that the existing of enforcement on the ground is a key issue in regulating public transport sector. The supporting of the executive authority is essential.

5. It is recommended that the MOT policy regarding restricting granting permits and the criteria of awarding these permits be reviewed and

even changed based on scientific approaches due to the existence of more than needed shared-taxis. This may be achieved by co-operating with the specialists and professionals in this field through building capacities and consulting the planners.

6. Although it was considered a practical idea to reduce of permit fees temporarily due to economic situation, it is recommended that these fees should be increased later on when the current economic conditions are improved.

7.2.3 Recommendations for Bus Service Permits (Exclusive Rights)

1. In order to improve the public transport service, the MOT needs a plan to deal with the situation that would facilitate granting loans from local or foreign banks or would provide subsidies through grants from donor countries.

2. It is necessary to revise the franchise regulations and operating conditions of the public transport service provided by the private sector. The new regulations shall encourage the competition and shall assist transit companies in providing service in various market segments.

3. The MOT should take actions regarding the violating operators and even cancel their permits (exclusive rights) if needed, and re-tender their service routes for other operators. A new procedure and criteria regarding the evaluation of the public transport service applicants should be followed by the MOT.

4. It is recommended that the MOT and municipalities initiate detailed studies on current existing bus services and coverage. This study will define the localities that suffer lack of bus services, and as a result will contribute in solving that problem.

5. It is recommended that future researches should study all items related to bus service permits.

7.2.4 Recommendations Regarding Public Transport Fares

1. As a kind of regulating and monitoring the public transport services, the MOT should ensure that the public transport operators charge the governmental tariff, which can be described zonal for buses and flat for shared-taxis.

2. In order to set the optimal and affordable public transport fare formula, the MOT should subsidize the public transport operators and take into account changes in fuel prices, maintenance costs, and driver wages in its fare formula. In addition, the price consumer index and the average national monthly earnings are also important indices.

3. To reduce travel time and facilitate the fare payment process, MOT should initiate and encourage the use of new technologies regarding fare collection system, like electronic or magnetic card system.

4. It is recommended that the MOT should ensure that the public transport operator's revenues are greater than operating costs with an acceptable percentage of profit (35% based on MOT regulations).

5. It is recommended that future researches should study all items related to public transport fares.

6. The establishment of fuel equalization fund by the public transport operators is encouraged to maintain public transport fares affordable.

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APPENDICES

APPENDIX A

Definitions of Important Repeated Terms

Public Transportation: It is the service that is provided for the carriage of passengers and their incidental baggage on established routes and fixed schedules at published rate of fare, and available to the general public in urban areas or for short distances in rural areas *(Sadeq, 2001).*

Public Travel (Mass Transit) Demand: Demand for mass transit is estimated as a part of total trip estimation process for the study area between the origin and destination points. It involves some information about those trips through a fixed route and schedule *(Sadeq, 2001).*

Ridership: It is the traveler who freely chooses a specific mode of transportation on a specific route to achieve his or her trip purpose between the origin and destination *(Sadeq, 2001).*

Bus Mode: The bus is a rubber-tired vehicle operating on a surface street and usually subjected to all traffic conditions. Almost all buses are powered by fuel-efficient, time proved diesel engine. Features vary such that no one size or body conformation is best adapted to all application. Standard bus lengths are 35 and 40 ft (12.2m)**,** and widths are 96 or 102 in (2.45 or 2.6m). The seated capacities are , respectively, 41 to 45 and 49 to 53 passengers *(Sadeq, 2001).*

Bus transportation is highly energy-efficient mode, averaging 300 seat-miles per gallon of fuel. Buses are also very safe. Their accident rate of 12 fatalities per 100 billion passenger-mile is more than 100 times than that of automobiles *(Sadeq, 2001.*

Shared-Taxi Modes: The shared-taxi is considered as one of the paratransit services. It is a service providing a transition of passengers and their packages from one place to another. The standard shared-taxi seated capacities is seven passengers. Services may deviate from routes and/or fixed schedule, and may pick up and drop off passengers at other than regular stops.

Intercity Bus Service: Intercity bus service is the public participation mode that connects two cities that have a bus service all week days in a fixed route, fixed schedule, and fixed bus fare. Intercity bus service is provided by a private companies; the most principal two companies for the study area of this research are Al-Tamimi and Al-Taneeb Bus Companies, which operate at a profit, with little or no support from the government.

Regression Analysis: Regression analysis is a statistical method dealing with the formulation of mathematical models that depict the relationships among variables, and the use of these modeled relationships for the purpose of predicting and other statistical inferences. The method of least square is the efficient method for estimating the regression parameters to minimize the overall discrepancy *(Sadeq, 2001).*

Travel Demand Elasticity: Travel demand elasticity is a major tool that measures the rider response's sensitivity for any change of one or more variable. That means that the rider may change his or her preferable transportation mode, route, and trip it self because of such changes *(Sadeq, 2001).*

Franchising Competition: Involves the grant of an exclusive right to provide a service that meets a number of general quantity, quality, and price standards established by the authority, usually because of a competition. The franchise may be for a self-contained area, such as a town or sector of large city, but it is also possible to have route franchises especially with fixed track systems. They differ from service contracts in allowing the contractor a greater degree of freedom to develop the system. The franchise system may have to be paid by the authority to provide service and fare combinations that are not commercially viable *(World Bank, 2002).*

Concessions: Involve the granting of an exclusive right to provide a service without payment by the authority, although the authority may attach conditions, such as maximum fares or minimum service requirements. In all other respects, the concessionaire is acting on his own behalf and not as an agent of the authority. Contracts are usually for rather long periods, often 10 years or more, to allow the contractor benefit from his development of market *(World Bank, 2002).*

Consumer Price Index (CPI): An index to measure the price level of a basket of goods and services purchased by an average household with respect to a base year. When used in the fare adjustment formula, it refers to the change in CPI (i.e. not the absolute CPI) as compared to preceding year *(Singapore MOT, 2005).*

Fare Adjustment Formula: A formula that is used to determine the quantum of fare changes *(Singapore MOT, 2005).*

Fare Cap: The limit on the maximum allowable increase in fares *(Singapore MOT, 2005).*

Fare Review Mechanism: A mechanism adopted to evaluate and process requests from public transport operators for changes in fares *(Singapore MOT, 2005).*

Fare Structure: The way in which the fare for a trip is calculated and the range of fare types that may be offered *(Singapore MOT, 2005).*

Price Cap Model: A model of regulating price where price increases are capped according to a specific formula. The formula usually comprises a cost and a productivity component *(Singapore MOT, 2005).*

Public Transport Operators: Bus operators that are licensed by Public Transport Council (PTC) to provide basic schedule bus services *(Singapore MOT, 2005).*

Rate-of-Return Model: A regulatory model where prices are set at a level to enable operators of public transport to earn a specified rate-of-return. It is essentially a cost-plus model *(Singapore MOT, 2005).*

APPENDIX B

Fare Calculations in the United Kingdom (U.K.)

London Buses Service Permits

Cost P (Pence) Per Mile of Each Cost Component in 2003 and in 2004

Component of index	Cost p per mile in 2003	Proportion of costs in 2003	Cost p per mile in 2004	Increases in costs in 2004
Vehicle cost	21.85	11.5%	22.12	1.3%
Parts	14.29	7.5%	14.65	2.5%
Garage and servicing	21.97	11.5%	22.77	3.7%
Fuel	14.98	7.9%	15.46	3.3%
Insurance	15.98	8.4%	15.74	-1.5%
Miscellaneous	1.66	0.9%	1.69	1.9%
The knowledge	9.19	4.8%	9.52	3.6%
Social costs	4.71	2.5%	4.88	3.6%
Total Operating Costs	**104.62**	**55%**	**106.84**	
Average national earnings	85.60	45%	88.68	3.6%
Grand Total	**190.23**	**100%**	**195.53**	
Year on year increase				**2.8%**

Source: Transport for London, 2005

The earlier mentioned cost elements in the table above are illustrated in the following paragraphs *(MOT, England, 2005)*:

Parts; Tires costs were provided by London Transport Buses. In 2003, the average cost for Jet, Taxi tire service, and Universal Tire and Auto Centers were used. From these three suppliers, the average cost of new tire was £63.18 in 2003 (1.38 pence/mile) and £63.2 in 2004 (1.39 pence/mile).

Garage and Servicing (premises); In 2003 the cost of premises was 9.53 pence/mile. In quarter 3 of 2003, all industrial rent index increased by 0.7%, giving 9.59 pence/mile for 2003.

Garage and Servicing (Labor); In 2003 the cost of labor was 12.44 pence/mile. Uplifting this by the 5.9% increase in hourly pay rates gives 13.18 pence/mile in 2004.

