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Demand on Public Transportation during the Economic Crisis: The Greek Case

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Abstract:

Purpose: *The purpose of this paper is to estimate the effect on the demand for public transportation in the economic crisis in Greece.*
Design/methodology/Approach: *Methodology is aimed at finding the factors that affect the demand on urban transport. For this reason, a questionnaire was used in Athens, with qualitative, quantitative and social characteristics of the people, aiming at presenting a new rational policymaking after the economic crisis.*
Practical implications: *Greece entered in the economic crisis in 2009, where the main features were the high debt cycle, deficits, unemployment and a decrease in the Gross Domestic Product. Since public transport is linked to economic conditions the economic crisis has positively affected public transport. The proposed model can be used as an effective policy in public transport.*
Originality/value: *The previous studies were largely descriptive, leaving a gap in the quantification of demand-related data. They mainly identified qualitative characteristics without reaching the level of gravity that each factor contributes to the economic crisis as in this research.*

Keywords: *Sustainable mobility, economic crisis, public transportation, urban transport, transport demand.*

JEL classification: *R41, L91, O18.*

Paper type: *Research article.*

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1. Introduction

The economic crisis has a significant impact on all aspects of life and hence on transport, including both passenger and freight transportation. The production decline and the rise of unemployment led to a negative effect on transport, reversing the general upward trend in traffic growth. In contrast to other surveys, which have more focused on qualitative characteristics that characterize the demand for transport companies, we are investigating the relationship between income and the use of public transport in times of economic crisis. The approach to determine the above relationship was carried out through a field research in the area of Athens which had been affected by the economic recession. Initially we calculated that the correlations are based on age and income. After the correlation study, we constructed the statistical forecasting model and commented the results of the survey. It is worth mentioning that in Athens, before the financial crisis, the average annual increase in traffic load was 3 per cent and the average annual reduction of the average speed was -2 per cent (which was much more important in the central arteries) (Sermpis *et al.*, 2013). According to the paper, public transports are mainly affected by the age and income of the commuters. As these variables are increased, the migrants tend to use their personal car more than the public transports, but less often than before the financial crisis.

2. State of the Art

Many studies have provided evidence about the influence of different variables on transport demand. The factors affecting the adoption of PT systems, user satisfaction and retention have been investigated by a significant number of research papers, while transportation agencies and organizations have attempted to create a framework including directions and indices for public authorities (for example, TRB, 1999; CEN, 2002). Efforts to investigate the relationship between the economic crisis and the effects on transport mode, have taken place since the onset of the 2008 global crisis (Rigas *et al.*, 2011). The previous studies were largely descriptive, leaving a gap in the quantification of demand-related data. That is, they mainly identified qualitative characteristics without reaching the level of gravity that each factor contributes to the economic crisis. The most important factors are the age, income, number of cars the commuters have, how well the commuters' work area is covered by public transportation and the degree of compliance with the use of public factors due to the financial crisis.

In Spain, de Rus (1990) estimated a regression model using panel data for various Spanish cities for 1980-1988. The elasticities estimated for the fare and the service levels showed that transit demand, that is the number of passenger trips, was sensitive to these factors. The author calculated elasticity in the static model of −0.3 per cent for the fare and 0.71 per cent for the level of service, suggesting that the number of passengers could be increased at the same time as fares were increased along with service levels. Goodwin (1992) reviewed more than 50 existing research

works on the influence fare had on transit demand and found an average elasticity of −0.41 per cent, greater than the value of −0.3 per cent (Webster and Bly, 1981) considered at the time to be the reference in Great Britain. The author also estimated that long term elasticities are between 2 and 3 times higher than short term elasticities.

