Investigating the acceptance of an environmental transport charging policy. The case of Athens.

Asimina Korentzelou
Department of Transportation Planning and Engineering
National Technical University of Athens
Athens, Greece
asiminakrntzl@gmail.com

Virginia Petraki
Department of Transportation Planning and Engineering
National Technical University of Athens
Athens, Greece
vpetraki@mail.ntua.gr

Panagiotis Papantoniou
Department of Transportation Planning and Engineering
National Technical University of Athens
Athens, Greece
ppapant@central.ntua.gr

George Yannis
Department of Transportation Planning and Engineering
National Technical University of Athens
Athens, Greece
geyannis@central.ntua.gr

The need for sustainable transport is increasingly recognized and receives more and more attention. Cities face the challenge to enhance the quality of urban environment reducing traffic congestion, pollution and road accidents. Moreover, transport charging policies consist a basic tool for sustainable mobility while they are increasingly applied in urban centers. The objective of the present research is to investigate drivers' acceptance of environmental transport charging policies with emphasis on environmental charging (annual card) for private cars access in Athens center. In order to achieve this objective, data were collected through a questionnaire survey, using stated preference methodology while a binary logistic regression model was developed to determine the acceptance of car access card in the center of Athens. The results demonstrate that annual card cost and travel time saving are the main factors for the acceptance of the annual card. Furthermore, men and young people are more likely to accept the annual card while several other parameters such as vehicle's age and usage, vehicle's engine capacity and driver's perception of environmental pollutants affect policy's acceptance and should be taken into account by policymakers when developing and implementing similar environmental mobility strategies.

Keywords— annual card, environmental policies, drivers acceptance, method of stated preference, binary logistic regression

I. INTRODUCTION

Considering that the vast majority of European citizens live in an urban environment, with over 60% living in urban areas of over 10,000 inhabitants, the quality of the environment in urban areas is of vital importance [1]. Within this framework, sustainable urbanization is widely acknowledged as a key global challenge for the 21st century, particularly in developing countries. One of the main problems affecting the quality of the environment and life in urban centers is traffic which is a significant challenge for road transport and transport policy at all levels.

The fast pace of everyday life, the need for comfort, the rapid increase in the number of vehicles as well as the growth in vehicle ownership have led to increased use of private cars as mode of transport and as a consequence traffic congestion in urban centers. However, traffic congestion in an urban road network is a significant challenge that degrades the urban environment having a negative impact on emissions, noise, fuel consumption and the overall quality of life. Many European towns and cities suffer from chronic traffic congestion which is estimated to cost 80 billion Euros annually [2].

Based on the above, a key target of all authorities is to find effective strategies to reduce these problems. Several cities apply access regulations into urban areas such as Congestion Charging Zones (CC), Low Emission Zones (LEZs) or a combination of both. The idea of Congestion Charging first appeared in the 1950s [3] and to date, it has been implemented in several cities internationally (Singapore, London, Stockholm, Milan, Gothenburg). The principle of charging policy is the pricing of vehicles for the burden they cause on traffic and consequently on the environment and public health. However, transport charging is not easily accepted by the public [4-6].

In recent years, transport pricing measures and policies have been considered as central means of controlling transport demand, congestion and environmental impacts. However, there is an important precondition for the successful implementation of urban access restriction schemes; that is public acceptability [7-9]. Significant progresses have been made on understanding public acceptance of such schemes from different perspectives while several researchers studied the acceptability of congestion charging schemes within the societies using different approaches.

Considering demographic factors, according to Liu and Zheng [10], females are more receptive to the application of a proposed congestion pricing scheme in Brisbane, Australia than males. Also, the same study shows that for people with high income, introducing the congestion charge may have no impact on their travelling to the city. A similar study was conducted by Nikitas et al., [11] reporting that the acceptability of congestion charging for people aged above 60 is affected significantly by social norms and pro-social values. The income level of different groups in the society does not affect the acceptability of congestion charging significantly [12]. However, Rentziou et al. [13] indicate that respondents - drivers with high household income, age between 35 - 64 years, kept traveling through the charging zones using their cars.