Fuel; The average cost/liter was 75.63 pence in 2003. The 2004 average is 78.25 pence, which is an increase of 3.5%. The calculations assume an average of 5.06 mile/liter.

Insurance; Westminster Insurance provides the increase in their own premiums. London Transport Insurance provides other premiums (Norwich Union and Hold sure) through a broker from Protector policies. An average increase in premiums of at least 3 companies was used. Westminster Insurance made no changes to their premiums for 2004, Norwich Union reduced their premium by 5%, and the average increase of the Hold sure premiums was 0.5%. The average of the three companies produced a 1.5% decrease year-on year.

Miscellaneous; This comprises the cost of hiring a meter, smoke test, vehicle license, and driver license. The figure of £364.47 for 2003 included the expected increase in license costs. This was a departure from normal practice as it is usually only considered historic increases in costs and not forthcoming changes. In 2004, the costs were risen to £371.5 following a further rise in license costs in April.

Earnings related; The knowledge and social costs are uplifted each year in line with national earnings. The 2004 average earning index is 3.6% for quarter 3 2003.

The total operating costs were given a 55% weighting towards the final index and national earnings made up the remaining 45%. The index components and relative weights used were under review and may be revised in calculating the 2005 index value *(MOT, England, 2005).*

London Buses Service Permits

1. Introduction

The following points are intended to provide information on the London service permit system operated by London Buses on behalf of Transport *for* London.

2. What Is A London Service Permit?

Transport *for* London provides a comprehensive network of local bus services within Greater London normally through a process of inviting tenders to operate services or by way of 'London Local Service Agreements'. These services form the 'London bus network'.

Local bus services that are not part of the London bus network can only be provided in accordance with a London service permit. This London service permit system is replacing the previous system that involved the granting of London local service licenses by the Traffic Commissioner. These licenses will continue to their original expiry date whereupon an application must be made for a London service permit.

A London service permit is not required if the service is provided free of charge to all passengers and does not entail any pre-paid arrangement.

3. Duration

A London service permit can be valid for a period of up to five years. A longer period is not permitted under the Greater London Authority Act. At the end of the period, a new permit must be applied for three months prior to expiry if the service is to continue.

4. Requirements

The requirements for a successful application take account of standards set by national legislation regarding bus operation, the statutory duties and powers of Transport *for* London and the Transport Strategy of the Mayor of London. Key requirements are set out in the following sections.

4.1 Licenses

Applicants must be in possession of a valid operators' license or, where appropriate, a community bus permit granted under section 22 of the Transport Act 1985, or be able to demonstrate a capability to obtain a license or permit before commencing operation of the service.

4.2 Environmental

All vehicles will be expected to comply with statutory requirements regarding exhaust emissions. Over time, these requirements are leading to a progressive reduction in exhaust emissions from new vehicles.

In addition, Transport *for* London wishes to see a parallel reduction in exhaust emissions from vehicles already in existence, particularly in central London. Progressively raising minimum standards for existing vehicles and encouraging operators to develop strategies for reducing emissions will achieve this.

4.3 Access & Mobility

The Mayor's Transport Strategy includes an Accessibility Action Plan with timetabled proposals to comprehensively improve the accessibility of transport in London. The plan includes improvement in vehicle design and staff training.

All vehicles must comply with the provisions of the Disability Discrimination Act 1995 which requires that new vehicles should be fully accessible and that existing vehicles should comply by 2016.

4.4 Health & Safety

First time applicants must submit a summary of their Health and Safety arrangements and may be required to co-operate with follow up visits and to embrace a Health and Safety policy, engineering standards and maintenance, driver training, risk assessment and incident records.

4.5 Stopping Places, Terminals and Route

Transport *for* London must ensure that granting an application will not prejudice safety or cause delay or inconvenience to other road users, pedestrians and cyclists. Applicants will be expected to operate services in a manner that does not prejudice this requirement.

4.6 Information

Better information is seen as an important component of a strategy to improve public transport and in particular information should be integrated with Transport *for* London information where appropriate.

4.7 Service Levels

Information on frequency and times of operation will be required as part of the application. For certain kinds of service where demand fluctuates in an unpredictable way, for example sightseeing tours, the facility will exist to grant an application based on minimum and maximum frequencies.

4.8 Route Numbers

Where route numbers are allocated to proposed services, applicants must take account of existing route numbers to avoid situations of two or more services with duplicate route numbers operating within the same locality. Transport *for* London reserves the right to allocate an appropriate route number.

5 The Process

5.1 How to apply

Applications should be made to The Licensing Manager of London Buses, whose contact details are given at the end of this document, using a standard form to be available on request.

5.2 When to apply

An application for a permit should, if at all possible, be submitted at least three months before the proposed start date of the service. In certain cases e.g. where there is a clear need for a service to begin operation as quickly as possible, a shorter period of notice may be allowed at the discretion of Transport *for* London.

5.3 Who will make the decision?

The decision as whether to grant or refuse the application and what conditions might be imposed will be taken by London Bus Services Ltd under powers delegated by Transport *for* London.

5.4 Attachment of conditions

When granting or renewing the permit, conditions may be attached. These could include:

- The size and dimensions of the vehicles used.
- Provision of adequate route identification.
- That passengers are only taken up or set down at specified points.

- No stopping or standing other than at specified points which may be subject to maximum time limits.
- That steps are taken to secure the safety and convenience of the public, including those who have mobility difficulties.
- A code of practice relating to particular aspects of the operation of the service.
- Measures to reduce vehicle emissions.
- Measures to improve access and mobility.

5.5 Publication

Where Transport *for* London grants a London service permit it will send notice of the grant, including particulars of the services authorized to the London authorities affected, the Police and the London Transport Users' Committee. The appropriate Traffic Area will also be notified in cases of cross-boundary services.

5.6 Fees

A non-refundable one-off fee of £150 including VAT will be charged to process the application. There will be no further charges within the duration of the permit.

6 During the Period of the Permit

6.1 Making changes

Operators may propose changes to services during the life of a permit. Such proposals will normally be dealt in a similar manner to a new application. An exception may be made if the change is relatively minor or uncontentious.

Transport *for* London does have the right, at any time, to vary a London service permit by altering or removing a condition attached to the permit or by attaching a new condition. Such action might be prompted by changed circumstances such as changes in national legislation, recognition that the condition was no longer appropriate or in the interests of the safety and convenience of the public.

6.2 Monitoring

Monitoring of services may be conducted on a regular or ad-hoc basis in response to particular issues or concerns.

6.3 Communication with the public

Operators will be required to have mechanisms by which the public can make comments, suggestions and complaints relating to the service direct to the operator. Transport *for* London will refer any comments or complaints it receives on permit services to the operator but will expect them to be properly investigated and dealt with in a timely manner.

6.4 Revocation

A permit may be revoked or suspended on the grounds that there has been a contravention of any condition attached to it. In justifying revocation, Transport *for* London will need to be satisfied in regard to:

- The frequency of the breach of conditions, or
- The breach having been committed intentionally, or
- The level of risk to the public involved.

6.5 Expiry of permit

When a permit is due to expire an application for a new permit must be made prior to that expiry date in order for the service to be able to continue.

7 Right of Appeal

Before considering refusal to grant a London service permit, Transport *for* London will negotiate with the operator and affected authorities to try and resolve any conflicting issues. In the event of Transport *for* London refusing to grant a London service permit, it will inform the applicant of the reasons for its decision.

8 Legislation

The primary legislation covering the London service permit system is contained in sections 185 to 195 of the Greater London Authority Act 1999.

APPENDIX C

Regulatory Forms of Mass Transit Services

1. Organizational Models for Mass Transit

The regulatory forms of mass transit services include public and private monopolies, deregulation, regulated competition, and competitive tendering services. Each of these models has advantages and disadvantages, and each may be suitable for specific environments based on political, economical, and social conditions *(Kaysi and Abbany, 2002)* .

- **Public and Private Monopolies**

Public monopoly gives one public operator the exclusive rights for designing, owing, and operating all transit services, without any competition from other operators. This single operator could also be a privately owned company (in which case the setup is called private monopoly) that works under regulatory rules set by the transit authority.

Theoretically, public monopoly enables the government to directly implement its accessibility and social equity concerns through the public operator. It creates a well-coordinated system that is able, with the government support to expand its services without fear of financial risks. However, many countries cannot afford high subsidies, and without this financial support, such systems may not be able to return sufficient profits for the expansion and renewal of transit services.