Balcombe *et al.* (2004) elaborated a guide for the Transport Research Laboratory (TRL) on the factors affecting the demand for surface public transport. This guide updated the results presented in the 1980s by Webster and Bly (1981). The authors looked at existing research and established the short-run elasticity of the bus fare was around −0.4 per cent and the long run −1 per cent. These results can also be found in a later article by Paulley *et al.* (2006). Friman *et al.* (2001) found that PT employees' behavior, reliability, design and information simplicity are all factors that affect PT user satisfaction in Sweden. Srinivasan *et al.* (2007) applied multivariate models to examine the impact of quality changes in public transport of the developing countries before and after mode choices. One year later, Taylor *et al.* (2008) analyzed data from public transport operators of 265 urban areas in the US and found that the quality depends on the regional geography, economy, the characteristics of the population and the road network. On the other side of the Atlantic, Fellesson and Friman (2008) investigated the PT satisfaction of users in eight European cities. They found that the level of satisfaction depends on comfort, staff behavior, system and safety, while like Taylor in the US (2008), they concluded that the perception of satisfaction depends on the characteristics of the population. During the recession of 2008 and 2009, the growth of public transport demand did not follow the increasing trend of the previous years but was around 0 per cent.

Employment is a main determinant of the public transport demand, according to the Report of Transport for London (2010). Dell'Olio *et al.* (2010a) explored the factors that affect the satisfaction of bus users in Santander, Spain. They found that the stated, perceived satisfaction of the respondents mainly depends on the reliability and waiting time at the station, therefore punctuality and headways should be the priorities of the service providers. Moreover, they observed that about 35 per cent of the respondents modified their overall satisfaction score after being asked about specific factors of the PT systems. In addition, Dell'Olio *et al.* (2010b) concluded that the most important factors for PT users in Santander are waiting time, cleanliness and comfort, while driver behavior, bus occupancy and time of journey are less important; the impact of these factors vary depending on the socio-economic characteristics of the users.

Cirillo *et al.* (2011) investigated the factors that affect PT satisfaction in Southern Italy, using data from a random sample of 470 students who use the bus for their trips to a university campus. They found that punctuality is valued as the most important characteristic by the users since one-third of the respondents stated that they are willing to pay more in order to use an on-time service. Eboli and Mazzulla (2012) presented a detailed and comprehensive literature review on the performance

indicators for measuring public transport service quality. They concluded that the aspects of service quality that have been investigated in a great extent are the service availability and reliability, while others such as customer care and environmental protection have been ignored. Román *et al.* (2014) explored the impact of quality factors on the choices of PT users. The results of their research showed that the behavior of urban and interurban travelers differ because of the different perceptions of factors, such as frequency and willingness to pay.

Carrel *et al.* (2012) focused their research on the impact of reliability and frequency of PT services on usage. The results of their research demonstrated that PT user's rate punctuality is an important factor. More specifically, they prefer punctual modes even if they are smaller and crowded, instead of non-punctual larger and of the low frequency of service. This finding shows the direction for strategic policies that the PT service providers should follow. Redman *et al.* (2013) reviewed several studies about factors that affect the adoption of PT and concluded that despite the fact that frequency and reliability are rated as very important by the users, these factors are not those that will affect the decision of travelers to switch from private to public transport. The shift depends on personal perceptions and motivations. De Oña *et al.* (2013) developed an SEM (structural equation models) to estimate satisfaction of bus users about the overall quality of service, with latent variables the service, personnel, and comfort. The results showed that quality is the most important of the unobserved characteristics, while personnel and comfort follow. Two years later, De Oña *et al.* (2015) investigate the relationship between customer satisfaction and perceived accessibility for the Metro of Seville in Spain, using SEM models. The results of the SEM models indicate that user's rate is most important to the tangible service equipment, then accessibility, service availability, information, security, customer service, individual space and finally environmental pollution. De Oña and de Oña (2015) provide a detailed review of papers and assessment of the methodological approaches used to measure the quality of service through customer satisfaction surveys. Cordera *et al.* (2015) investigated the impact of unemployment rates and income on demand for public transport in Spain. They found that unemployment affects public transport demand with elasticity from 0.133 to 0.210 and income with an elasticity between −0.505 and −0.861 depending on the model used.

