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The Demand Determinants for Urban Public Transport Services: A Review of the Literature

INTRODUCTION

Mobility is an essential part of human life especially in cities. Indeed mobility is perceived as a right especially in large cities in developed economies (Albalate and Bel, 2010). Public Transport1 (PT), mainly resulted from rapid urbanization, population growth, modern life styles, economic conditions, etc., is one of the most commonly used transport modes that provide the mobility required in our time. Methods that provide mobility not only influence the degree of flexibility but also how quality people's lives would be. Therefore, the way that PT services are delivered and how high qualities they have are important because of their effect both on the attitude and behavior of travelers and the demand for services.

PT services are mostly delivered either by private or public organizations. Regardless of the party that delivers them, PT services require substantial investments and high operating costs. A PT service supplier has to consider various factors including service productivity and efficiency (Barnum *et al*., 2007; De Borger and Kerstens, 2006), both of which are closely related and linked to PT demand2. Avoiding undesired costs such as traffic congestion and environmental costs (e.g., pollution) are also among the primary objectives of the public authorities and policy makers. The achievement of those aims is associated with the level of demand obtained for PT services. Therefore, the basic problem for the decision makers is, on one side, how to deliver them most effectively and efficiently in order to increase customer satisfaction so that those services attract as many people to be sufficient as to reach the predefined goals; on the other side, how to minimize the operational, environmental and other (e.g., social) costs. PT operators.

PT organizations have to utilize organizational resources effectively and efficiently and maximize the demand for services. Because of the close interrelations between these two issues, only one cannot enable the organization to achieve its goals. Therefore, the issue of demand and the factors affecting it are concerned very much by the PT operators and decision makers.

Without understanding the system dynamics and more importantly, the behaviors of public travelers, it would be too difficult to make accurate forecasts, which are necessary for marketing, service planning and fare policy purposes (Polat, 2007; Taylor and Camilla, 2012). In this sense, it should firstly be known the factors that affect the PT demand, which has both physical and behavioral dimensions.

The PT issue has been studied extensively from several aspects and the current literature makes great emphasis on the factors that influence the demand. There take place some comprehensive and collaborative studies on the subject, one of which is the inclusive report by Balcombe *et al*. (2004), also known as TRL Report. The study covered the surface urban transport in Great Britain but international sources and examples were also used extensively. The aims of the study were to research and analyze by using primary and secondary data sources on the factors that influence the demand, produce quantitative indications of how these factors influence the demand, provide accessible information on such factors for key stakeholders such

as PT operators and central and local government and produce a document that assist in identifying cost-effective schemes in order to improve services. The study provides practical guidance on demand estimation especially for operating planners and demand forecasters. However, most of the studies in the area seem to be carried out by transport or environmental sciences point of view with engineering perspective and most are insufficient to bring out and catch the brink of the demand drivers. Some studies are seen to have caught the focus but the area is so diverse that it is rarely possible to see the demand driving factors comprehensively especially from the demand management point of view. What it lacks in many of those studies is the evaluation of demand-affecting factors and putting them altogether to serve decision makers, modelers and other relevant parties especially from the (demand) management point of view.

The purpose of this study is to review the current literature on the demand determinants of PT services in urban domain for operational purposes and to summarize the main findings that may contribute especially to those who work in operational decision-making, demand forecast modeling, demand management, PT marketing, etc. Demand determinants are needed for variety of decision situations including determining the variables for modeling and forecasting PT demand. Therefore; local authorities, PT operators, transport planners, PT marketers, operating planners and researchers need to know which factors, in what way and in which importance affect the demand. Towards the specific purposes of the paper, it is organized in four main parts. The second part discusses the main characteristics of PT demand; the third part discusses the demand determinant factors under several subtitles and presents the findings from the literature and the final part is the summary and conclusion.