As for private monopolies, they can provide consistency and coordination in the production of transit services, can benefit from possible economies of scale, and could eliminate the need for government subsidy. The main disadvantage is that monopolists tend to abuse the exclusive rights to maximize their revenues by increasing fares and providing lower-quality services.

- **Unregulated Systems**

Also called “Open Market”, an unregulated market presents no restrictions on transit operators, except those related to safety concerns, environmental issues, vehicle maintenance, and general business and traffic laws. Towards this end of organizational strategies, competition between different operators exists in the market, particularly to attract more riders and increase the revenues. This competition benefits the whole mass transit system because it pushes the operators to reduce their cost, increase their benefits, and accordingly invest in expanding and ameliorating their services. Riders also benefit from lower fares (particularly in high demand areas), a large variety of options, and possibly a more frequent operation.

Deregulation however has many drawbacks and disadvantages. For instance, operators may suffer from “unfair competition, predatory practices and threatening tactics”. Riders also suffer because of the absence of any fare and service coordination, as well as respected schedules. Finally, with the preferred use of smaller vehicles at higher frequencies, congestion and environmental problems seem much more aggravated when adopting a similar strategy.

- **Regulated Competition**

This system preserves the competitive aspect of deregulated markets, with additional rules regarding fares, level of service, entry to the system (through a license), and operated routes. These rules could enable the government to create an integrated network with sufficient coordination between different operators. The entry restrictions also set the stage for profitable services by eliminating destructive competition, and benefit traffic conditions by limiting the number of transit operators, and accordingly reducing congestion problems.

The main disadvantage relate to possible preferential treatment that could be given by the regulator to stronger operators, the need for continuous fare adjustments to maintain sufficient levels of profitability, and the inability of the system, without public support, to maintain services in low demand areas.

- **Competitive Tendering**

Competitive tendering "Contracting Out" falls midway between public or private monopolies and full deregulation techniques. It enables the introduction of competition for the market, while keeping certain levels of public control over fares, service quality, and coordination between different operators.

Competitive tendering has been recently widely applied in many cities around the world, such as London, Copenhagen, and Stockholm. The experiences revealed many benefits in as far as cost savings, improved quality of service, network expansion, congestion reduction, amelioration in safety and environmental measures, and enhanced customer satisfaction. In London, for example, 15 years after the initiation of the competitive tendering process, operating costs dropped by 47% due to lower labor costs and more efficient operation.

Moreover, operated vehicle-kilometers expanded by 29%, and ridership levels increased by a very meaningful 5% (more than 20% drop in other areas of the UK). This success is however greatly dependent on a decisive and close monitoring of the performance of each operator. This would be best achieved when an authority that is completely independent from any political pressure, i.e. not the public operator, organizes the tender.

Competitive tendering requires a number of transport policies and legislatives reforms in order to successfully achieve its objectives. Moreover, the transit authority needs to decide on two major aspects of the tendering process:

- Who bears the revenue risk/ what type of contract to adopt?
- How to design the contract?

2. Type of contract

The adopted contract can be a cost contract, a revenue contract, or a shared contract. In cost contracts, the operator specifies in the bid the full cost required in exchange for provided services, and which will be received irrespective of collected fares. The revenues are transferred to the transit authority that bears the revenue risks and is responsible for controlling the adherence of the contractor to the service levels cited in the contract.

Revenue contracts, on the other hand, transfer the revenue risks from the transit authority to the private operator who keeps the collected fares. In some instances, the operator could receive additional subsidies in case the operated routes are non-profitable; when the opposite is true, the operator might be asked to pay the transit authority for the “right to operate”.

Finally, the shared contracts provide a comprise between cost and revenue contracts, whereby revenue risks are equally shared by the transit authority and the private operator. This alternative is very beneficial because it creates incentives for both public and private parties to provide a better service and become more cost efficient.

Selecting the appropriate contract from a specific case is not an easy task. In fact, although revenue contracts transfer all revenue risks from the public authority to the private operator, cost contracts could be more appropriate when looking at other criteria such as competition, incurred cost, incentives, and ease of contract management. The selection should follow a careful and detailed study of existing conditions as well as aims and capabilities the transit authority.

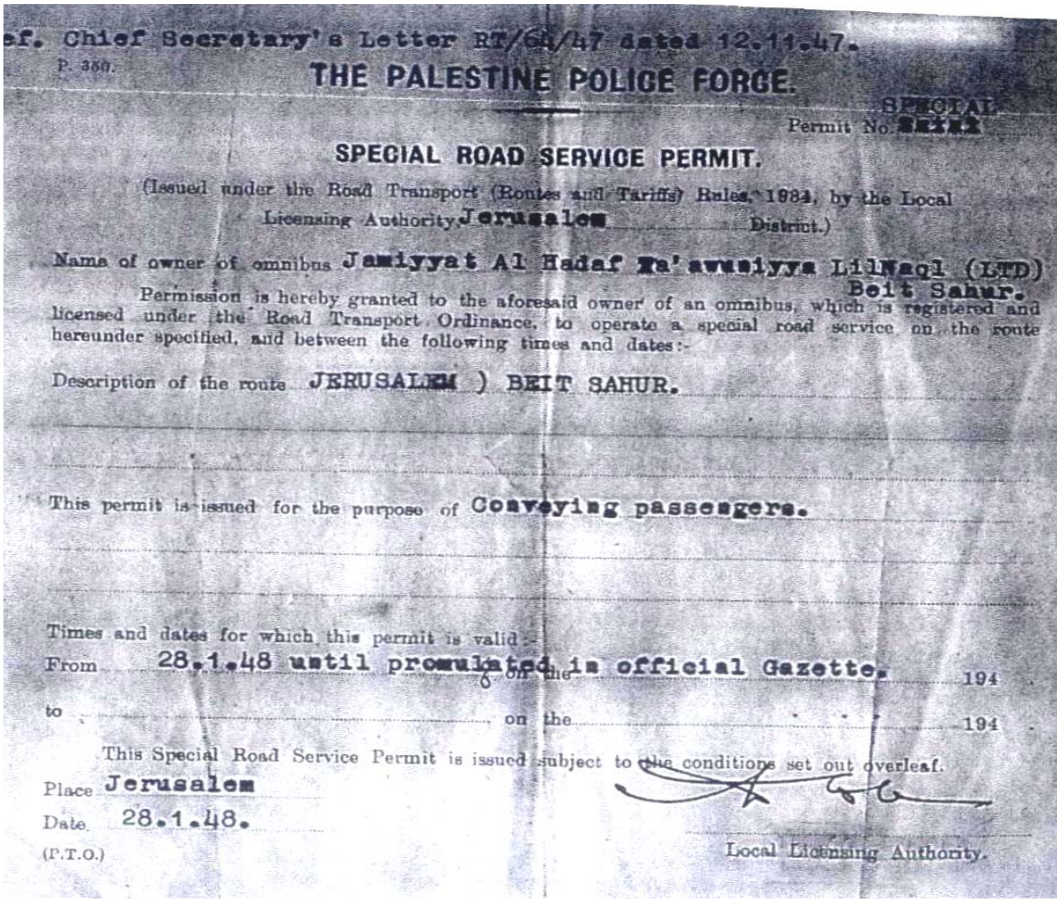
3. Competitive Tender Structure

In every contract or competitive tender, the following issues should be clearly specified:

- Routes to be tendered;
- Contract size;
- Contract duration and renewed;
- Fares;
- Schedules;
- Vehicle characteristics;
- Service and safety standards;
- Asset ownership and use;
- Roles and responsibilities of both regulating authority and the private sector;
- How much control would the regulating authority have over the product;
- System integration policies, such as service coordination, integrated fares and ticketing, and passenger information.

APPENDIX D

Public Transport Regulatory Forms



ef. Chief Secretary's Letter RT/64/47 dated 12.11.47.

P. 350.

THE PALESTINE POLICE FORCE.

SPECIAL
Permit No. xxxx

SPECIAL ROAD SERVICE PERMIT.

(Issued under the Road Transport (Routes and Tariffs) Rules, 1934, by the Local Licensing Authority, Jerusalem District.)

Name of owner of omnibus Jamiyyat Al Hadaf Ta'awuniyya LilNaql (LTD) Beit Sahur.

Permission is hereby granted to the aforesaid owner of an omnibus, which is registered and licensed under the Road Transport Ordinance, to operate a special road service on the route hereunder specified, and between the following times and dates:-

Description of the route JERUSALEM) BEIT SAHUR.

This permit is issued for the purpose of Conveying passengers.

Times and dates for which this permit is valid:-

From 28.1.48 until promulgated in official Gazette. 194

to .... on the 194

This Special Road Service Permit is issued subject to the conditions set out overleaf.

Place Jerusalem

Date 28.1.48.