In Greece, Tyrinopoulos and Antoniou (2008) used data collected by surveys targeting PT users of the four public transportation systems in Athens, namely the Athens Metro, buses, trolleybuses and electric railway, and bus users in Thessaloniki, Greece. They performed factor analysis on the ratings posed by the surveyed individuals to the importance of factors related to the quality of service, punctuality and service production, and developed ordered logit models to model their overall satisfaction. The results of the factor analysis revealed the existence of three prevalent factors per PT system, with varying factor loadings, among the following: (1) information provision, (2) behavior of the personnel, (3) in-vehicle conditions, (4) transfer quality and (5) service production. Quality of service is rated

as the most important factor in all PT systems. With regards to the ordered logit model that was developed to examine the satisfaction of the respondents, the authors found that punctuality is the most important determinant of satisfaction for bus users, but not for those who use Metro as their main PT mode, who take it as granted. Tyrinopoulos and Antoniou (2013) investigated the factors that affect the satisfaction of PT users in tourism destinations, areas that are characterized by seasonal transport demand. They found that the most important factor for tourists is service production (for example on-time performance, service frequency, service hours, distance to stops).

Like Tyrinopoulos and Antoniou (2008), Efthymiou *et al.* (2014) repeated the same survey in Athens, in order to investigate the impacts of the economic crisis on the satisfaction of the Metro and Buses users. A hybrid discrete choice and latent variable model was developed to model overall satisfaction, including quality factors - such as satisfaction about the quality of service, information provision, transfer quality, and service production - as latent variables. The result of the hybrid model showed that service provision is the factor with the highest impact on satisfaction, while the other latent perceptions follow. Moreover, they developed an ordered logit model to estimate the shift from/to Metro and Buses.

In order to gain a deeper understanding of the impact of the economic crisis on PT user satisfaction and demand, Efthymiou and Antoniou (2017) expanded the analysis including all four PT services that operate in Athens (Metro, Buses, Trolleybuses, and Rail). They applied the non-parametric test Mann-Whitney/Wilcoxon to compare the distributions of the satisfaction ratings for 23 quality factors and measure the shift from 2008 to 2013. Furthermore, they developed a hybrid discrete choice and latent variable model to model the increase of PT usage and they proved that causes positive impact on PT demand the latent satisfaction about the quality of service, the improvement of PT, the high car usage costs and the environmental consciousness. On the other hand, less usage is declared due to preference in using bike and walking and because of the ticket price increase.

In the current research, the datasets used in Tyrinopoulos and Antoniou (2008) and Efthymiou *et al.* (2014) are enriched with survey responses from 2017. The authors aim to investigate the trend of satisfaction about factors affecting adoption and demand from pre-crisis (2008) to mid (2013) and deep crisis (2017).

3. New Economic Data on Transport and the Urban Development

Transport is inextricably linked to economic conditions. Since the Second World War, both in the USA and in Western Europe, the economic growth had a relationship to transport growth, whether in terms of transferring goods or moving people. Periods with the economic recession have always contributed to almost reducing transport. In Greece, since 1980, all types of transport (road, sea, air, and rail) had been steadily increasing, because of economic prosperity. This sustained

upward trend has led to the failure of the basic rules and the interconnection of economic parameters with transport activities. Thus, studies carried out over decades provided almost always increase (continuous) of traffic figures by 2 to 4 percent per year, since in the models GDP growth, which is predicted by various organizations were continuous. Between the year of the 1940s and 1990s, the car's share of travel modes was constantly increasing at the expense of public transport, bicycle, and walking. After the year of 1990, there was a reverse trend (Litman, 2012). In the more developed countries, the percentage of the population with a driving license, of any age, was steadily rising, with higher increases for women.

For the first time since 1986, the constant increase in traffic loads has stalled as a result of a large reversal of economic parameters. Immediately, in many European countries with modern roads and motorways at an advanced stage (Portugal, France, Spain, Italy, Germany, Austria), traffic dropped significantly. In Greece, in April 2009, the country joined under the supervision of the International Monetary Fund with the large and steep increases of 30 per cent and 40 per cent in fuels which came from the V.A.T. and specific consumer tax increase. As a result, reductions in traffic occurred on both the motorway network and the urban and suburban road network. The negative effects of the economic crisis are presented in international and domestic freight traffic in all transport sectors, with the direct consequence of decreasing volume, mainly in the domestic transport and logistics services. The biggest decline in 2010 is attributable to road transport, while international road haulage has also been affected by the fall in import and export trade. The negative course of many major customer sectors has considerably curtailed the business activity of the industry.