SOME MAJOR CHARACTERISTICS OF PUBLIC TRANSPORT DEMAND

PT, also called public transportation, public transit and mass transit, is a collective form of transport other than private car or taxi, which comprises all transport systems in which passengers do not travel in their own vehicles. It includes transport modes such as bus, coach, tram, metro, rail etc. Broadly speaking, PT refers to any system that transports members of the general public.

PT services are specific and important. They are among the very basics of people's lives in modern times and that is why they are not only demanded but also required by people. That is why public authorities are required to provide PT services when there are no private companies that supply it. In terms of their effects as well, PT services are more than simple transport services. It is the very basic instrument of mobility for a big percent of the population almost in all countries, where it forms one of the driving forces of economic and social life. Mobility is inevitable and much of it is provided by PT in many countries whether developed or undeveloped. People's mobility increases with modern life, so does the need for transportation and, in turn, the demand for PT even in developed countries. For instance, Balcombe *et al.* (2004) reported that overall trends indicate that the absolute volume of public transport demand, in terms of passenger-km, is still growing in western Europe and North America, in three main PT modes (bus and coach, metro and tram, rail) although the opposite is claimed by Taylor and Camilla (2012) (n/a) for North America but such claims are rare. Based on its significance, it is a matter of public policy for many local or, even, national governments, which are required to meet the transport needs of people and other issues as well such as to reduce environmental externalities.

The nature of PT services shapes their own demand characteristics and vice-versa. Those characteristics are essential to be known in prior in order to better understand the factors that affect the demand.

Firstly, the PT environment is dynamic and even interactive. It includes a combination of alternative transport modes, various types of passengers (e.g., students, workers and leisure travelers) and passengers with different travel purposes, different travel frequencies and different travel times. The existence of various transport modes makes it available transition between those modes for passengers. In such an environment, the demand is also dynamic (Matas, 2004) and volatile. However, it is in balance as a whole. Secondly, PT demand is time-dependent (Hauer, 1971). In general it is higher and even more condensed in the morning and evening times while it is sparse in the remaining times of the day. While the rush hour demand mainly comes from the workers and students, the remaining demand comes from the parties such as shoppers, leisurers and other travelers. Thirdly, different traveler types have different expectations from the PT services based on the travel time and purpose. The level and type of expectations shape demand differently. For instance, as the quality of services is one of the main determinants of the demand, that on the route does not depend on the service quality especially in rush hours; if not in regular times (Hauer, 1971). Also, the time and the purpose of travel also have different effects on the level of expectations and, in turn, on demand. A traveler using PT for work and leisure in different times of the day may require different level of service quality. In many cases due to the availability of limited number of vehicles in service and passengers' having short of time, the service quality becomes out of a major issue for many especially in large cities. Also the availability of alternative transport modes is a main factor on PT demand. For instance, in a metropolitan city such as Ankara, a city with about 5 million inhabitants, many people have no other alternative transport medium to use or time especially in rush hours, in which cases managing getting to work takes the highest priority than the service quality) (Hauer, 1971). However, service quality is still an important cause determining the demand.

Although, this is a review study, it is still impossible for such a study to comprehend all the work in the area, where the literature is vast and immense. However, in order to display a comprehensive picture, the demand determinant factors, whether or not they are quantifiable and measurable, at least for today, have to be identified from the literature and put into exhibition. This study's intent is to make a review in such a way that would bring the main factors into attention and put them into a specific frame. Because decision-making and modeling depend on individual abilities and talents as much as knowledge that one holds, it is our primary preference to detect the demand determinant factors for PT and leave them with the decision-makers and researchers, letting them how they decide to use.

The factors influencing the PT demand have received considerable attention in the literature but in different contexts. Price and time elasticities3, modal choice and externalities internalization have been the leading topics in the recent literature on urban public transport demand. (Albalate and Bel, 2010). As may be expected, most of the studies focused only some aspects of the issue, especially those which are concentrated on exploring the effect of specific factors such as price and time elasticities; of course, no single study could comprehend all the demand determinant factors in a single context. In order to being able to see the whole picture at a time, the issue has to be taken in a much broader context and literature review studies are those that are needed in such cases.