(P.T.O.)

Local Licensing Authority.

Special Road Service Permit

CONDITIONS.

(a) The omnibus shall conform, to and the owner shall comply with the Rules made under the Road Transport Ordinance, and any Ordinances or Rules amending or substituted therefor or which may be in force hereafter.

(b) The permit shall not be transferable by the holder thereof to any other person, and shall be delivered up to the Local Licensing Authority at Jerusalem on expiry.

(c) The omnibus operating the route shall cover the entire route on each journey, and shall not be turned about or parked at any point along the route.

(d) The omnibus shall not transport any passengers other than those for whose special conveyance this permit is granted.

(e) The omnibus shall not be stopped at any "Bus Stop" sign within a municipal area.

(f) The omnibus shall carry a board marked "SPECIAL", to be fixed so as to obscure the route number of the omnibus, and the lettering on the aforesaid board shall conform to that prescribed for omnibuses operating under a Special Road Service Permit.

(g) If, during the currency of this Special Road Service Permit, there has been a breach of, or failure to comply with one or more of the conditions prescribed herein, the Local Licensing Authority may revoke or suspend the said permit for such period as he may see fit.

Place Jerusalem

Date 28.1.48.

Local Licensing Authority.

TRAFFIC C[illegible] OFFI[illegible]
JER[illegible] DIST[illegible]

GPP. 10459—2000—16.5.40

Permit Conditions

السلطة الوطنية الفلسطينية
وزارة النقل والمواصلات
دائرة النقل على الطرق
رخصة لتشغيل تكسي عمومي

عملا بالصلاحية المخولة لي كمدير عام للنقل على الطرق اعطي بهذا رخصة لتشغيل تكسي عمومي لـ : –

رقم التكسي : ......

رقم رخصة التشغيل: ....

نوع التكسي: ...... سنة الانتاج: ......

اسم المالك: ......

اسم المستاجر: ......

رقم الهوية : ......

العنوان : ......

اعطي بتاريخ : ......

ساري حتى : ......

مجرى خط سير التكسي : ......

....

......

محطة التكسي : ......

هذه الرخصة تابعة للشروط التي تصدر عن السلطة من حين لآخر وهي قابلة للالغاء حسب تقدير السلطة في اي وقت .

لا تكون هذه الرخصة سارية المفعول الا اذا كان معها رخصة مركبة سارية المفعول.

على سائق المركبة العمومي الالتزام بخط السير الممنوح له من قبل دائرة النقل على الطرق ومن يخالف ذلك يتحمل المسؤولية القانونية.

רשות הלאומית הפלסטיניח
לשכת התחבורה
משרד התחבורה
רשיון להפעלת מונית

בתוקף סמכותי כמינהל תחבורה כללי ניתן ביזה רשיון הפעלת למונית ל : -

מסי המונית: ......

מסי רשיון הפעלה: ....

סוג הרכב: ...... שנת יצור: ......

שם הבעל: ......

שם הסוחר: ......

ת . ז. : ....

כתובת ......

ניתן ביום ......

תוקף עד : ......

מקום עבודת הקבוע של המונית ......

......

....

בתחנת מוניות : ... .

רשיון זה כפוף לתנאיי שהרשות תקבע מזמן לזמן ואחריות ניתן לבטול על ידי הרשות לפי שיקול דעתה בכל עת .

לא יהיה תוקף לרשיון זה אלא אם צמוד אליו רשיון רכב בר תוקף.
על נהג המונית להתחיב לנהו בקווי התנועה המואשרים למניות מטעם משרד התחבורה נהג מונית שיעבור על קווי תנועה אלו מתחיב משרד התחבורה לנקוט נגדו צעדי עניש חמורים ביותר.

مدير عام النقل على الطرق
מנהל תחבורה כללי

Shared-Taxi License

بسم الله الرحمن الرحيم

السلطة الوطنية الفلسطينية
وزارة النقل والمواصلات
دائرة النقل على الطرق

صورة السائق

السلطة الوطنية الفلسطينية

بطاقة معلومات

رقم السيارة : ______________________

اسم السائق : ______________________

رقم الهوية : ______________________

مجرى الخط : ______________________

رقم السيارة على الخط : ______________________

أجرة نقل الراكب : ______________________

____

____

كل قشط او تغيير في هذه البطاقة تعتبر لاغية — دائرة النقل على الطرق

Public Transport Driver ID

APPENDIX E

LimDep Statistical Analysis Results

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,PRIVATE,DIST$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 238.1765881    , Std.Dev.=        2.86583 |
| Fit:        R-squared=  .225480, Adjusted R-squared =          .14536 |
| Model test: F[  3,     29] =    2.81,    Prob value =          .05671 |
| Diagnostic: Log-L =    -79.4373, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    2.220, Akaike Info. Crt.=      5.057 |
| Autocorrel: Durbin-Watson Statistic =   1.46280,   Rho =       .26860 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.959761894      1.7408658       2.275   .0305
 POP       .1320185773E-02  .52309341E-03    2.524   .0173  3427.4545
 PRIVATE  -.2742370748E-01  .18781563E-01   -1.460   .1550  90.454545
 DIST     -.1391251857      .99514615E-01   -1.398   .1727  13.533333
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,DIST,SERVICES$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 187.2207141    , Std.Dev.=        2.54084 |
| Fit:        R-squared=  .391182, Adjusted R-squared =          .32820 |
| Model test: F[  3,     29] =    6.21,    Prob value =          .00217 |
| Diagnostic: Log-L =    -75.4654, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    1.979, Akaike Info. Crt.=      4.816 |
| Autocorrel: Durbin-Watson Statistic =   1.16024,   Rho =       .41988 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.049746302      1.4471531        1.416   .1673
 POP      -.5619987485E-03  .45528165E-03   -1.234   .2270  3427.4545
 DIST     -.3705370641E-01  .83438122E-01    -.444   .6603  13.533333
 SERVICES  .1626199208      .49936044E-01    3.257   .0029  27.666667
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,SERVICES,EMPLOYME$

+---+

| Ordinary least squares regression Weighting variable = none |

| Dep. var. = TAXISC Mean= 4.121212121 , S.D.= 3.099975562 |

| Model size: Observations = 33, Parameters = 4, Deg.Fr.= 29 |

| Residuals: Sum of squares= 158.9675380 , Std.Dev.= 2.34129 |

| Fit: R-squared= .483058, Adjusted R-squared = .42958 |

| Model test: F[3, 29] = 9.03, Prob value = .00022 |

| Diagnostic: Log-L = -72.7661, Restricted(b=0) Log-L = -83.6532 |

| LogAmemiyaPrCrt.= 1.816, Akaike Info. Crt.= 4.652 |

| Autocorrel: Durbin-Watson Statistic = 1.48276, Rho = .25862 |

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
Constant	1.280349652	.89915407	1.424	.1651	
POP	-.1300843072E-02	.51035723E-03	-2.549	.0164	3427.4545
SERVICES	.1073268913	.51974381E-01	2.065	.0480	27.666667
EMPLOYME	.5824250684E-02	.25095182E-02	2.321	.0275	743.45455

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,DIST$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 255.6867406    , Std.Dev.=        2.91940 |
| Fit:        R-squared=  .168539, Adjusted R-squared =          .11311 |
| Model test: F[  2,     30] =    3.04,    Prob value =          .06275 |
| Diagnostic: Log-L =    -80.6078, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    2.230, Akaike Info. Crt.=      5.067 |
| Autocorrel: Durbin-Watson Statistic =   1.31331,   Rho =       .34334 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.962646176      1.6312675        1.816   .0794
 POP      .6769543981E-03  .28734060E-03    2.356   .0252  3427.4545
 DIST     -.8583727739E-01  .94311680E-01    -.910   .3700  13.533333
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,SERVICES$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 188.4938951    , Std.Dev.=        2.50662 |
| Fit:        R-squared=  .387042, Adjusted R-squared =          .34618 |
| Model test: F[  2,     30] =    9.47,    Prob value =          .00065 |
| Diagnostic: Log-L =    -75.5772, Restricted(b=0) Log-L =     -83.6532 |
|             LogAmemiyaPrCrt.=    1.925, Akaike Info. Crt.=      4.762 |
| Autocorrel: Durbin-Watson Statistic =   1.14786,   Rho =       .42607 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.571328010      .95324256        1.648   .1097
 POP      -.6008592618E-03  .44077444E-03   -1.363   .1830  3427.4545
 SERVICES  .1666012742      .48462926E-01    3.438   .0017  27.666667
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,PRIVATE$

```
+-------------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 254.2289467    , Std.Dev.=        2.91106 |
| Fit:        R-squared=  .173280, Adjusted R-squared =          .11817 |
| Model test: F[  2,     30] =    3.14,    Prob value =          .05759 |
| Diagnostic: Log-L =    -80.5135, Restricted(b=0) Log-L =     -83.6532 |
|             LogAmemiyaPrCrt.=    2.224, Akaike Info. Crt.=      5.061 |
| Autocorrel: Durbin-Watson Statistic =   1.28987,   Rho =       .35507 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.078186176      1.1216253        1.853   .0738
 POP       .1065690101E-02  .49813712E-03    2.139   .0407  3427.4545
 PRIVATE  -.1779433446E-01  .17748790E-01   -1.003   .3241  90.454545
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,TAXIFARE$