Athens, the capital of Greece, includes approximately 4,200,000 inhabitants, extending in an area of approximately 385.000 acres. The traffic in Athens is increasing annually by approximately 2.6 per cent in the center, 3.5 per cent and 7 per cent in the suburbs. There are about 1,500,000 cars in the capital. Over the last decade, the private car ownership index has been increased by 40 per cent. In the wider area of Athens, there are two public transport systems. The first one belongs to the public sector and serves 172 almost all the urban area, while the second one belongs to the private sector and mainly serves the passage. The urban system consists of the following independent public limited companies: E.T.H.E.L.-Thermal Bus Company, E.L.P.A.P-Athens-Piraeus Electric Buses, E.S.A.P. Athens - Piraeus Electric Railways, ATTIKO METRO, TRAM, and the RAILWAY STATION. In recent years, in addition to the above public companies, several municipalities in Athens have set up their own municipal transport companies. The main difference between state and municipal transport companies is that they are developed within the boundaries of each municipality and are not entitled to receive a fare. Each company is administrated by an independent board of directors and has its own development programs. The state founded OASA is in charge to solve the problem of coordination of public transport in Athens.

Furthermore, in public transport systems, there are also the taxis, although they do not constitute a centrally guided system, as they offer service to the traveling public, even in a way that is competitive with other public systems. It is noticed that around 73 per cent of the operating cost consists of staff remuneration, in the cost structure of the overall urban transport system. It is remarkable that the cost per passenger is much higher than the total revenue per passenger. The lowest cost per passenger is reported by E.T.H.E.L., while the highest is E.L.P.A.P. Overall, the results of almost all surveys suggest that the social cost of private cars is about four times higher than the public transportation and that hidden subsidies to private cars (stranded costs) are far higher than the external costs caused by public transportation, which considerably curtailed the business activity of the industry.

The shrinking economic activity in Greece was inevitable to drag along with transportation. The sharp drop in the car market and the number of removals as a consequence of unemployment, reduced consumption in the marketplace, recreation and every service and activity are being borne by many as a negative result of the general recession and bankruptcy of the Greek Society. It is widespread that, in a general basis, the periods of economic recession are associated with the increased use of public transportation. However, international experience and research on this issue do not argue. For example, the data from European cities so far show that the economic downturn has not led to an increase in passenger traffic for public transportation in any city. In London, passenger metro traffic dropped 6 per cent, in Paris the RATP declined by 0.8 per cent, despite the 6 per cent increase in the offered vehicle-kilometers, in Milan there is a decrease of 1.2 per cent, while in Madrid and Barcelona the decline in passenger traffic is above 10 per cent, which is reasonable due to the extremely high unemployment rate in Spain and the inelasticity of the demand for travel to and from work.

From the previous data, it is obvious that any reduction in traffic and congestion was not accompanied by an increase in the use of public transportation. The reduction in passenger traffic is probably a consequence to the reduction of the movements due to the increase in unemployment, which combined with the reduction in workers' earnings and the increase in the price of gasoline, leading to the non-realization of some, particularly flexible movements such as shopping and entertainment, or the cancellation of other movements, such as those who lost their Jobs.

Consumption theory argues that demand for a commodity decreases when income is limited or when the commodity is economically inferior and substitutable. Some studies conducted under conditions of economic growth concludes that the public transportation is inferior with good negative income elasticity, which means that the increase in income leads to a decrease in the demand for the public transportation. This result is due to the strong correlation of income and ancillary index of ownership to private cars.

Moreover, the non-inclusion of the property index along with income is an omission error and fictitiously leads to negative income elasticity. If this was the case, then for example in the increasingly richer cities of Northern Europe, the share of the urban transport would have been shrunk in the last 30 years, which has not happened - even in cases where the property ratio is far from the level of saturation. It is certain that public transportation is not a luxury asset (with income elasticity > 1) but normally a necessary commodity (with elasticity < 1). Otherwise, the reduction in income will increase the share of the expense for urban transport as an income percentage.