978-1-7281-8995-6/21/$31.00 ©2021 European Union

The acceptability of a pricing scheme implementing for the urban access restriction also depends on personal-outcome expectations. Drivers will more possibly accept the scheme if they expect a positive impact of the reduction in traffic and environment quality [14-15]. The acceptability is also related to the concrete use of its revenue. According to surveys, collected revenues should be used in projects that directly benefit the users, such as improving public transport, reducing the tax on users, expanding the road capacities, etc. [16-17].

The design of the mechanism of a congestion charging system is related to the willingness of the public to accept congestion charging [18]. Bonsall and Cho [19] found that public acceptability of complex charging mechanisms, such as time-based charging or charging based on congestion delays, is lower than fixed-rate charging. More complex a congestion charging mechanism is, the more difficulty the public will have in understanding it, which has led to public disapproval [20].

Considering Greece, the problem of traffic congestion has already come to an acute stage for most cities and is still growing fast. The average Greek driver spent approximately 36 hours in road congestion the year 2017, the fifth higher waste of time comparing to others European countries [21]. The continuous increase of the vehicle fleet in combination with the decrease of the new registrations from 2007 onwards [22], indicates that old technology cars are not withdrawn which leads to an aging vehicle fleet. The large number of motor vehicles traveling in the Athens city center combined with the high average age of the vehicle fleet is a major cause of atmospheric and noise pollution.

The current management traffic system called Athens Ring (Daktylios Athinon) controls the private car access in the city center according to an odd/even system. The odd/even restrictions correspond the last number of a vehicle's license plate number to the calendar date. The Athens Ring originally designed and intermittently implemented from July 1979 and later imposed as a permanent solution to control traffic congestion in 1982. The Athens Ring allows environmentally friendly vehicles (electric cars and vehicles categorized as Euro5 or Euro6) to circulate without restriction on any day at any hour as of September 2012. Unfortunately, the number of private cars in modern day Athens has more than quadrupled since 1982 and legislation has not been revised to reflect this phenomenon.

In that context, the objective of this study is to investigate and analyze drivers' acceptance toward environmental transport charging policies with emphasis on environmental charging (annual card) for private cars access in Athens center. For this purpose, a questionnaire has been developed and a stated preference survey has been conducted which lead to the development of a statistical model, presented in the following chapters.

II. DATA AND METHODOLOGY

A. Survey

Within the framework of the present research, a personal interview, questionnaire-based survey was undertaken, aiming at collecting information on the level of understanding and accepting environmental charging policies and measures for private cars access in Athens. The questionnaire survey included questions on travel characteristics of respondents, environmental awareness and sensitivity, stated preference on alternative annual card cost and demographics. Questionnaire filling time was on average 10 minutes.

The first part of the questionnaire focused on the drivers' travel profile and on the characteristics of their cars. Respondent's travel profile included information on the main transport mode used for accessing workplace/ education or leisure, the number of weekly trips, the travel cost, if they travel through the Athens center and the drivers' satisfaction on their typical daily trip. Concerning the car's characteristics, there were questions about the cubic capacity, the year of first registration and fuel type are included.

The second section investigated respondents' environmental awareness and sensitivity. In particular, it includes a series of questions related to perceptions of key environmental issues of road transport as well as some general environmental questions. Respondents were asked to state their opinion on environmental pricing measures, such as environmental vehicle registration fees, environmental incentives for old-technology vehicles withdrawal, environmental incentives to purchase new-technology and environmental friendly vehicles, environmental car access fees in urban areas, and environmental tolls.

The third part examined a hypothetical scenario of replacing the current car access mobility restrictions (Small Ring) in the center of Athens with an environmental charging system for private cars (annual card). It targeted at identifying the public acceptance of the annual card, considering the charging depending on the year of the vehicle's first registration and the time saving of a typical trip. This refereed to the stated preference part of the questionnaire which will be further analysed in the statistical analysis section. Finally, the fourth part collected information on demographics characteristics of respondents (gender, age, income, education level and so on).

B. Area

Athens is the capital and largest city of Greece, and among the most important economic centers in Southeastern Europe. The city of Athens (Municipality of Athens) has a population of 664,046 inhabitants [22] of which 315,210 are men and 348,836 are women, and a land area of 38.96 km^2. Residencies correspond to a 35% of the metropolitan area's total land uses, while 7% of that land corresponds to industrial activities, 6% to administration, 5 % to recreation and 26% to commerce and other activities [23].