```
+----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 254.5261500    , Std.Dev.=        2.91277 |
| Fit:        R-squared=  .172313, Adjusted R-squared =          .11713 |
| Model test: F[  2,     30] =    3.12,    Prob value =          .05861 |
| Diagnostic: Log-L =    -80.5328, Restricted(b=0) Log-L =     -83.6532 |
|             LogAmemiyaPrCrt.=    2.225, Akaike Info. Crt.=      5.063 |
| Autocorrel: Durbin-Watson Statistic =   1.30159,   Rho =       .34921 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.265822667      1.7957715        1.819   .0790
 POP       .7075510055E-03  .29047291E-03    2.436   .0210  3427.4545
 TAXIFARE -.4389865428      .44596823        -.984   .3328  3.5757576
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,INCOME$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 242.9797618    , Std.Dev.=        2.84593 |
| Fit:        R-squared=  .209861, Adjusted R-squared =          .15718 |
| Model test: F[  2,     30] =    3.98,    Prob value =          .02921 |
| Diagnostic: Log-L =    -79.7667, Restricted(b=0) Log-L =     -83.6532 |
|             LogAmemiyaPrCrt.=    2.179, Akaike Info. Crt.=      5.016 |
| Autocorrel: Durbin-Watson Statistic =   1.28155,   Rho =       .35922 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  9.851799739      5.2210602        1.887   .0689
 POP       .7024945688E-03  .28079990E-03    2.502   .0180  3427.4545
 INCOME   -.4818359864E-02  .30842739E-02   -1.562   .1287  1689.0303
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,INTTRADE,TAXIFARE$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 222.3547089    , Std.Dev.=        2.76901 |
| Fit:        R-squared=  .276931, Adjusted R-squared =         .20213 |
| Model test: F[  3,     29] =    3.70,    Prob value =         .02271 |
| Diagnostic: Log-L =    -78.3031, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    2.151, Akaike Info. Crt.=      4.988 |
| Autocorrel: Durbin-Watson Statistic =   1.42415,   Rho =       .28793 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.574159484      1.7137656       2.086   .0459
 POP      -.1664395776E-03  .50823398E-03    -.327   .7457  3427.4545
 INTTRADE     .3395531210E-01     .16576645E-01         2.048       .0497
66.727273
 TAXIFARE -.3211147910      .42784507       -.751   .4590  3.5757576
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,DIST,TAXIFARE$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 254.0040275    , Std.Dev.=        2.95952 |
| Fit:        R-squared=  .174011, Adjusted R-squared =          .08856 |
| Model test: F[  3,     29] =    2.04,    Prob value =          .13068 |
| Diagnostic: Log-L =    -80.4989, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    2.284, Akaike Info. Crt.=      5.121 |
| Autocorrel: Durbin-Watson Statistic =   1.31138,   Rho =       .34431 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.309621014      1.8333935        1.805   .0814
 POP       .7009272015E-03  .29637972E-03    2.365   .0249  3427.4545
 DIST     -.3618992914E-01  .14822548        -.244   .8088  13.533333
 TAXIFARE -.3079164679      .70250463        -.438   .6644  3.5757576
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,PRIVATE,TAXIFARE$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 239.6291411    , Std.Dev.=        2.87456 |
| Fit:        R-squared=  .220757, Adjusted R-squared =          .14015 |
| Model test: F[  3,     29] =    2.74,    Prob value =          .06143 |
| Diagnostic: Log-L =    -79.5376, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    2.226, Akaike Info. Crt.=      5.063 |
| Autocorrel: Durbin-Watson Statistic =   1.41629,   Rho =       .29185 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  4.090091734      1.8755280       2.181   .0375
 POP       .1290213124E-02  .52008324E-03    2.481   .0192  3427.4545
 PRIVATE  -.2448317059E-01  .18234293E-01   -1.343   .1898  90.454545
 TAXIFARE -.6086576998      .45789974       -1.329   .1941  3.5757576
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,INCOME,SERVICES$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 187.0715070    , Std.Dev.=        2.53983 |
| Fit:        R-squared=  .391667, Adjusted R-squared =          .32874 |
| Model test: F[  3,     29] =    6.22,    Prob value =          .00214 |
| Diagnostic: Log-L =    -75.4522, Restricted(b=0) Log-L =     -83.6532 |
|             LogAmemiyaPrCrt.=    1.979, Akaike Info. Crt.=      4.815 |
| Autocorrel: Durbin-Watson Statistic =   1.13085,   Rho =       .43457 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.912082267      5.0775568         .770   .4473
 POP      -.5141252535E-03  .48330304E-03   -1.064   .2962  3427.4545
 INCOME   -.1402653627E-02  .29870755E-02    -.470   .6422  1689.0303
 SERVICES  .1568817568      .53289212E-01    2.944   .0063  27.666667
```

REGRESS;Lhs=TAXISC;Rhs=ONE,PRIVATE,DIST,SERVICES$

```
+--------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 114.9743743    , Std.Dev.=        1.99114 |
| Fit:        R-squared=  .626118, Adjusted R-squared =          .58744 |
| Model test: F[  3,     29] =   16.19,    Prob value =          .00000 |
| Diagnostic: Log-L =    -67.4203, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    1.492, Akaike Info. Crt.=      4.329 |
| Autocorrel: Durbin-Watson Statistic =   1.61746,   Rho =       .19127 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.818959322      1.2074160        3.163   .0036
 PRIVATE  -.5770422872E-01  .12681816E-01   -4.550   .0001  90.454545
 DIST     -.1189328920      .65601945E-01   -1.813   .0802  13.533333
 SERVICES  .2577622064      .38740296E-01    6.654   .0000  27.666667
```

REGRESS;Lhs=TAXISC;Rhs=ONE,POP,SERVICES,EMPLOYME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 158.9675380    , Std.Dev.=        2.34129 |
| Fit:        R-squared=  .483058, Adjusted R-squared =          .42958 |
| Model test: F[  3,     29] =    9.03,    Prob value =          .00022 |
| Diagnostic: Log-L =    -72.7661, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    1.816, Akaike Info. Crt.=      4.652 |
| Autocorrel: Durbin-Watson Statistic =   1.48276,   Rho =       .25862 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.280349652      .89915407       1.424   .1651
 POP      -.1300843072E-02  .51035723E-03   -2.549   .0164  3427.4545
 SERVICES  .1073268913      .51974381E-01    2.065   .0480  27.666667
 EMPLOYME     .5824250684E-02     .25095182E-02        2.321       .0275
743.45455
```