4. Research Findings

In this article, the presented data are the result of a primary survey, conducted by the Laboratory of Transport Economics and Sustainable Mobility, through 310 questionnaires collected in April 2016. The sample chosen was random, as the purpose of the research is to study the attitudes of migrants of all ages, sex, educational level, marital status, and monthly personal income. Regarding the economic crisis and urban transport, 58 per cent of the moving people estimate that before the financial crisis (2009), they made more movements during a working day than today, while 42 per cent of them estimate that there was no change in the number of daily removals before and after the economic crisis.

The use of public transport increased during the period of economic crisis and, while before the crisis, commuters used public transport at a rate of 40.5%, in 2016 whenever the survey was conducted, the percentage rose to 46.3%. In absolute numbers, the number of trips is also proved by the validations of the tickets, which, as it results from the O.A.S.A. changed from 265,387,297 to 131,864,707, due to the general decrease in travel that characterizes the period of economic recession. At the same time, as was logical, there was a reduction in the use of private cars, from 43.2% before the financial crisis, to 38.1%.

Several tests were performed in order to find the factors that affect the demand for transport services. The most important of these are income and age. The data in Table 1a show that according to their age, those moving between the ages of 26-30, 31-40 and 61 years and above are the ages that have changed the means of transport that is currently used, compared before the financial crisis. Those who currently use more public transport are between 16-25, 31-40 and 61 years and above. It is important here to point that the ages between 31-40 and 61 years old and above use public transport, because they are the ones most affected by the economic crisis.

Today, moving people between 31-40 years old due to the economic crisis resulting to reduced financial gain, they have limited the use of their own car, showing a greater preference for public transport, and this is because they are most affected by the economic crisis. In addition, moving people 61 years old and above were also using their own cars before 2009 because they had increased work and family

obligations. Instead, they are currently using public transport due to the financial crisis which had brought about high reductions in their pensions. It is also important here to emphasize that ages 61 and above have a reduced fare.

Regarding the financial crisis and urban transportation, according to the monthly net personal income, as shown in Table 1b, those with zero income and income between €801-1200 are the ones who have changed the means of transport that they are using today compared to before the economic crisis. Those who currently use more public transport are those who do not have any income (70.6 per cent), those with income up to €400 (68 per cent) and those with an income between €401-800 (58,6 per cent). Moving people with the above income may use public transport because they are most affected by the economic crisis. It is important here to emphasize that those who have zero income are either unemployed or students, with a reduced fare in public transport. In the past, people with zero income used their own car the more, because they are probably employed but now unemployed. Presently, they are using more public transport because they are most affected by the economic crisis.

Table 1. *Comparison means of transport before and after the economic crisis according to age and income*

a. Depending on Age

Age	**Before Economic Crisis**	**Today**
16-25	Public Transportation	Public Transportation
26-30	Public Transportation	Personal Car
31-40	Personal Car	Public Transportation
41-50	Personal Car	Personal Car
51-60	Personal Car	Personal Car
Over 61	Personal Car	Public Transportation

b. Depending on Income

Income	**Before Economic Crisis**	**Today**
Zero Income	Personal Car	Public Transportation
Up to €400	Public Transportation	Public Transportation
€401-800	Public Transportation	Public Transportation
€801-1200	Public Transportation	Personal Car
€1201-2000	Personal Car	Personal Car

Source: *Own study.*

5. Correlation Study

In the present study, an attempt was made to assess the factors that affect the use of a private car and public transit. The linear regression method was used, in order to describe the movement of the dependent variable, which is based on the values of the independent variables. For this reason, each independent variable must be strongly correlated with the dependent one. For the dependent variable, which is the most frequently used means of transport that people use for their daily routes an attempt has been made to analyze the factors that affect the people to choose either their own car/bicycle or public transport.

The Pearson correlation coefficient is a numerical measure or index of the magnitude of the relationship between two sets of values. It ranges in size from +1.00 to -1.00. The "+" sign means positive correlation, which means that the values of a variable increase when the other increases. The "-" sign means a negative correlation, which means that the values of a variable increase when the others decrease. Correlation coefficient of 1.00 means a perfect correlation between the two variables, while the value of 0.00 means no correlation. A correlation coefficient of -0.5 means that there is a moderate negative linear relationship between the two variables. Since correlation coefficients are usually based on data samples, it is common to include some statistical significance statement of the correlation coefficient, which is a statement of the likelihood of a specific correlation coefficient for a sample of data being obtained.

There is a negative correlation between the age and the use of public transportation (r = -0,256, df=307, p=000) since, at 1 per cent significance level the null hypothesis of independence (H0) is rejected, so there is a statistical significance between the two variables. A negative correlation exists between the monthly personal income and the use of public transportation (r = -0,335, df=304, p=000), since at 1 per cent significance level the null hypothesis of independence (H0) is rejected, so there is statistical significance between the two variables. On the other hand, there is a positive correlation between the level of satisfaction on how well the area where participants worked is covered by transportation and the use of public transportation (r = 0,152, d=259, p=0.014), since at 5 per cent level of significance the null hypothesis of independence (H0) is accepted, so there is statistical significance between the two variables. At significance level 1 per cent, the null hypothesis of independence (H0) is rejected, between the number of cars and the use of public transportation, so there is statistical significance (r = -0,243, df=307, p=000), of the two variables, there is a negative correlation. There is also a positive correlation between the means of transport used by the level of agreement to use the public transportation due to the economic crisis (r = 427, df=306, p=000), because of the null hypothesis there is statistical significance between the two variables (Table 2).

Table 2. *Pearson Correlation*

		For your daily routes (work, education, entertainment) you use more often:	age_new	Monthly income	The area where you work is covered by transportation:	In your family how many private cars do you have?	Due to the financial crisis, use public transport for my daily routes jou.
For your daily routes (work / employment, education, homework, entertainment) you use more often:	Pearson Correlation	1	-,256**	-,335**	,152*	-,243**	,427**
	Sig. (2-tailed)		,000	,000	,014	,000	,000
	N	307	307	304	259	307	306
age_new	Pearson Correlation	-,256**	1	,535**	,035	-,145*	-,035
	Sig. (2-tailed)	,000		,000	,577	,011	,544
	N	307	310	307	262	310	308
Monthly income	Pearson Correlation	-,335**	,535**	1	,037	-,021	-,097
	Sig. (2-tailed)	,000	,000		,556	,718	,090
	N	304	307	307	259	307	305

The area where you work is covered by transportation:	Pearson Correlation	,152*	,035	,037	1	-,143*	,084
	Sig. (2-tailed)	,014	,577	,556		,020	,176
	N	259	262	259	262	262	260
In your family how many private cars do you have?	Pearson Correlation	-,243**	-,145*	-,021	-,143*	1	-,130*
	Sig. (2-tailed)	,000	,011	,718	,020		,023
	N	307	310	307	262	310	308
Due to the financial crisis, use public transport for my daily routes:	Pearson Correlation	,427**	-,035	-,097	,084	-,130*	1
	Sig. (2-tailed)	,000	,544	,090	,176	,023	
	N	306	308	305	260	308	308

Source: *Own study.*

6. Statistical Forecasting Model

In order to construct a model after the tests, we came to a better model with independent variables age, monthly net income, level of satisfaction on how well the area where participants work is covered by transportation, the number of private cars that the participants have in their family and the level of agreement on the choice of public transport used for their daily routes, because of the economic crisis, while the dependent variable is the means of transport frequently used for daily transportation.

In constructing the statistical forecasting model, chi-square test must be calculated. The X2 is a statistic produced considering the observed distances by the expected frequencies and concerns the total of the cells in the Table. The terms used to calculate the X2 are square ($\geq$0). The highest X2 is, the more dependency exists. Therefore, the chi-square test must be selected, which examines whether the value, Asymp. Sig., (2-sided) is less than 0.05 (for 95 per cent confidence interval). In all the variables examined, such as age, net monthly personal income, number of private cars and use of public transport, the probability is less than 0.05, so that there is a significant relationship between the variables, thus the independence case is rejected (Table 3). The coefficient R, called the correlation coefficient must first be reported between the independent variables and the dependent variable of the model. It is a measure of multiple linear regressions between the dependent variable, in this case, the most used means of transport for daily routes and the independent variables mentioned above. In Table 4 it is observed that the correlation coefficient of the model is R=0.599. In the same Table, it is also reported that the coefficient of determination R square is, R2=0.359, which defines the percentage of variability of the dependent variable that is interpreted by the independent variables.