Passenger cars constitute 69% of the total vehicle fleet in Attica, followed by motorcycles (motorcycles and mopeds) with 24%, trucks with 6.7% and buses with 0.3% [24]. Considering passenger vehicles there is a steady annual increase (1.2% on average) after the year 2013.

Noise and air pollution are two fundamental problems facing Attica Region today. According to the latest Strategic Noise Map published by the Ministry of Environment and Energy in 2013, more than half of the residents of Athens (53%) living or moving in the city center, experience daily noise values of 65-70 dB. During 2018, the highest NO_2 air pollution emissions of the last five years were identified [25].

C. Sample Characteristics

Data were collected through a questionnaire that was completed in the form of interviews in areas of the northern, southern, central and western suburbs of Athens. The filtering

procedure on the database A quality and validity check was performed leading lead to a total of 370 questionnaires. The sample size was considered sufficient for the purposes of the study.

The collected data were interpreted using descriptive statistics. As expected, the percentage of men (49%) who answered the questionnaire is approximately equal to the percentage of women (51%). Also, almost equal percentages are observed in the age categories 18-30 and 31-55. The largest age group (>55) constitutes the smallest percentage (16%) of the sample. The results confirm that the sample follows a properly balance stratification with respect to these parameters (Fig. 1, 2).

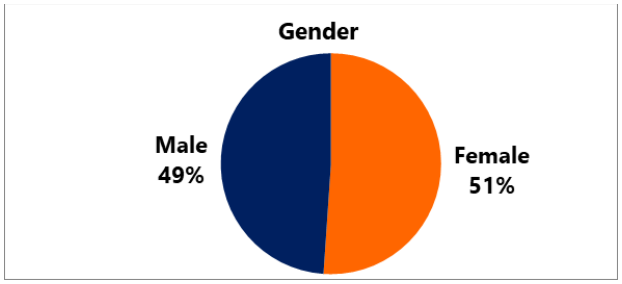

Fig. 1. Distribution of respondents per gender

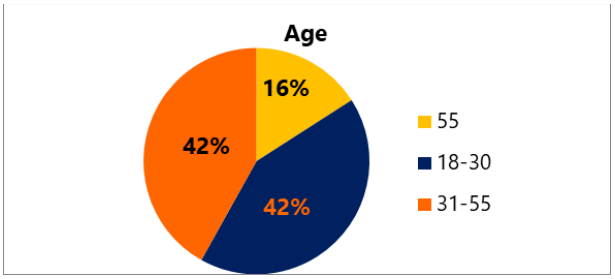

Fig. 2. Distribution of respondents per age group

III. RESULTS

A. Descriptive Analysis

A preliminary part of the analysis focused on interpreting collected data using descriptive statistics. According to Fig. 3 respondents satisfactorily accept the proposed annual card policy for their access into the center of Athens. In fact, the respondents who drive the newest and oldest technology vehicles seem to accept the proposed policy to a greater extent compared to those who drive a car with a registration date between the years 2001 to 2010.

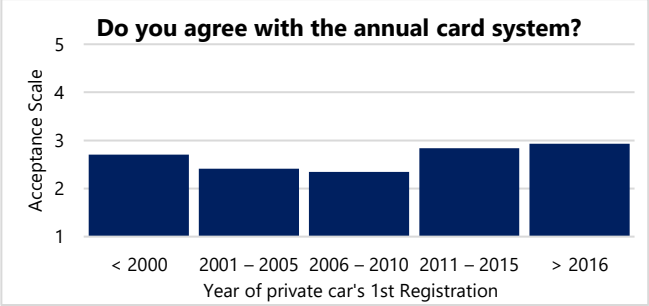

Fig. 3. Acceptance level of the annual card system according to the year of private car's first registration

Moreover, the majority of survey participants (57%) prefer the suggested annual card system instead of the existing management traffic system in the center of Athens which is an odd/even system (Athens Ring). In particular, it is observed that the owners of vehicles with first registration date after 2015 are more positive towards the proposed annual card system.