REGRESS;Lhs=TAXISC;Rhs=ONE,PRIVATE,DIST,EMPLOYME, SERVICES$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = TAXISC   Mean=   4.121212121    , S.D.=   3.099975562     |
| Model size: Observations =      33, Parameters =   5, Deg.Fr.=     28 |
| Residuals:  Sum of squares= 100.9027352    , Std.Dev.=        1.89833 |
| Fit:        R-squared=  .671877, Adjusted R-squared =          .62500 |
| Model test: F[  4,     28] =   14.33,    Prob value =          .00000 |
| Diagnostic: Log-L =    -65.2662, Restricted(b=0) Log-L =     -83.6532 |
|            LogAmemiyaPrCrt.=    1.423, Akaike Info. Crt.=      4.259 |
| Autocorrel: Durbin-Watson Statistic =   1.78839,   Rho =       .10581 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  3.414885141      1.1691602       2.921   .0068
 PRIVATE  -.6131754671E-01  .12228215E-01   -5.014   .0000  90.454545
 DIST     -.1221356732      .62565283E-01   -1.952   .0610  13.533333
```

EMPLOYME .3280456662E-02 .16601006E-02 1.976 .0581
743.45455

SERVICES .1975955477 .47866862E-01 4.128 .0003 27.666667

REGRESS;Lhs=BUSESC;Rhs=ONE,POP$

+---+

| Ordinary least squares regression Weighting variable = none |

| Dep. var. = BUSESC Mean= 1.818181818 , S.D.= .6351449369 |

| Model size: Observations = 33, Parameters = 2, Deg.Fr.= 31 |

| Residuals: Sum of squares= 12.39870052 , Std.Dev.= .63242 |

| Fit: R-squared= .039537, Adjusted R-squared = .00855 |

| Model test: F[1, 31] = 1.28, Prob value = .26729 |

| Diagnostic: Log-L = -30.6729, Restricted(b=0) Log-L = -31.3385 |

| LogAmemiyaPrCrt.= -.858, Akaike Info. Crt.= 1.980 |

| Autocorrel: Durbin-Watson Statistic = 1.59218, Rho = .20391 |

+---------+--------------+----------------+--------+---------+----------+

|Variable | Coefficient | Standard Error |t-ratio |P[|T|>t] | Mean of X|

+---------+--------------+----------------+--------+---------+----------+

Constant 1.577911885 .23949680 6.588 .0000

POP .7010156664E-04 .62055991E-04 1.130 .2673 3427.4545

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,PRIVATE$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 11.91287720    , Std.Dev.=         .63016 |
| Fit:        R-squared=  .077171, Adjusted R-squared =          .01565 |
| Model test: F[  2,     30] =    1.25,    Prob value =          .29979 |
| Diagnostic: Log-L =    -30.0133, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=    -.837, Akaike Info. Crt.=      2.001 |
| Autocorrel: Durbin-Watson Statistic =   1.52846,   Rho =       .23577 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.528418506      .24279717        6.295   .0000
 POP      -.2761215560E-04  .10783128E-03    -.256   .7996  3427.4545
 PRIVATE   .4249678312E-02  .38420639E-02    1.106   .2775  90.454545
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,DIST$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 8.650236043    , Std.Dev.=         .53697 |
| Fit:        R-squared=  .329911, Adjusted R-squared =          .28524 |
| Model test: F[  2,     30] =    7.39,    Prob value =          .00247 |
| Diagnostic: Log-L =    -24.7328, Restricted(b=0) Log-L =     -31.3385 |
|             LogAmemiyaPrCrt.=   -1.157, Akaike Info. Crt.=      1.681 |
| Autocorrel: Durbin-Watson Statistic =   1.96128,   Rho =       .01936 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.373385777      .30004408        7.910   .0000
 POP       .8497567842E-04  .52851445E-04    1.608   .1183  3427.4545
 DIST     -.6254587960E-01  .17347039E-01   -3.606   .0011  13.533333
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,DIST,SERVICES$

```
+----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 8.648799002    , Std.Dev.=         .54611 |
| Fit:        R-squared=  .330023, Adjusted R-squared =          .26071 |
| Model test: F[  3,     29] =    4.76,    Prob value =          .00808 |
| Diagnostic: Log-L =    -24.7300, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=   -1.095, Akaike Info. Crt.=      1.741 |
| Autocorrel: Durbin-Watson Statistic =   1.96811,   Rho =       .01594 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.377568125      .31103942        7.644   .0000
 POP       .9065180229E-04  .97854568E-04     .926   .3619  3427.4545
 DIST     -.6276937602E-01  .17933517E-01   -3.500   .0015  13.533333
 SERVICES -.7450247945E-03  .10732851E-01    -.069   .9451  27.666667
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,DIST,EMPLOYME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 8.468273906    , Std.Dev.=         .54038 |
| Fit:        R-squared=  .344007, Adjusted R-squared =          .27615 |
| Model test: F[  3,     29] =    5.07,    Prob value =          .00605 |
| Diagnostic: Log-L =    -24.3820, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=   -1.117, Akaike Info. Crt.=      1.720 |
| Autocorrel: Durbin-Watson Statistic =   1.90729,   Rho =       .04636 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.440234409      .31359704        7.781   .0000
 POP       .1660693469E-03  .11568123E-03    1.436   .1618  3427.4545
 DIST     -.6561240518E-01  .17884035E-01   -3.669   .0010  13.533333
 EMPLOYME   -.4079512097E-03     .51679245E-03         -.789       .4363
743.45455
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,DIST,TAXIFARE$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 8.565222181    , Std.Dev.=         .54346 |
| Fit:        R-squared=  .336497, Adjusted R-squared =          .26786 |
| Model test: F[  3,     29] =    4.90,    Prob value =          .00708 |
| Diagnostic: Log-L =    -24.5698, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=   -1.105, Akaike Info. Crt.=      1.732 |
| Autocorrel: Durbin-Watson Statistic =   1.86542,   Rho =       .06729 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.451375581      .33667023       7.281   .0000
 POP       .9036406405E-04  .54424882E-04    1.660   .1076  3427.4545
 DIST     -.5138660662E-01  .27218981E-01   -1.888   .0691  13.533333
 TAXIFARE -.6921062340E-01  .12900252       -.537   .5957  3.5757576
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,TAXIFARE,INCOME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 9.615949061    , Std.Dev.=         .57583 |
| Fit:        R-squared=  .255103, Adjusted R-squared =          .17804 |
| Model test: F[  3,     29] =    3.31,    Prob value =          .03383 |
| Diagnostic: Log-L =    -26.4791, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=    -.989, Akaike Info. Crt.=      1.847 |
| Autocorrel: Durbin-Watson Statistic =   1.54287,   Rho =       .22856 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.465643005      1.0573438        2.332   .0269
 POP       .1000535654E-03  .57543755E-04    1.739   .0927  3427.4545
 TAXIFARE -.2537258139      .90574315E-01   -2.801   .0090  3.5757576
 INCOME   -.4921654329E-04  .64111397E-03    -.077   .9393  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,PRIVATE,EMPLOYME, INCOME$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 11.73299625    , Std.Dev.=         .63607 |
| Fit:        R-squared=  .091106, Adjusted R-squared =         -.00292 |
| Model test: F[  3,     29] =     .97,    Prob value =         .42071 |
| Diagnostic: Log-L =    -29.7623, Restricted(b=0) Log-L =     -31.3385 |
|             LogAmemiyaPrCrt.=    -.790, Akaike Info. Crt.=      2.046 |
| Autocorrel: Durbin-Watson Statistic =   1.45489,   Rho =       .27255 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.298173444      1.1872933       1.936   .0627
 PRIVATE   .4368340223E-02  .34102531E-02    1.281   .2104  90.454545
 EMPLOYME   -.1403358789E-03     .42808504E-03         -.328        .7454
743.45455
```

```
 INCOME   -.4563532739E-03  .68966685E-03    -.662   .5134  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,POP,DIST,INCOME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 8.607784189    , Std.Dev.=         .54481 |
| Fit:        R-squared=  .333200, Adjusted R-squared =          .26422 |
| Model test: F[  3,     29] =    4.83,    Prob value =          .00757 |
| Diagnostic: Log-L =    -24.6516, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=   -1.100, Akaike Info. Crt.=      1.736 |
| Autocorrel: Durbin-Watson Statistic =   1.92993,   Rho =       .03503 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.735956883      1.0058910       2.720   .0109
 POP       .8693781460E-04  .53873304E-04    1.614   .1174  3427.4545
 DIST     -.6178318310E-01  .17715412E-01   -3.488   .0016  13.533333
 INCOME   -.2247550346E-03  .59430281E-03    -.378   .7080  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,PRIVATE,SERVICES, INCOME$

```
+--------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369    |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 11.72614624    , Std.Dev.=         .63589 |
| Fit:        R-squared=  .091637, Adjusted R-squared =        -.00233 |
| Model test: F[  3,     29] =     .98,    Prob value =         .41790 |
| Diagnostic: Log-L =    -29.7526, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=    -.791, Akaike Info. Crt.=      2.046 |
| Autocorrel: Durbin-Watson Statistic =   1.47629,   Rho =       .26186 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.382578035      1.2439326       1.915   .0654
 PRIVATE   .4753231202E-02  .41402585E-02    1.148   .2603  90.454545
 SERVICES -.4538288951E-02  .12863461E-01    -.353   .7268  27.666667
 INCOME   -.5143710303E-03  .72227908E-03    -.712   .4821  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,SERVICES,INCOME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 12.25908863    , Std.Dev.=         .63925 |
| Fit:        R-squared=  .050352, Adjusted R-squared =        -.01296 |
| Model test: F[  2,     30] =     .80,    Prob value =         .46072 |
| Diagnostic: Log-L =    -30.4860, Restricted(b=0) Log-L =     -31.3385 |
|             LogAmemiyaPrCrt.=    -.808, Akaike Info. Crt.=      2.029 |
| Autocorrel: Durbin-Watson Statistic =   1.58800,   Rho =       .20600 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.060930822      1.2183782        1.692   .1011
 SERVICES  .7912226097E-02  .69544174E-02    1.138   .2642  27.666667
 INCOME   -.2733248331E-03  .69474195E-03    -.393   .6968  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,DIST,EMPLOYME,INCOME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 9.057350107    , Std.Dev.=         .55886 |
| Fit:        R-squared=  .298374, Adjusted R-squared =          .22579 |
| Model test: F[  3,     29] =    4.11,    Prob value =          .01513 |
| Diagnostic: Log-L =    -25.4916, Restricted(b=0) Log-L =     -31.3385 |
|             LogAmemiyaPrCrt.=   -1.049, Akaike Info. Crt.=      1.787 |
| Autocorrel: Durbin-Watson Statistic =   2.02580,   Rho =      -.01290 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.641913248      1.0497336       2.517   .0176
 DIST     -.5931958790E-01  .18140914E-01   -3.270   .0028  13.533333
 EMPLOYME     .2500844310E-03     .24576178E-03        1.018       .3173
743.45455
 INCOME   -.1224762418E-03  .60686943E-03    -.202   .8415  1689.0303
```