The literature has approached to the issue from various aspects including but not limited to, demand sensitivity, the factors affecting multi-mode travel demand, the effect of price issue in urban transportation, etc. In such a wide area of study, it is difficult for decision-makers and academicians to determine which specific factors have the influence on PT demand, which factors should be evaluated first-and of course- without missing any important variable in the light and findings of the literature. Therefore the issue needs to be clarified in essence especially for operating decision-makers, academicians and even strategic managers.

The literature identifies variety of factors which have influence over the PT demand. Surely all of them are not with equal weights in affecting the demand but we need to know in principle what factors we have to affect decisions. Moreover, a specific factor with little weight in a specific decision situation might have a larger effect on another decision domain, which is something that we may not know for sure. It is the expected role of such literature review studies to present a portfolio of matters concerned detected from the literature without judging their relative importance. As the studies that look comprehensively at the issue are very rare mainly due to the specific nature of the subject.

THE FACTORS AFFECTING DEMAND FOR PUBLIC TRANSPORT: FINDINGS FROM THE LITERATURE

There is little doubt that a wide range of factors influences PT demand. The literature includes plenty of empirical evidences of the relevant factors, some of which may be more important than others, in different situations. It can be a formidable task for a PT decision-maker, a demand forecaster or an academician to combine all the factors together, consider and evaluate them with respect to their effects on the decision issue under consideration. Also, as the PT demand is a complex function of all the relevant factors (Balcombe *et al*., 2004) the changes in each of which is likely to affect the decision outcomes, which yield a complex decision situation in each time. In order to explain the demand characteristics and how the changes in the relevant factors affect the demand, it is needed the models that consider all the relevant factors, which are clearly not easy to build. However, the models had developed been imperfect, it is still needed to know which factors are relevant, to be evaluated and to be included in. Then it comes the issue of how well a specific model serves to the needs of the decision-maker or researcher. This part of the paper discusses the relevant factors affecting PT demand.

One of the basic indicators of the demand is the number of total passenger trips taken place in a specific period of time. However, alternative-and commonly used- measures such as passenger-kilometers can also be used (FitzRoy and Smith, 1998). As the first one shows the number of total passengers used PT services directly, the second one is an indirect indicator of the demand, which refers to the frequency of demand and the amount of services offered to meet the underlying demand.

Prior to the detailed discussion of the demand determinant factors, we can list some major attributes of those services like this: Service frequency, walking (access) distance to/from, waiting time, operating speed, reliability, comfort (Hauer, 1971), fare, journey time, mode of travel and service quality (Lythgoe and Wardman, 2002).

Cost of travel: The literature shows that the 'cost' is one of the main determinants of PT demand (Albalate and Bel, 2010). Souche (2010) also pointed to two structural variables that stand out from the others, one of which is the user cost of transport-by public transport and private car. The generalized cost of a journey is the sum of fares charged directly on each leg, plus traveler-specific components associated with a traveler's valuation of his/her own time (Horn, 2004, 2003). Therefore, in PT concept the cost of travel is combined of two main elements, namely fares and time.

Fares: Fares[4] are essential to the supply of PT services since they create a main source of income to operators. The effects of fares on PT patronage are relatively easy to observe. In general, if fares are increased, PT patronage will decrease. The changes in fare prices are the variables with the most direct and powerful influence on patronage (FitzRoy and Smith, 1998; Bonnel and Chausse, 2000; Bresson *et al*., 2003, 2004).

The literature distinguishes the effects of changes in fares between three main terms: namely short-term (1-2 years), medium-term (around 5 years) and long-term (around 10 years or longer) in general. Fares elasticity[5] differs significantly depending on the mode, the time period over

which it is being observed and the specific conditions in which a mode is operating (Balcombe *et al.*, 2004).

Extensive discussions took place on the effects of fares on PT demand, mostly in form of fare elasticities, including but not limited (Bresson *et al.*, 2003, 2004; Nijkamp and Pepping, 1988; Preston, 1998; Goodwin, 1992). Bresson *et al.* (2003) studied estimating fare elasticities for local bus services for a panel of 46 English counties (urban and rural) in the UK. Bresson *et al.* (2004) also calculated elasticities for each urban area by using **panel data** analysis for 62 urban areas in France. Dargay and Hanly (2002) found that bus patronage was relatively fare-sensitive with a wide variation in the elasticities. In their comprehensive study, Balcombe *et al.* (2004) summarized fare elasticities from individual studies, meta-analysis and the Black Book (the first LTR Report edited by Webster and Bly (1980), pointing out noteworthy differences among the elasticity values. From their own study, for instance, Balcombe *et al.* (2004) reported 'bus fare elasticities' averaging around '-0,4' in the short-run, '-0,56' in the medium-run and '-1,0' in the long-run; 'metro fare elasticities' averaging around '-0,3' in the short-run and '-0,6' in the long-run and 'local suburban rail' around '-0,6' in the short-run, taking accepted 'standard' PT fares elasticity value of '-0,3' for short-run, despite the findings revealed significant differences from those of Webster and Bly (1980). Hanley and Dargay (1999) did a detailed review of bus fare elasticities in different countries).

The effect of fares on PT patronage is not similar in all PT modes and in all time frames. Not all the evidences about fare changes explain the changes in demand. Crotte (2008), who studied the factors that characterize travel demand in Mexico City, found that changes in fares did not explain changes in metro demand in Mexico City. He/she detected that service improvements have a more significant effect on patronage than changes in metro fares or gasoline prices, which may be seen as a contradiction to the findings above but the author explained these results with several factors: (1) relatively low level of metro ticket price compared to income of those who even work at a daily minimum wage, (2) metro riders' possible captivity to metro services, (3) metro fares' comparably lower rate than other public transport fares and the fare's being independent of distance travelled, unlike minibus fares, (4) road traffic congestion's making over-ground services considerably slower, (5) bus and minibus services mainly act as feeder routes between the metro and the peripherally located low income neighborhood, rather than as substitutes to metro services, especially for longer journeys, (6) bus and minibus services provide a very low quality of service compared with the metro and may not be considered as viable substitutes.

The majority of the elasticity values, in spite of the differences among, (as summarized in Balcombe *et al.* (2004)are in the same direction, implying that fares increases in the short-run make little effect on the demand and, oppositely, increase revenues. The other studies performed on different countries and various counties also produced parallel but quite different elasticity values. In many of those studies it was found PT fares with higher elasticities albeit having observed some considerable differences among different countries (Nijkamp and Pepping, 1988) and even between smaller and larger cities (Preston, 1998). The findings (the size of elasticity) were tied up to country-specific factors, a finding also supported by Bresson *et al.* (2003), who founded that the demand was less sensitive to changes in factors including income, fares and service in France than in England. Most of those studies, more or less, agree that the changes in fares have relatively a sizeable effect on the PT demand. However, the fare sensitivity is described to be higher in case of price increases than of decreases (mainly for commuters) and when the service is poor than it is good; but riders are approximately twice as sensitive to changes in travel time as they are to changes in fares. Additionally, the response to fare changes increases with the level of fare, so that fare reductions will have a greater impact on demand when fares are high, which suggest that subsidies will be most effective when and where the

fares are high (Bresson *et al*., 2003). Similarly, the fares effect is not same for inward and outward travels to a city. For instance, Lythgoe and Wardman (2002) found the fare elasticity to be lower for inward travels than it is for outward travels (of rail for airport).

Fare elasticities may be affected by the magnitude, direction and level of the fare change. In general, greater fare increases yield higher elasticity values than lower increases; a fare increase and fare decrease may not produce symmetric elasticity values; and the level of the fare relative to people's income may affect fare elasticity. Elasticity values may also change based on trip purposes and traveler types. Those values may be expected to be lower in the peak demand situations (such as work and school trips) than those for off-peak demand situations (leisure, shopping and personal business trips). Additionally, travelers who have access to cars are more responsive to fare changes than those who do not; males are expected to be more sensitive against fare changes than are females and travelers with higher incomes are more likely to be sensitive to fare changes but they are also more likely to absorb the effects of fare increases. Travelers on low income are more likely to be affected by fare changes and, in sum, demand elasticity values are likely to be higher for them than those on higher income travelers. No clear evidence is provided for age groups (Balcombe *et al*., 2004).

An additional point is that the effects of fares may vary with respect to the time frame. It is expected to be greater in the long-run than in the short-run. Also, policy measures aimed at fare reduction (subsidization) can play a substantial role in encouraging the use of PT, which reduce the use of private cars at the same time (Bresson *et al*., 2003). It can be assumed the opposite to be valid as well, meaning that growth in fares may reduce the demand. Matas (2004) presented such an example in which the growth in real fares reduced demand by more than 5% and the introduction of the travel card had an effect of higher than 7% in the Madrid bus market. In explaining the increase in PT demand in the German City of Freiburg. FitzRoy and Smith (1998) also pointed out the importance of the introduction of low-cost, cost transferable season tickets. However, Balcombe *et al*. (2004) concluded that the effects of pre-paid ticketing systems (travelcards or season tickets) show no consistent pattern.

Conversely; if a travel is made by car, the traveler should consider some extra cost components other than fares. In this case total costs are combined not only by fares but also by some other elements including parking costs and other negative externalities coming from owning or using car. For instance, the greater congestion and parking problems in large cities make travel by car less attractive (Bresson *et al*., 2003). However, the other costs such as negative externalities are not as apparent as fares to the user partly due to the fact that car owners pay for other cost indirectly. Car also offer some advantageous and flexibilities over PT and this makes it, as a transport mode, more attractive to the user, because of which the cost of using car is considered lower than that of using PT. Hovell and Jones (1975) point out to the same issue that the perceived cost of the trip to the transporters by car appears less than it would be if undertook by PT certainly until the considerable increases in petrol costs. Regarding the generalized cost of travel, the traveler chooses among the alternative transport modes such as private car, PT or taxi, or among the alternative paths in multi-leg journeys (between origin and destination). The car dominates when car travel is underpriced and supply matches the pressure of demand, even when PT supply is also increased (Bonnel and Chausse, 2000). This is the regulatory role of pricing in urban transport system.

Against the flexibilities offered and the total cost of travel by car, PT is subsidized by public authorities in many countries. However, it is claimed that urban car travel is also under-priced in many European cities (Asensio *et al*., 2003; Bonnel and Chausse, 2000; Newbury, 1988, 1990), which is a significant factor that affect the travel system and PT demand.

The transport literature also sheds light on the influence of pricing policies on the competition among different transport modes, which it exposes how and in what way those

policies influence it. Bonnel and Chausse (2000)study is an example that how transport policies distorted competition between different transport modes and how they promoted the transport demand for some specific modes (e.g., urban car travel when under-priced) in case of France.

The marketing management of PT companies should consider all these together in designing the marketing mix and related strategies (Polat, 2007). In fact it is already known that some railway companies in the UK already use the price tool to manage the demand e.g., to distribute the service demand through different hours of the day, especially during the rush hours by applying higher prices and lower prices at out of rush hours. The price is an effective competition tool and can be utilized in competing among other modes of transport (e.g., private car use).

Travel time: It is one of the most leading factors that influence the use of PT and choice of transport mode. The importance of time comes from its structural attributes. As pointed out by Walle and Steenberghen (2006), unlike price and other factors, the time is an absolute constraint because people cannot increase the time spent on traveling indefinitely (Golob *et al.*, 1972). The term 'travel time' includes several components within the PT frame. Walk (or access) time, waiting time and journey (in-vehicle) time are the three main components of the travel time. Sometimes interchange (connection) time is also added to this list Krkygsman *et al.* (2004). Each of these components has different value for travelers. For a typical PT user, the price includes many of these cost components including access times to service points and final destinations, waiting times at stops and interchanges and travel times at vehicles (Horn, 2003), which all influence the travelers' assessment of PT services.

Service quality: Service quality is also one of the most important determinants of the public travel demand. Balcombe *et al.* (2004), Bresson *et al.* (2003), Francis (2002) Lythgoe and Wardman (2002) and FitzRoy and Smith (1998) are just a few who pointed out to it. FitzRoy and Smith (1998) pointed out the service quality as one of the transport variables with the most direct and powerful influence on patronage. That is why, the PT providers in the UK paid attention to the service quality in order to maintain market share and increase profitability on a deregulated and privatized market (Pullen, 1993). Bresson *et al.* (2003) concluded that service is at least as important as fare, if not more so, claiming that fare increases can be compensated for by equivalent service improvements without affecting patronage.

The term service quality includes but not limited and equivalent to, waiting times and service frequency but it is a more comprehensive than each of these concepts. It includes various prominent attributes of services such as service frequency, walking distance (also called access and egress time), waiting time (service intervals), operating speed, reliability and comfort. FitzRoy and Smith (1998) stated other service quality indicators as the extensions in the bus (tram, underground, etc.) network and effective park-and-ride schemes.

FitzRoy and Smith (1998) made specific emphasis on the quality of PT services. For most goods, the quality of a product is an attribute which is a fixed characteristic. However, in the case of PT services, it is clear that quality is a function of the quantity supplied. Thus a greater supply of vehicle kilometers over a given route network implies, in general, a more frequent service, lower waiting times for customers and greater demand for public transit all else equal. Similarly, a larger route length with a given frequency will reduce travel time to stations as the density of transit coverage rises, also boosting demand for a given fare structure. Crotte (2008) commented on the issue saying that if policy makers want to attract more users to public transport, improvements in quality of service should take precedence over reduction in fares.

Bresson *et al.* (2002) described service quality as a function of transport supply. They pointed out that the service quality of a specific transport mode not only depends on the supply of that mode but also the supply of alternative transport mode. Similarly, service quality and level of demand interact. As the service quality influence the travel demand (Hauer, 1971), the

level of travel demand, in turn, affect the service quality offered. In other words, there is a two-way interaction between variables.

Lythgoe and Wardman (2002) reported different sizes of service quality effects for rail demand for inwards and outwards journeys for airport passengers. This might be due to the fact that the outward passengers may feel that they have more free time to use alternative modes of travel compared to inward passengers, who may face higher costs (or penalties) if they miss their aircraft. A similar image can be assumed for bus passengers when there are alternative modes of travel (e.g. minibuses, green busses and double-decker busses in Ankara), in which case service quality becomes more important for outward passengers than for inward passengers.

One of the factors that increase service quality and influence the level of demand is the integration of PT system, which has been the case for Madrid. Integration includes several issues such as the coordination of service levels, routes and timetables and a common fare system (Matas, 2004). Therefore the more the PT system gets integrated, the higher the service quality and the level of demand become in a city.

Not all the findings on quality are similar. Bresson *et al*. (2004) indicated that, concerning service measures, the quantity (seat km) had a greater impact than quality (frequency of service and network density) for French example; however, most of the studies reported quality to be one of the main factors that influence the PT demand. Below is a more detailed discussion of the components of service quality.

The route length is the indicator of the span of area covered for PT services and is considered one of the service quality indicators. The wider the area covered is, the higher the accessibility of the services and the number of passengers that can use the services are. It means that the route length increases the quality of the services and the demand for them. The quality is treated as an important variable in demand forecast studies. For instance, Matas (2004) entered the route length as the only quality variable in her model for demand forecasting. She found that service quality measured in terms of route length had a positive impact on PT patronage, where the effect of the bus doubles that of the underground.

The other service quality indicator is the service frequency, which refers to how often a PT service is delivered on a specific route in a given period of time. It can be measured in a number of ways: total vehicle kilometers or hours, frequency, headway/service interval, wait time and schedule delay (Balcombe *et al*., 2004). Service frequency influences the PT demand (Francis, 2002) in a way that it determines how much a passenger is likely to wait for. It is an attribute of service quality and reflects the availability of service whenever the need for the trip arises. It is also an indicator of the freedom to choose a departure time so as to reach the destination close to the desired arrival time (Hauer, 1971).

The operating speed is also an attribute and quality indicator of PT services. It is defined to be the ratio of the distance between two points of the route (between which there is at least one stop) and the average time to traverse that distance" (Hauer, 1971). The operating speed is important in the sense that the in-vehicle time, which increases the time component cost of travel, gets longer or shorter as the operating speed increases or decreases, respectively but the capability of increasing operating speed is limited in urban traffic.

Reliability: Reliability refers to the degree of dependability on and trust-ability of passengers in a specific mode of transport and PT services. It also includes features such as accessibility and confidence. Passengers should be able to depend on those services and be able to see that they are obtainable on regular basis and are long termed. Longer waiting times due to late arrival of buses or trains and excessive IVTs due to traffic or system problems reduce reliability, one of the clearest measures of which is the degree of those services' following of time schedules announced. The factors such as service frequency and service capacity, which determine the usability of PT services, also affect the reliability. For instance, the number of

seats available can be considered in this frame. If the service capacity available are insufficient to meet the current demand, travelers are little likely to find those services reliable.

Comfort: Comfort is another indicator of service quality. Although the degree of importance given to it may differ from one group of passengers to another based on the journey time, journey purpose and passenger type, the comfort is a quality factor that should be taken into account. Different transport modes provide different degree of comfort and it is a major factor that influences the demand. For instance, car provides door-to-door transport and is more comfortable and convenient in terms of seating, ventilation and storage capacity (Hovell and Jones, 1975). On the other hand, the comfort ability and convenience offered by other PT modes are more limited compared to car.

Availability and costs of alternative travel modes: PT demand is also closely related to the availability and costs of alternative travel modes. If the number of alternative transport modes is numerous, the passengers are likely to choose among those alternatives. Alternative (public or private) transport modes have a direct influence (on PT demand) but cross-elasticities (i.e., for the fuel price) also have to be considered (Bresson *et al*., 2004). There is a perceptible competition between PT and private car use. Bresson *et al*. (2004) who considered car ownership among the structural factors, specified that the main factor behind lower PT use to be growing car ownership, which can be linked to the growth in economy. Lythgoe and Wardman (2002) also pointed out the cost and availability of alternative transport modes. Needless to say, the costs of alternative transport modes (besides that of PT) can also be very influential in the use of PT services.

The time of travel: Time of travel is already known to be an important factor on PT demand. Especially in work trips, journeys are made in certain times of the day. Morning and evening times are the peak times, while other times of the day are more relaxed. People generally go to their work, school and other activities in the morning and return their home in the evening times. Although this is already a known topic, many studies pointed out the time of the day effect on the travel demand both for work and non-work trips. For instance, Jennifer and Bhat (2000)pointed out the time of day effect on the travel demand and examined the effect of individual and household socio-demographic characteristics, employment-related attributes and trip characteristics on departure time choices of individuals. In non-work trips such as eating, recreation and child care, people have more freedom to choose the time of their trips. Nurdden *et al*. (2007) also found travel time to be an important factor influencing the individual's choice of transportation. Therefore, individuals' travel patterns are a result of how and when they want to use their time.

The End