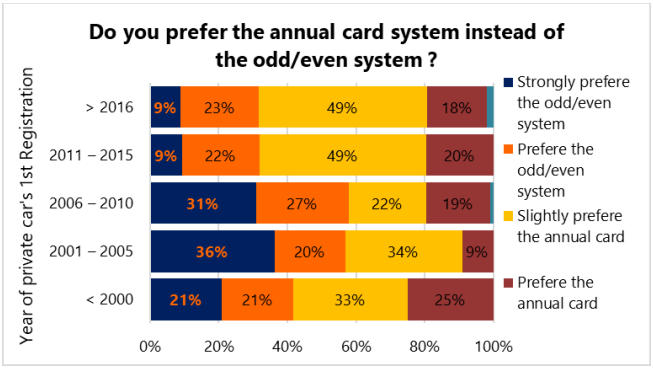

Fig. 4. Preference level of the proposed system and the current system in the center of Athens according to the year of private car's first registration

Another interesting figure refers to the fact that about 1 out of 3 older technology vehicle owners is willing to replace her/his private car in case that annual card system is applied. Within this question, drivers of private cars with first registration date between 2001 and 2005 have the lowest percentage of willingness to replace their car (Fig.5).

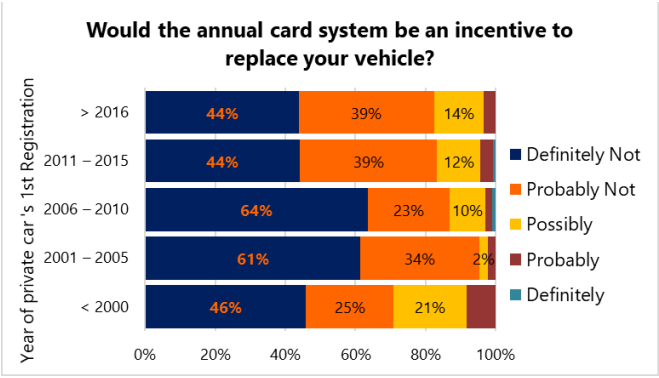

Fig. 5. Willingness to replace the vehicle in case of implementation of the annual card system according to the year of private car's first registration

B. Theoretical Background

The questionnaires have brought out a large number of variables. Following the data collection and the data base, it was decided that statistical binary logistic regression model would be appropriate for the statistical analysis of the proposed annual card system acceptance. Specifically, a binary logistic regression model was developed to model how parameters of annual card cost, travel time saving, date of private car's first registration, demographic characteristics, vehicle's characteristics, respondent's travel profile and environmental awareness influence the public acceptance of the proposed environmental charging policy (annual card) for private cars access in the center of Athens.

Following Washington [26], in developing the logistic regression equation, the LN of the odds represents a logit transformation, where the logit is a function of covariates such that:

$$Yi = logit(Pi) = LN\left(\frac{Pi}{1-Pi}\right) = \beta_o + \beta_1 X_{1,i} + \beta_2 X_{2,i} + \cdots + \beta_\kappa X_{\kappa,i} \quad (1)$$

and where β_0 is the model constant and the β_1, …, β_K are the unknown parameters corresponding with the explanatory variables (X_k, k = 1, …, K the set of independent variables).

In the analysis under consideration, the dependent variable was considered to be discrete taking into account the fact that it corresponded to values 0 (I do not accept the annual card system) and 1 (I accept the annual card system). The final model was evaluated considering the common statistical tests (R^2, t- test etc.) but also based on the logical explanation of the results. In order a variable to be accepted as an independent variable, it should be statistically significant and thus a control coefficient Wald test was carried out for each variable.

The correlation of variables was also examined to select the best-fitting mathematical model. In practice, what is expected is the best possible correlation between dependent and independent variables and the zero correlation between independent variables. Those independent variables that showed high correlation, greater than the empirical upper bound of 0.5 were not taken into account in the final model. A variable was considered in the final regression model if the corresponding parameter estimate was significant at 95% confidence level. In particular, a variable was considered statistically significant only if the respective value of the t- test was higher than 1.7 [27].