REGRESS;Lhs=BUSESC;Rhs=ONE,PRIVATE,EMPLOYME, TAXIFARE$

```
+-------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   4, Deg.Fr.=     29 |
| Residuals:  Sum of squares= 9.676708976    , Std.Dev.=         .57765 |
| Fit:        R-squared=  .250396, Adjusted R-squared =         .17285 |
| Model test: F[  3,     29] =    3.23,    Prob value =         .03679 |
| Diagnostic: Log-L =    -26.5830, Restricted(b=0) Log-L =     -31.3385 |
|            LogAmemiyaPrCrt.=    -.983, Akaike Info. Crt.=      1.854 |
| Autocorrel: Durbin-Watson Statistic =   1.49174,   Rho =       .25413 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.322285889      .37868694       6.132   .0000
 PRIVATE   .3435764293E-02  .30906932E-02    1.112   .2754  90.454545
 EMPLOYME   -.7042080352E-05     .38922542E-03         -.018       .9857
743.45455
```

```
 TAXIFARE -.2264272912      .87519936E-01   -2.587   .0150  3.5757576
```

REGRESS;Lhs=BUSESC;Rhs=ONE,SERVICES,INCOME$

```
+-----------------------------------------------------------------------+
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSESC   Mean=   1.818181818    , S.D.=   .6351449369     |
| Model size: Observations =      33, Parameters =   3, Deg.Fr.=     30 |
| Residuals:  Sum of squares= 12.25908863    , Std.Dev.=         .63925 |
| Fit:        R-squared=  .050352, Adjusted R-squared =         -.01296 |
| Model test: F[  2,     30] =     .80,    Prob value =          .46072 |
| Diagnostic: Log-L =    -30.4860, Restricted(b=0) Log-L =     -31.3385 |
|             LogAmemiyaPrCrt.=    -.808, Akaike Info. Crt.=      2.029 |
| Autocorrel: Durbin-Watson Statistic =   1.58800,   Rho =       .20600 |
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |t-ratio |P[|T|>t] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  2.060930822      1.2183782        1.692   .1011
 SERVICES  .7912226097E-02  .69544174E-02    1.138   .2642  27.666667
 INCOME   -.2733248331E-03  .69474195E-03    -.393   .6968  1689.0303
```

APPENDIX F

International Criteria in Evaluation the Competition in Bus Service

Relevant International Procedure Regarding Fare Regulations

International Criteria in Evaluation the Competition in Bus Service

Competitive tendering has been recently widely applied in many cities around the world, such as Helsinki, London, Copenhagen, and Stockholm. The experience revealed many benefits in as far as cost savings, improved quality of service, network expansion, congestion reduction, improvement in safety and environmental measures, and enhanced customer satisfaction.

In Helsinki, for example, the official body responsible for the regional public transport services is Helsinki Metropolitan Area Council (YTV). YTV has set the following targets for competitive tendering reduction the cost of transport, improvement in service level, added impetus to the increase in productivity gained from using operators, etc,.

In tendering invitation, YTV specifies certain requirements regarding the operator, the bus fleet, and the service quality. The operator must fulfill or submit the following to YTV *(Helsinki Metropolitan Area Council , 2003)*:

- The applicant must be entitled under the Passenger Transport Act to operate bus service,
- The person who would be responsible for the bus services must fulfill the conditions stipulated by law,
- Financial statements for the previous three financial years,
- A certificate from the taxation authorities stating that the applicant has no tax debts,

- Notification confirming that employees' pension contributions have been paid,
- A staffing plan and any personnel accounts, and
- Accident statistics.

The tender requirements specified for the bus fleet include: the number of seats, the spacing of seats, the number of doors, and various vehicle properties affecting level of service, such as places for disabled persons, safety equipment, illuminated and informative signs, lighting, etc. YTV has also classified vehicles into four categories (low-floor buses, semi-low-floor buses, bogie buses, and articulated buses). Particular types of bus can be specified in the tender for different services.

The quality requirements for bus service provision specified in the tender invitation include:

- Quality control programme for the operator
- Quality of customer service, such as provision of information, procedure for service interruptions, and driver uniforms.
- Quality of service provision, such as service reliability, use of route number displays, and driving practices.
- Technical quality, such as vehicle condition and cleanliness.

YTV carries out a customer satisfaction survey twice a year, on the basis of which the best services are paid a quality bonus.

YTV follows a two-stage process in awarding tenders. At the first stage, applicants, who for financial or other operational reasons, are not expected to fulfill the tender specifications are rejected. To make this decision, YTV commissions external consultants to conduct financial analysis of the information provided by the applicants. Generally, applicants fulfill the requirements concerning financial and technical performance.

At the second stage of the process, the tenders submitted by approved applicants are compared. The contract is awarded to the applicant whose bid would produce the lowest tender price. In this overall financial evaluation, different factors are weighted as follows:

- The lowest tender price is given 87 points. The points given to the other tender prices are calculated in relation to this.
- The bus fleet can receive up to 2 points. The points given depend on certain properties of the vehicle, such as low floor, nitrous oxide and particle emissions, noise, additional doors, number of seats, and seat spacing.

Evaluation of bids is carried out by first evaluating the fleet and the quality factors. Only then are the tender prices examined and the overall costs of the bid calculated. The principles on which the tender is awarded have remained almost unchanged throughout the period of competitive tendering. Initially the age of the fleet was also a factor in the evaluation, but this was removed and replaced with a requirement of the maximum average age of bus fleet. The concession period of this type of tendering usually varies from three to five years.

Relevant International Procedure Regarding Fare Regulations

1. London, U.K.

Bus fares are set by the Mayor of London. Flat fares are introduced across the entire bus network, to make fares simpler, quicker, and easier. The annual increases in bus fares aimed at paying for public transport renewed and meet revenue target.

Taxi fares are usually reviewed each year. The new tariff rates largely depend on the "cost of living index" which looks at the various costs associated with being a licensed taxi driver and running a taxi, such as vehicle parts, fuel servicing, etc. These figures are then compared with the national earnings to give a target percentage, so driver's net earnings increase in line with the national average. The following Table shows the cost pence per mile of each cost component in 2003 and 2004. From Table, the proposed taxi fare increase was 2.8%. This figure represents the annual increase in the operating costs and the average national earnings.

Cost P Per Mile of Each Cost Component in 2003 and in 2004

Component of index	Cost p per mile in 2003	Proportion of costs in 2003	Cost p per mile in 2004	Increases in costs in 2004
Vehicle cost	21.85	11.5%	22.12	1.3%
Parts	14.29	7.5%	14.65	2.5%
Garage and servicing	21.97	11.5%	22.77	3.7%
Fuel	14.98	7.9%	15.46	3.3%
Insurance	15.98	8.4%	15.74	-1.5%
Miscellaneous	1.66	0.9%	1.69	1.9%
The knowledge	9.19	4.8%	9.52	3.6%
Social costs	4.71	2.5%	4.88	3.6%
Total Operating Costs	**104.62**	**55%**	**106.84**	

Average national earnings	85.60	45%	88.68	3.6%
Grand Total	**190.23**	**100%**	**195.53**	
Annual				**2.8%**

Source: Transport for London, 2005

2. Singapore

The Public Transport Council (PTC) in Singapore put in place a framework to cap overall fare increases in smaller, regular steps. From 2005, the annual fare adjustment were based on the new formula recommended by Government as follows *(MOT, Singapore, 2005)*:

$$Maximum\ \ fare\ adjustment = 0.5 \times CPI + 0.5 \times WI - 0.3\%$$

Where

CPI = change in Consumer Price Index over the preceding year

WI = change in Average Monthly Earnings (Annual National Average) over the preceding year

0.3% = The productivity extraction based on a sharing of productivity gains achieved by public transport operators

The PTC instituted a mechanism to ensure that volatile fuel prices do not have a significant effect on public transport fares. Each operator is required to build up its own Fuel Equalization Fund (FEF) over the years, up to a target level that is at least equal to the cost of one year's fuel consumption based on the reference fuel prices set by the PTC on a yearly basis. As and when the operator may draw down their FEF to reduce the impact of sharp temporary increases in fuel prices, thereby enabling the operators to tide over periods of higher fuel prices without increasing fares.

3. India

The Association of State Road Transportation Undertakings (ASRTU) found that the cost of labor and fuel formed the major cost elements, which when not properly reflected in the fare structure caused serious financial imbalance in the State Transportation Units (STU) . The ASRTU advocated a policy to empower the STUs to automatically revise the passenger fares as and when the price of diesel was increased and to adjust the increase in the dearness allowances on the wage component on a yearly basis. It also formulated a fare adjustment formula keeping with the base data as 1st April 1998 *(Tata Energy Research Institute, India, 2002).*

ASRTU arrived at a formula of $18\ paisa + [(RP \div BP) \times 5.4]$ where RP is the revised price and BP is the base price of diesel as on 1.4.98. Similarly for annual revision of Dearness Allowance (DA) the ASRTU suggested a model by which it arrived an increase of one paisa in passenger fare for every 12 point increase in DA, based on the neutralization point of 16.

(The revised Central DA point -16) × W, where W = 1000 paisa ÷ (BU×S×L) where S is the average number of seats (not less than 55) and L is the state average load factor and staff ratio of 7.5 per bus.

4. Australia

The proposed fare increase percentage is usually based on comparing the actual costs of any year to the actual costs in the preceding year. The summation of the percentage change for all components is calculated based on their sign (either positive or negative). As a result, the net percentage value presents the proposed fare increase. The operating costs include fixed costs (e.g., depreciation, registration, licensing, insurance), variable non-labor costs (e.g., fuel, tires, maintenance), and variable labor costs.

The Canberra Taxi Commission proposed the following formula to calculate the taxi fare based on an average distance traveled and including flag fall, radio fee, and waiting time element.

$$Taxi\ \ fare = \left[A + \left(8.8 \times B\right) + C + D\right] \times r$$

Where

A = flag fall, currently $2.9

B = rate 1 distance fare, currently $1.005 per km (from 6.00am to 9.00pm)

C = waiting time for one minute (40 cents per minute)

D = radio fee (phone booking charge) = 60 cents

r = the proposed fare increase (net percentage of change in fixed, variable non-labor, and variable labor costs with respect to preceding year)

The 8.8 average trip kilometer used in the formula is based on observation of the average distance traveled by taxis in Canberra.

جامعة النجاح الوطنية
كلية الدراسات العليا

تقييم اثر سياسة وزارة النقل والمواصلات في مجال المواصلات العامة في فلسطين

اعداد
امجد زهدي فتحي عيسى

اشراف
أ.د. سمير عبدالله ابو عيشة

قدمت هذه الاطروحة استكمالا لمتطلبات درجة الماجستير في هندسة الطرق والمواصلات بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين
2006

تقييم اثر سياسة وزارة النقل والمواصلات
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الملخص

ان تقييم سياسة وزارة النقل والمواصلات فيما يتعلق بقطاع النقل العام، ودراسة تاثير هذه السياسة ونتائجها يعتبر من الامور الهامة والحيوية. وبنظرة عامة وشاملة نجد أن هذا القطاع غير مؤهل حاليا ويعاني من سوء التنظيم، وذلك فيما يتعلق باعداد المركبات العمومية (التاكسيات المشتركة) والتي تعاني من وجود فائض كبير. وكذلك الامر بالنسبة للباصات والتي تعاني من تداخل في الخطوط وتنافس مع الوسائل الاخرى وخاصة التاكسيات المشتركة وعدم صلاحية نسبة كبيرة من هذه الباصات للنقل العام بعد ان تجاوزت اعمارها 15 عاما وعدم الاهتمام بصيانتها بالشكل المطلوب. واخيرا فان اجرة النقل العام والمحددة من قبل وزارة النقل والمواصلات لا يتم الالتزام بها من قبل المشغلين (حيث يتم جباية حوالي 50% من الاجرة الحقيقية) وذلك طمعا منهم في استقطاب الركاب وجذبهم من الوسائل الاخرى.

وقد هدفت الدراسة إلى تقييم وتحليل السياسات الحالية لوزارة النقل والمواصلات في مجال المواصلات العامة وذلك بهدف مساعدة الوزارة في تطوير الأنظمة والقوانين من خلال التوصيات الملائمة. وقد تم تقييم عدد التاكسيات المشتركة الموجودة حاليا والتي تخدم القرى والبلدات المحيطة بمدينة نابلس، بالإضافة إلى تقييم السياسات المتعلقة بإعطاء امتيازات الخطوط للباصات ومسائل الاجرة والاذون للتاكسيات المشتركة.

اقتصرت الدراسة على محافظة نابلس وذلك بحصر خطوط الباصات والتاكسيات المشتركة والتي تربط ما بين مركز المحافظة (مدينة نابلس) والقرى والبلدات المحيطة بها، وقد تمت الدراسة على (33) خطا خارجيا تخدم حوالي (45) تجمعا سكانيا. وقد تم جمع المعلومات اللازمة من خلال وزارة النقل والمواصلات، الجهاز المركزي للاحصاء الفلسطيني، والمسح الميداني.

وقد توصلت الدراسة إلى ما يلي:

1. فيما يتعلق بالنموذج الرياضي لعدد التاكسيات المشتركة اللازمة:

- تم التوصل الى صيغة رياضية منفردة تصف العوامل التي تلعب دورا هاما في تحديد عدد التاكسيات المشتركة اللازمة لخدمة خط معين ما بين المدينة والقرية وهي: عدد المركبات الخاصة، المسافة، عدد المؤسسات الخدماتية، واخيرا عدد الايدي العاملة (فوق 15 سنة).
- تم استخدام برنامج LimDep version 7.0 في بناء النموذج الرياضي وفي التحليل الإحصائي لها.

2. فيما يتعلق باعداد الاذون الممنوحة من قبل وزارة النقل والمواصلات:

تم تحليل سياسة وزارة النقل والمواصلات فيما يتعلق بالاعداد الكبيرة لاذون التاكسيات المشتركة والممنوحة من قبل الوزارة وما نتج عن ذلك من فائض كبير في اعدادها داخل المناطق الحضرية ومن والى المناطق الريفية. وقد بررت الوزارة كثرة اعداد الاذون الممنوحة الى الاوضاع الاقتصادية والمعيشية الصعبة خلال فترة الانتفاضة الثانية. وقد توصلت الدراسة الى ان منح الاذون يجب ان يكون مبنيا على اسس علمية هي الحاجة الفعلية لهذا العدد وحسب الطلب.

3. اما بالنسبة لتقييم الامتيازات الممنوحة لشركات الباصات العاملة منذ الانتداب البريطاني والحكم الاردني للضفة الغربية والمصري لقطاع غزة، فقد توصلت الدراسة الى وجوب مراقبة ومتابعة هذه الشركات والتأكد من انها تعمل حسب شروط الامتياز المنوح لها فيما يتعلق بتوفير الاعداد المطلوبة من الباصات، الاجرة، المواعيد، جودة الخدمة، النظافة، ..الخ. وكذلك وجوب معاقبة أي شركة لا تلتزم بهذه الشروط وحرمانها من امتيازها بعد استنفاذ كل السبل القانونية واعادة طرح الخط العاملة عليه للتنافس بين الشركات الاخرى.

4. واخيرا وفيما يتعلق بموضوع اجرة النقل العام، فقد توصلت الدراسة الى ان المعادلة المعتمدة من قبل الوزارة حاليا جيدة ويجب تطبيقها مع الاخذ بعين الاعتبار زيادة اسعار الوقود، تكاليف الصيانة، واجرة السائقين والتي تشكل الوزن الاكبر في المعادلة. اضافة لذلك يجب ان تتناسب الاجرة مع معدل الدخل الشهري ومستوى غلاء المعيشة.

وحتى يتم الاستفادة من هذه الدراســـة بالشــكل المطلوب، يجب ان يتم تبني التوصيات الواردة فيها من قبل الجهات الرسمية المختصة وتطبيق ما ورد فيها من خلال وضع الاليات والخطــط المناسبة للنهوض بقطاع المواصلات العامة وتنظيمه بالشكل المطلوب.