From the value of this coefficient, the result is that approximately 35.9 per cent of the variability of the prices of the means of transport currently used by the participants is interpreted by the independent chosen variables. This value is corrected for its impartiality for the estimation of the multiple coefficients of determination and is shown in the adjacent column of Table 4 as R2 adjusted=0,346. It is important to note here that due to the relatively large number of observations in

the sample (310) the correction made is small, just 0.0133. Therefore, the research model in this study is presented in equation 1 as:

$$MT = 1{,}56 - 0{,}054A - 0{,}093MI + 0{,}05WS - 0{,}146NC + 0{,}173PT \quad (1)$$

where:
MT = Means of transport that you use more often for your daily routes (1= Public transportation 2= Car/Motorcycle); A= Age (1=16-25, 2=26-30, 3=31-40, 4=41-50, 5=51-60, 6=61 and above) (p=0,013<0,05); MI = Monthly net income (1= Does not exist, 2= less than €400, 3=€401-800, 4=€801-1200, 5=€1201-2000, 6=€2001-3000, 7=€3001-4000, 8=€4001-5000, 9=€5001 and more) (p= 0,00<0,05); WA = How well covered by public transportation the area where you work/employ (1= Not at all, 2=Low, 3= Moderate, 4= Good, 5= Very good), (p= 0,04<0,05); NC = Number of private cars (1= None, 2= 1, 3= 2, 4=3, 5= over 4) (p= 0,00<0,05); PT= Level of agreement on the choice of the use of public transport for your daily routes, because of the economic crisis, (1= Strongly disagree, 2= Disagree, 3=Neutral, 4=Agree, 5=Strongly agree) (p= 0,00<0,05).

Table 3. *Chi square test*

AGE

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38,825[a]	5	,000
Likelihood Ratio	41,110	5	,000
Linear-by-Linear Association	20,008	1	,000
N of Valid Cases	307		

INCOME

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47,122[a]	8	,000
Likelihood Ratio	51,121	8	,000
Linear-by-Linear Association	34,087	1	,000
N of Valid Cases	304		

WORK AREA

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,488[a]	4	,009
Likelihood Ratio	14,321	4	,006
Linear-by-Linear Association	5,990	1	,014
N of Valid Cases	259		

NUMBER OF CARS

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28,654[a]	4	,000
Likelihood Ratio	33,562	4	,000
Linear-by-Linear Association	18,027	1	,000
N of Valid Cases	307		

USE OF PUBLIC TRANSPORT

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67,129[a]	4	,000
Likelihood Ratio	74,789	4	,000
Linear-by-Linear Association	55,675	1	,000
N of Valid Cases	306		

Source: *Own study.*

[3]*Gnardellis, Ch. (2013). Data analysis with IBM SPSS Statistics 21, Papazisis Publications, Athens, pp. 579.*

It should be noted at this point that the coefficients of regression depend on the units of the respective independent variables and are not directly comparable in their significance, in the interpretation of the dependent variable. In addition, the value of a coefficient may be small, whereas, on the contrary, the independent variable in which it is said, to have a significant effect on the importance of the dependent. For example, the income factor b = 0.093, which is small, the corresponding variable (income) appears to have a significant influence on the choice of the transport mean, as p = 0.00 <0.054.

Table 4. *Predictive Statistical model*

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,563	,181		8,655	,000
	age_new	-,054	,022	-,156	-2,497	,013
	Monthly income	-,093	,022	-,263	-4,208	,000
	The area where you work is covered by public transportation:	,050	,024	,107	2,068	,040
	In your family how many private cars do you have?	-,146	,036	-,213	-4,090	,000
	Due to the financial crisis, use public transport for my daily routes:	,173	,025	,362	7,040	,000

a. Dependent Variable: For your daily routes (work / employment, education, homework, entertainment) you use more often:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,599[a]	,359	,346	,405

Source: *Own study.*

If all the variables remain constant (ceteris paribus), then the following conclusions can be drawn. If the age increases by 1 per cent then the likelihood of using public transportation is reduced by 5.4 per cent. In addition, if the income of the participants increased by 1 per cent, then the chance of using public transportation will decrease by 9.3 per cent. If the work area is covered better by public transportation, then 5 per cent is likely to use the means of public transportation. Those with more cars have 14.6 per cent less chance of using the means of public transportation than their own cars. Finally, if the level of agreement of the passengers, to the fact that because of the economic crisis they use more of the

[4]*Gnardellis, Ch. (2013). Data analysis with IBM SPSS Statistics 21, Papazisis Publications, Athens, pp. 580.*

public transportation, increases by 1 per cent, the chance of using the public transport increases by 17.3 per cent.

Age affects the means of transport used by the participants, as the age increases both tend to use their own car more. This is reasonable because, in a younger age, the participants have not got a driving license, to enable them to use their own car, thus creating more use of the means of public transport. Similarly, the higher the monthly net personal income of the participant, the more they use their personal car, because they have more financial compensation to cope with the costs of a car (gasoline, traffic taxes, taxes). On the other hand, the extent to which the work/occupation area of transport is satisfactorily covered by transport shows that it has a negative impact on the use of a car, since the better the transport area covered, the more the use of public transportation and reducing the use of private car.
In addition, the more cars a family owns, the more they seem to use it, while more people using public transport because of the economic crisis have restricted the use of their own car. At this point, it is important to note that attempts were made to construct other models with more variables, which resulted in an increase in the coefficient of determination R2. However, these variables were not included in the model because they were not statistically significant.

7. Conclusions and Further Research

According to this survey, the factors that determine and influence the use of the car and the public transport in a period of economic crisis have been quantified, in order to estimate what has affected the demand for public transportation in the economic crisis, in the city of Athens. The results of the survey revealed that moving people nowadays have changed the options of the means of transport that they use, compared the case before the economic crisis and have switched more to public transportation. There are factors that influence this option, such as age, monthly net income of participants, number of owned car removals, satisfactory coverage of the working/occupation area and level of satisfaction in the use of public transportation.

The main reasons that moving people use their personal car are age and monthly personal income, as the more they move, the more they are using their personal car. Initially, according to the paper, public transports are mainly affected by the age of the commuters, as if this variable is increased, then the likelihood of using public transportation is reduced by 5.4 per cent, because the migrants tend to use their personal car more than the public transports, but less often than before the financial crisis. In addition, if the income of the participants was increased, then the chance of using the public transportation would decrease by 9.3 per cent. Moreover, public transports are negatively affected by the number of cars of the commuters, as if this variable is increased, then the likelihood of using public transportation is reduced by 14,6 per cent.

The two remaining variables, such as the satisfactory coverage of the working / occupation area and the level of satisfaction in the use of public transportation have a positive effect on the use of public transports with 5 per cent and 17.3 per cent, respectively. The wealthier people using their personal car could turn to the use of public transportation, provided there are qualitative improvements, such as the existence of routes covering remote areas of working, as well as improved cleanliness of the means of transport. The results exported can be an exceptionally good tool for policy on urban transport. What would be feasible to do is to search for ways and methods that society could adopt in order to divert people using more frequent public transport.

Taking all the above mentioned into consideration, the use of public transport is especially important for improving society and the environment and it would be very important for the people to turn to their use, especially in times of economic crisis. This research is a more general tool, which records trends in the use of transport during the economic crisis. It could also be used as a basis for conducting relevant studies for further research, such as for pedestrians and bicycles, so that interesting conclusion can be drawn for periods of economic crisis. Such research is, therefore, necessary and could be an important element for more rational use of public transport. Policy makers and governments should focus more on these factors in order not to influence the negative impact of the economic crisis on society.

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