To complement the developed model, elasticity analyses were conducted as well. As defined in practice, elasticity analyses allow for the quantification of the response of the dependent variable for a 1% change of an independent continuous variable. When dealing with independent categorical variables, it is meaningful to implement pseudo-elasticities to obtain the incremental changes that are incurred as a result of category changes in the categorical variables [27]. By using elasticity and pseudo-elasticity analyses, the influence of each variable on the acceptance of annual card system was thus quantified. Following Washington [26], the elasticity of a dependent variable Y with respect to a continuous independent variable X that has a regression coefficient β can be defined as:

$$e_i = \beta_i \frac{X_i}{Y_i} \approx \frac{\partial X_i}{\partial Y_i} * \frac{X_i}{Y_i} \quad (2)$$

For categorical independent variables, the pseudo-elasticity is defined as per the exponential change:

$$E_{X_{ik}}^{\lambda_i} = \frac{EXP(\beta_k)-1}{EXP(\beta_k)} \quad (3)$$

The absolute elasticities can be rescaled to fit the range of all independent variables, by setting the lowest value to 1 and adjusting the rest of the variables in proportion with their absolute score. All independent variables that included in the final model were treated as continuous variables except from variable 'Gender' which was treated as categorical.

It should be noted that the final selection of the model was made after several configuration considerations of the many possible combinations of variables, which were documented but are not presented here for brevity. The analysis was conducted using SPSS Statistics [28].

C. Statistical Analysis

Before proceeding to the core analysis of the present research the key objective should be recalled. More specifically, the aim is to investigate the acceptance of a proposed annual card in Athens based on questionnaire data and through a stated preference survey with key parameters the time and the cost of a 20 minutes hypothetical trip in Athens. In Table I the results of the binary logistic model are presented and explained below.

TABLE I Binary logistic model results for annual card acceptance

Independent Variables	B	Std. Error	Wald	Sig.	Absolute elasticity	Relative elasticity
Cost	-0.026	0.002	187.327	0.000	-14.332	60.25
Travel time saving	0.336	0.022	230.029	0.000	2.555	-10.74
Gender	-0.272	0.148	3.285	0.032	-0.176	1.00
Age	-0.326	0.114	7.890	0.040	-0.238	1.00
Private car's 1st registration	-0.164	0.085	3.729	0.039	0.406	1.70
Weekly trips for work & education	0.511	0.122	17.687	0.000	0.735	-3.09
Engine capacity	0.483	0.057	21.743	0.000	0.385	-1.62
Annoyance from exhaust fumes	0.105	0.129	3.043	0.000	1.056	-4.44
Annoyance from road traffic noise	0.603	0.098	32.433	0.089	0.349	-1.47
Constant	-6.156	0.750	65.804	0.000	-	-
Adjusted R^2	0.453					

Regarding the Goodness-of-fit measures, it should be noted that the Adjusted R^2 value is 0.453 while all individual parameters have significant p- values. Based on model results the parameters that affect the acceptance of the annual card system are presented below.

- The variable "Cost" represents the cost of the annual card and corresponds to three different price values depending on the year of first registration of the respondent's car (low, medium, high). The price range of the variable is from 40 € to 560 € per year.
- The variable "Travel time saving" represents the time saving of a typical everyday trip in case of the implementation of the annual card and corresponds to three values (5, 10 ,15 minutes).
- Variables "Gender" and "Age" represent the respondent's gender (female, male) and age group (18-30, 31-55, 55+) respectively.
- The variable "Private car's 1st registration" represents the year of first registration of the respondent's private car and corresponds to five age groups (≤2000, 2001-2005, 2006-2010, 2011-2015 and ≥2016).
- The variable "Weekly trips for work & education" represents the number of trips that occur in the greater area of Athens per week for work or education.
- The variable "Engine capacity" represents the engine capacity of the respondent's private car.
- Variables "Annoyance from exhaust fumes" and "Annoyance from road traffic noise" represent the annoyance level from exhaust fumes on roads and from road traffic noise in the center of Athens, respectively (1=not at all annoying,..,5=very annoying).

The elasticity analysis indicates that the cost of the annual card has the most significant influence and is the main factor that affects the level of acceptance of the annual card system for the controlled passenger cars access in the center of Athens. It is observed that an increase in the cost of the annual card leads to a decrease in the public acceptance level of this policy. In particular, an increase of 1% of the annual card cost decreases the possibility of acceptance by 14.3 %. This may be explained by the desire of the respondent to pay the

minimum possible amount of money for her/his travel using private car in the center of Athens while it is also affected by the economic crisis in Greece in the last decades.

The time saving of a typical travel with a car is also a critical factor that affects the level of acceptance of the proposed annual card system in the center of Athens. In particular, an increase of 1% of the travel time saving increases the acceptance of the proposed annual card system by 2.5 %. The increase in travel time saving leads to increased acceptance of the annual card, probably because the reduction of the daily travel time is a dominant desire of drivers, especially on those that work in the center of Athens.

The third most important factor, which affects the possibility of acceptance of the proposed annual card system, according to the calculated elasticity, is the level of annoyance from the exhaust gases on roads. Considering the elasticity analysis, an increase of 1% of the variable "Annoyance from exhaust fumes" increases the acceptance of the proposed annual card system in the center of Athens by 1%. Probably, this behavior is explained by the fact that the passengers who are bothered by the exhaust gases see the implementation of this environmental policy as a way to limit the exhaust gases, through the possible reduction of traffic.

It also turned out that the drivers who make many trips during the week for the purpose of work or education accept to a greater extent the implementation of the annual card system in the center of Athens. A possible explanation is that drivers who make many trips per week believe that through the implementation of a system like the proposed one will help them to save significant time from their daily trips. Weekly trips for work or education is also a quite important factor that affects the acceptance of the annual card system.

Respondents driving old technology cars, in other words cars older than twenty years, are more likely to accept the annual card system compared to respondents who own newer technology cars. Possibly, this is explained by the fact that a private car which does not cause much environmental burden, should probably not have been included in the policy of the annual card and had free access to the center of Athens. Also, considering the vehicle's characteristics it was observed that by increasing the private car's engine capacity, the possibility of accepting the annual car access card to the center of Athens also increases. Possibly, this is due to the fact that most drivers who own large private cars are more likely to have a high income and be able to afford the cost of the annual card more easily.

The annoyance by road traffic noise is a factor that increases the level of accepting the annual card system. It is likely that commuters disturbed by traffic noise view these policies as environmental measures that will restrict traffic, especially of old-fashioned vehicles, and therefore the traffic noise they cause to some degree. However, the relative influence of the variable is quite small on the final mathematical model which describes the level of acceptance of the annual card.

Regarding demographic characteristics of drivers-respondents, it was found that men and younger people are more likely to accept the annual card system, than women and older drivers respectively. This is probably due to the fact that men are more connected to their private vehicle and, also, that young people are more flexible and open to new situations, while older people are attached to their habits. Also, this may be explained by the fact that young people may be characterized by a greater environmental sensitivity compared to the elderly. Considering elasticity analysis, the variable representing the age of the respondent affects less than all other continuous variables the acceptance of the proposed system.

Considering the next sensitivity figures, conclusions are drawn in agreement with what has been previously mentioned. More specifically, Fig. 6 confirms that men compared to women are more receptive to the implementation of the annual card system in the city center and there is a declining acceptance trend as annual costs increase regardless of gender.

In addition, an increase of the year of private car's first registration as shown in Fig. 7, leads to the acceptance of the proposed annual card system. At the same time, there is a decreasing trend as the cost of the annual card increases, while when the cost is greater than 400 € the acceptance possibility of the annual card is zero. Finally, Fig. 8 shows a higher acceptance possibility of the annual card by younger people. However, the possibility of acceptance of the annual card decreases as the cost of the annual card increases regardless of the respondent's age.

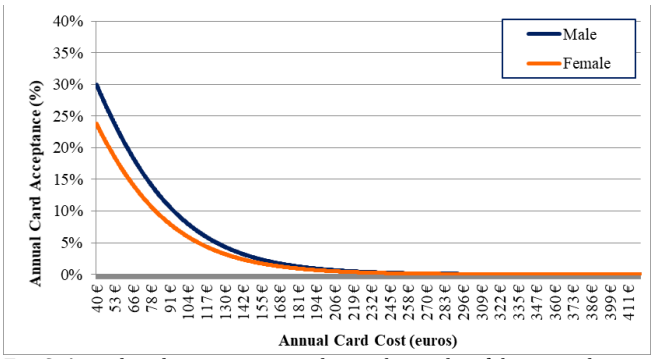

Fig. 6. Annual card acceptance according to the gender of the respondents

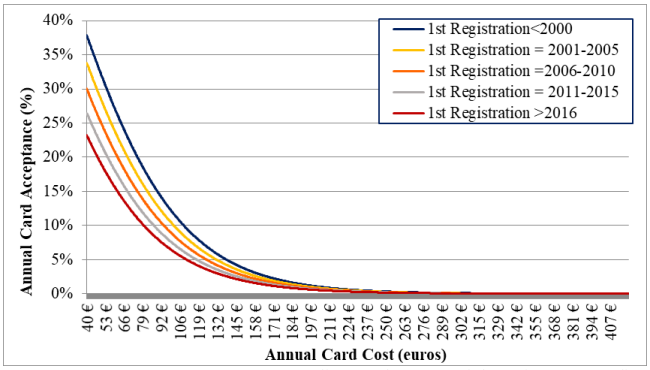

Fig. 7. Annual card acceptance according to the year of the private car's first registration

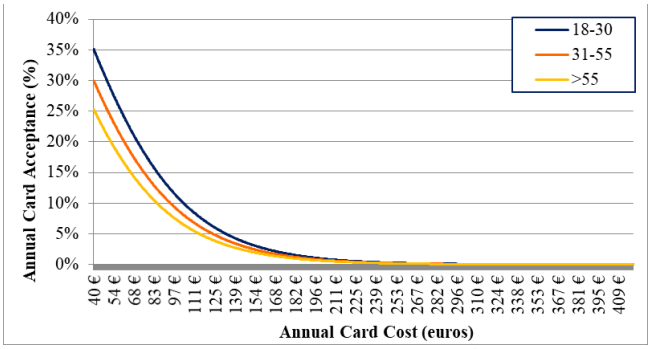

Fig. 8. Annual card acceptance according to the respondent's age

IV. CONCLUSIONS

The present research aimed to explore the factors affecting the drivers' acceptance toward environmental transport charging policies with emphasis on environmental charging (annual card) for private cars access in the center of Athens. In order to achieve that aim, a questionnaire was developed and a stated preference analysis was conducted. The questionnaire-based survey was undertaken, aiming at collecting information on the level of understanding and accepting environmental charging for private cars access in the center of Athens. The questionnaire survey included questions on travel characteristics of respondents, environmental awareness and sensitivity of the respondents, stated preference on alternative annual card cost and demographics.

After data collection, a dataset was produced consisting of 370 drivers' responds in Athens. Based on that dataset a binary logistic regression model was developed which provided valuable insights as a number of affecting factors was determined for the level of acceptance of the proposed annual card system. In short, it was observed that annual card cost and travel time saving are the main factors that affect the acceptance of the annual card. The third most important factor, which affects the acceptance of the proposed annual card system, is the level of annoyance from the exhaust gases on roads.

Furthermore, drivers who make many trips during the week for the purpose of work or education are more likely to accept the annual card. Also, respondents who drive old technology cars (older than twenty years) are more likely to accept the annual card system compared to respondents who own new technology cars. Finally, considering demographic characteristics men and young people intend to accept the proposed policy to a greater extent than women and other age's travelers respectively. However, respondent's age affects less than all other variables the acceptance of the annual card system. The resulting high (adjusted) R^2 value lead to the conclusion that the vast majority of contributing factors of acceptance of annual card system in the city of Athens have been captured by the current study.

Considering that the environmental factor will be of high priority for all policymakers, respective stakeholders and cities will be planning and implementing sustainable urban mobility strategies and policies for the next decades in order to transform the cities, the present study deals with an on-going important transformation plan. Future research should focus on the comparison of these environmental transport charging policies in different countries/cities in order to identify regional characteristics that affect the public acceptance. Moreover, apart from the examined annual card system in the center of Athens, several other policies should be deeply investigated in order to provide to policymakers the most appropriate policies for each city.

REFERENCES

[1] Eurostat, Statistical Books, 2016 edition, Urban Europe — statistics on cities, towns and suburbs.

[2] European Commission, Assessment, I., 2011. accompanying document to the WHITE PAPER Roadmap to a Single European Transport Area–Towards a competitive and resource efficient transport system. EC, Brussels, 28.3. 2011, SEC (2011) 358 final.

[3] Lehe, L., 2019. Downtown congestion pricing in practice. Transportation Research Part C, 100, 200–223. https://doi.org/10.1016/j.trc.2019.01.020

[4] Jones, P., 1991. Gaining public support for road pricing through a package approach. Traffic engineering & control, 32(4).

[5] Jones, P., 2003. Acceptability of transport pricing strategies: meeting the challenge. Acceptability of transport pricing strategies, pp.27-62.

[6] Schade, J. and Schlag, B., 2003. Acceptability of urban transport pricing strategies. Transportation Research Part F: Traffic Psychology and Behaviour, 6(1), pp.45-61.

[7] Shatanawi, M., Abdelkhalek, F. and Mészáros, F., 2020. Urban Congestion Charging Acceptability: An International Comparative Study. Sustainability, 12(12), p.5044.

[8] Jakobsson, C.; Fujii, S.; Gärling, T. Determinants of private car users' acceptance of road pricing. Transp. Policy 2000, 7, 153–158.

[9] Schade, J.; Schlag, B. Acceptability of urban transport pricing strategies. Transp. Res. Part F TrafficPsychol. Behav. 2003, 6, 45–61.

[10] Liu, C.; Zheng, Z. Public Acceptance towards Congestion Charge: A Case Study of Brisbane. Procedia Soc. Behav. Sci. 2013, 96, 2811–2822.

[11] Nikitas, A.; Avineri, E.; Parkhurst, G. Understanding the public acceptability of road pricing and the roles of older age, social norms, pro-social values and trust for urban policy-making: The case of Bristol. Cities 2018, 79, 78–91.

[12] Hao, X.; Sun, X.; Lu, J. The Study of Differences in Public Acceptability Towards Urban Road Pricing. Procedia Soc. Behav. Sci. 2013, 96, 433–441.

[13] Rentziou, A.; Milioti, C.; Gkritza, K.; Karlaftis, M.G. Urban Road Pricing: Modeling Public Acceptance. J. Urban. Plan. Dev. 2011, 137, 56–64.

[14] Schuitema, G., Steg, L. and Forward, S., 2010. Explaining differences in acceptability before and acceptance after the implementation of a congestion charge in Stockholm. Transportation Research Part A: Policy and Practice, 44(2), pp.99-109.

[15] Eliasson, J. & Jonsson, L., 2011. The unexpected''yes'': Explanatory factors behind the positive attitudes to congestion charges in Stockholm. Transport Policy, 18(4),636–647.

[16] Jones, P. Gaining public support for road pricing through a package approach. Traffic Eng. Control. 1991, 32.

[17] Small, K.A. Using the revenues from congestion pricing. Transportation 1992, 19, 359–381.

[18] Wang, Y., Wang, Y., Xie, L. and Zhou, H., 2019. Impact of perceived uncertainty on public acceptability of congestion charging: an empirical study in China. Sustainability, 11(1), p.129.

[19] Bonsall, P.W.; Cho, H. Travellers Response to uncertainty: The particular case of drivers' response to imprecisely known tolls and charges. In Transportation Planning Methods, Proceedings of Seminar F, European Transport Conference, Cambridge, UK, 27–29 September 1999; Transport Research Laboratory: Wokingham, UK, 2000.

[20] Hensher, D.A.; Li, Z. Referendum voting in road pricing reform: A review of the evidence. Transp. Policy 2013, 25, 186–197.

[21] TomTom, www.tomtom.com/en_gb/trafficindex/ , 2017.01.13

[22] Authority-ELSTAT, H.S., 2011. Digital library (ELSTAT).

[23] Mnistry of Environment, Energy and Climate Change, 2014. 6th national communication and 1st biennial report under the united nations framework convention on climate change.

[24] Autority-ELSTAT, H.S., 2018. Digital library (ELSTAT).

[25] Minstry of Environment, Energy and Climate Change, 2018, Emissions gas stations mapsportal.ypen.gr/layers/geonode:stations

[26] Washington, S. P., M. G. Karlaftis, F. L. Mannering, 2010. Satistical and econometrics methods for transportation data analysis. Chapman and Hall/CRC.

[27] Ben-Akiva M., Lerman S., 1985. Discrete choice analysis, The MIT Press, Cambridge Massachusetts

[28] IBM Corp. (2015). IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp