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Driver choices towards ride sharing in Athens

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Abstract

The objective of this paper is to investigate and analyse the drivers' preferences toward ridesharing, with focus on examining whether the passengers intend to use a shared vehicle and identifying the main factors which determine the choice of ridesharing service as a way to travel. For this purpose, a stated preference experiment (questionnaire survey) was carried out in order to capture travelers' preferences on ride sharing preferences in Athens. In the next step, an appropriate modelling methodology has been developed, including descriptive analysis in order to explore the large database followed by two binary logistic regression models which were developed. Results indicate that especially young and female travelers were found to state that they would use ridesharing services to a higher degree. Furthermore, regarding traveling for work purposes, it was found that increasing transit time and number of weekly trips for work seems to lead to increase probability of the future ridesharing option.

Keywords: ridesharing services; drivers' preferences; stated preference analysis; binary logistic regression

1. Introduction

Ridesharing is one of the main drivers of the mobility sectors growth with worldwide revenues amounting to 44 billion, expected to exceed 100 billion by 2022, under an estimated annual growth rate of 19.1%. Similarly, the number of users is expected to reach 684.4 million by 2022, a figure almost double than the one reported in 2016 (Statista, 2018). This growth in the ridesharing market has been largely driven by the ability of filling gaps in transportation-related needs not met by other modes, as well as the lack of a well-defined regulatory framework. Particularly in cities where the taxi market is not as developed, TNCs have experienced continuous growth (CAR, 2016).

Ridesharing is the concept of “offer a ride” on vehicle where seats are available. It covers various options, the most common is when the owner of a vehicle has a predetermined journey and offers a seat to passengers going in the same direction in exchange for sharing the costs of the journey (Frazzani et.al., 2016). As defined by Le Vine et.al. (2014), car sharing sits within the emerging class of ‘mobility services’ that draw on modern technology to enable access to car-based mobility without the consumer owning the physical asset (a car). Rather than cars being shared between consumers, “the behaviour is more accurately described as sequential short-term car access”, where the vehicle is driven by the end user as in traditional car hire and not chauffeured. The dramatic rise of the internet-based smart sharing platforms has attracted substantial policy and academic interest, leading to debate on the ‘sharing economy’ concept (Martin, 2016). However, the rapid business expansion and innovation of the sharing mobility companies have profoundly challenged existing socio-economic relationships, knowledge systems and physical infrastructures in cities (Yaraghi and Ravi, 2016; Sundararajan, 2016).

Ridesharing has been among those novel ideas which use web technologies for exploiting unused transport capacity, at a low cost. Ridesharing services have been expanded worldwide, taking advantage of this new world of technology innovation. Technology has transformed them into a formal transportation service, which successfully competes with and/or complements traditional transportation modes (Stefansdotter et.al., 2015). In the last decade, several studies have investigated that ride-sharing is beneficial to drivers, passengers, and environment, because ride-sharing can reduce travel costs, total fuel consumptions, as well as carbon emissions, and help relieve traffic congestions (Kelley, 2007; Caulfield, 2009; Minett and Pierce, 2010; Chan and Shaheen, 2012; Amey et al., 2011).

Based on Chan and Shaheen (2012), ride-sharing services can be categorized into several kinds, based upon the way to make the trips i.e. traditional ride-sharing includes the “acquaintance-based” ride-sharing, which is typically formed among families and friends; the “organization-based” ride-sharing, which requires participants to share their trips within formal organizations; and the “ad hoc” ridesharing, which is realized through casual carpooling. Kahneman and Tversky (2013) indicated that the interaction between risk and value determines how consumers make decisions under risks. Research that studies the relationship between perceived value, perceived risk, and consumer intention to use e-services has not only proved perceived risk’s direct influence on purchase intention, but also confirmed that risk has a significant moderating role in the relationship between the users’ value perception and their adoption intention (Featherman and Fuller, 2010).

Nevertheless, ridesharing is not well-known as a potential option for traveling around Athens and has not been widely deployed in the city. This is probably due to the fact that for most people, owning a private car is a prime target for travel, especially in urban areas. This stems from the belief of Greek society that car ownership is proof of social recognition. An additional factor is the strong presence of the taxi market in Greece. Consolidation of ridesharing is being challenged by traditional taxi service companies (Athens Urban Transport Organization, 2015).

In that context, the objective of this study is to investigate and analyse drivers’ preferences toward ride sharing in Athens region, with focus on examining whether the passengers intend to use a shared vehicle and identifying the main factors which determine the choice of ridesharing service as a way to travel. For this purpose, a questionnaire has been developed and a stated preference analysis has been conducted which lead to the development of two statistical models, presented in the following chapters.

2. Data and Methodology

2.1 The 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 preferring ridership services over other travel options in the Athens Metropolitan area. The questionnaire survey included questions on travel characteristics of respondents, satisfaction of respondents with current mobility services, knowledge level of ridesharing services, stated preference on alternative mode choice sets and demographics. Questionnaire filling time was on average 7 minutes.

The first section of the questionnaire focused on recording the respondent's travel profile. This included information on trip purpose, public transport usage, vehicle ownership, main travel mode used for accessing workplace or other activities, travel time and cost for accessing workplace and attributes considered important for mode choice (Cost, Travel time, Reliability, Comfort, Safety, Flexibility, Availability). The second section of the questionnaire investigated traveler satisfaction on current mobility and transportation conditions in Athens. Respondents were asked to state their typical daily trip experience with respect to daily travel time and cost, public transport accessibility, access to taxi services, parking conditions, traffic safety and security, alternative travel options, as well as their overall satisfaction with their prevailing travel mode. Knowledge related questions with respect to ridesharing were included in the third section, aiming at understanding whether respondents have a good idea of what ridesharing is about. The fourth section was a choice set (stated preference) experiment, which targeted at identifying and understanding prevailing parameters affecting traditional mode choice selection versus ridesharing. Finally, the fifth section collected information on demographics of respondents (gender, age, income, level of education and so on).

In total, a sample size of 286 questionnaires was achieved which was deemed adequate for the purposes of the survey. A stratified random sampling technique was followed for data collection, reflecting current demographic characteristics of Athens inhabitants (gender, age, geographic distribution). At the first stage, pilot interviews were undertaken for assessing the quality of the survey process and questionnaires in order to identify limitations of the survey. Then, at the second stage, the survey was performed in four suitably selected Athens metro stations located in the center and suburbs of the Athens Metropolitan area and four suitably selected major commercial areas in Athens.

2.2 Area

Athens is the capital and largest city of Greece, and among the most important economic centers in Southeastern Europe. The city hosts significant commercial, financial and industrial activities, and its port (Piraeus) is the largest passenger port in Europe and the second largest in the world. The city of Athens (Municipality of Athens) has a population of about 700,000 inhabitants within its administrative limits, and a land area of 38.96 km². 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 (Ministry of Environment, Energy and Climate Change, 2014).

The Athens public transport system has a very good spatial coverage, but its performance has degraded in the recent years, because of budget cuts. Efforts are made for recovering, but these are partially hindered by the country's economic conditions (Figure 1).

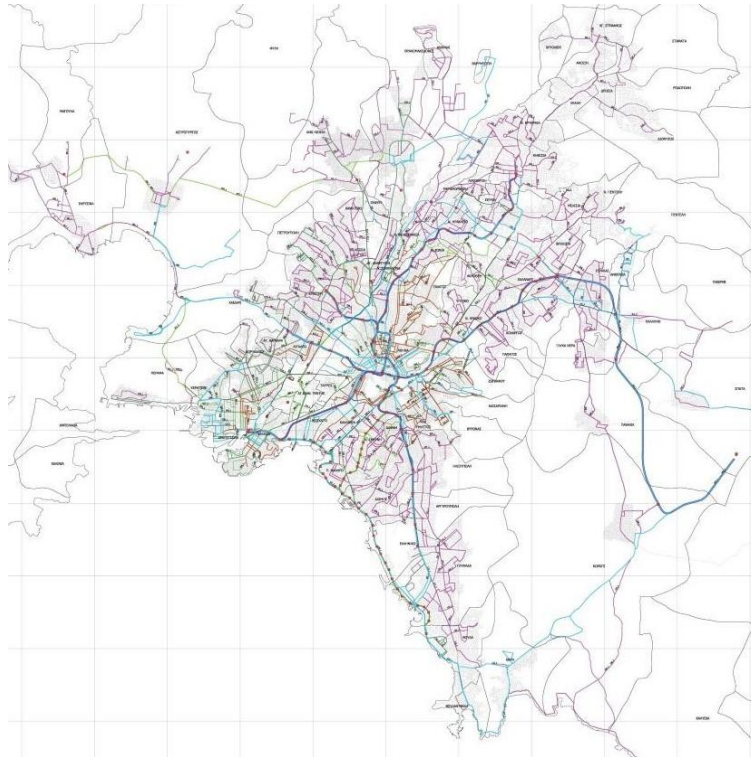


Figure 1: The Athens public transport network

Overall, current mobility services in the Athens metropolitan area tend to create preferential conditions for private vehicles. In this context, innovative mobility services could act as an efficient, alternative solution of private vehicle domination, possibly combined with improving performance of the city’s public transportation system.

2.3 Sample characteristics

In Table 1 the distribution of participants per age and gender is presented, indicating that sample follows a properly balance stratification with respect to these parameters.

Table 1. Distribution of participants per age group and gender

Age group	Female		Male		Total	
18-30	60	38%	61	48%	121	42%
31-55	77	49%	44	34%	121	42%
55+	21	13%	23	18%	44	16%
Total	158	100%	128	100%	286	100%

2.4 Statistical method

The questionnaires have brought out a large number of variables, which will next be used to develop models that will identify the main factors which determine the choice of ridesharing service as a way to travel. Certain specific criteria were implemented in order to accept an independent variable or not for the model. First, in order for a variable to be accepted for a model, it should be statistically significant and thus a separate t-test or a control coefficient Wald was carried out for each variable. Secondly, the correlation between the variables was tested so that the independent variables are linearly independent of each other because, otherwise, it is not possible to verify their influence to the three examined dependent variables.

After a series of exploratory tests, the application of the binary regression method was selected for statistical analysis of both questionnaire scenarios and the question related to the future use of ridesharing services. In each case, an effort was made so that the independent variables would also be distinguished by the ability to perform physical interpretation. A variable was kept in the final 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 while the quality of the model was determined by means of the R2 coefficient (Ben-Akiva and Lerman, 1985).

3. Results

3.1 Descriptive analysis

A preliminary part of the analysis focused on interpreting collected data using descriptive statistics. It is found that half of the respondents seem to be aware of ridesharing services, at least to some extent; this is rather encouraging given the fact that currently, ridesharing services are neither widely advertised, nor officially recognized by authorities as a competitive transport mode in Athens. Furthermore, while almost 57% of respondents have heard of ridesharing services, only 12% of them have used some ridesharing service in Greece and another 12% have used ridesharing services abroad. Additionally, many respondents are either unsure or unaware of the differences between taxis and a real-time ridesharing service. This may be attributed to the fact that ridesharing and taxi services in Greece share some common attributes such as electronic service booking.

An interesting remark is that most participants (46%) think that ridesharing services would be useful for the case of Athens (Fig. 2) indicating that people are willing to try ridesharing services, which is confirmed by the results of Fig. 3(a). However, only a small percentage of respondents (13%) feel that they could replace the use of their private vehicle with the ridesharing service in the future. This trend can be explained by the fact that in Greece the index of vehicle ownership is particularly high and the ownership of one or more cars is a sample of social wealth.

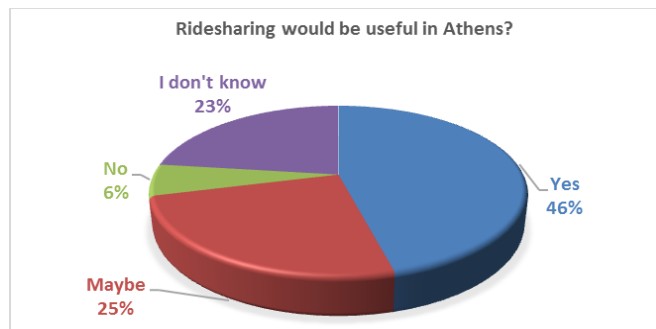


Fig. 2 Respondents' opinion about utility of ridesharing services for the case of Athens

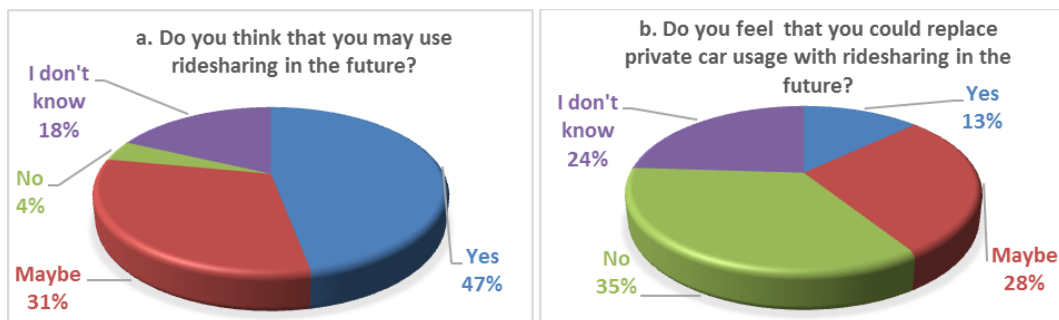


Fig. 3 Respondents' opinion in (a) future use of ridesharing services (b) replacing the private car usage with ridesharing services in the future

Finally, Fig. 4 presents respondents' satisfaction with respect at various aspects of their personal transportation and mobility conditions.

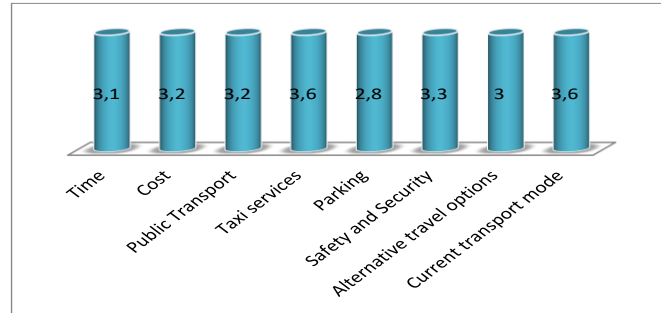


Fig. 4 Respondents' satisfaction (1: extremely dissatisfied, 5: very satisfied)

Results presented in Fig. 4 (on a scale from 0 to 5) indicate that respondents are moderately satisfied with respect to travel time and cost. Given that travelers tend to select modes and routes that minimize their generalized cost, it seems that mobility options are not that satisfying for respondents. Public transport accessibility satisfaction is adequate, while parking availability obtains the lowest rating among all aspects. Satisfaction on safety and security is higher compared to other aspects, while respondents are moderately satisfied by alternative travel options. Finally, satisfaction of respondents with respect to their preferred mode of travel is relatively high. This is an indication that many respondents might not be willing to shift to another mode, given current conditions in the Athens transport system.

3.1 Selection of ridesharing services in scenarios of stated preference experiment

As stated before, questionnaire data were initially analyzed, and two binary logistic regression models were developed. The first regression model investigated the factors on which the selection of ridesharing services depends. The dependent variable was designated as the choice of ridesharing services among (i) private car, (ii) taxi and (iii) public transport. Several trials were made to obtain the optimal model based on goodness-of-fit, both overall and based on variable significance. The model parameter estimates are summarized in Table 2.

For better understanding of the results it is noted that variable Time2 refers to the required travel time for a taxi to the scenarios, variables Comfort1 and Comfort3 represent comfort for traveling with private car and public transport respectively in the scenarios and finally the variables Cost1 and Cost3 represent the costs required to move to a private vehicle and public transport respectively in the scenarios.

Table 2. Binary logistic regression results

Abbreviation	Coefficient	Std. Error	Significance	Odds Ratio	Wald
Gender	,159	,077	,038	1,173	4,293
Income	-,605	,064	,000	,546	89,262
Time2	,035	,005	,000	1,036	59,645
Comfort1	-,964	,104	,000	,381	86,006
Comfort3	-,165	,082	,043	,848	4,095
Cost1	,256	,031	,000	1,292	70,106
Cost3	,811	,164	,000	2,250	24,394
Taxi usage frequency	-,529	,063	,000	,589	69,769
Travel time_work	,185	,036	,000	1,203	26,988
Current transport mode_satisfaction	-,112	,037	,002	,894	9,403
Ridesharing differs from taxi	-,183	,038	,000	,833	23,381
Constant	-2,399	,535	,000	,091	20,084

Based on these results, a series of deductions can be made. Females appear to intend to use ridesharing services to a greater extent than men. This observation is probably due to the fact that men are more attached to their private vehicle than women and therefore are less willing to change their mode of transport and choose ridesharing

services. It is also noted that increasing the cost of travel by both private car and public transport in the scenarios leads to an increase in the preference of the ridesharing service by the passengers.

Another interesting finding is that the probability of choosing ridesharing services decreases, the higher the annual income of the traveler is. This may be because of the perception in the Greek society of the ownership of a car; private car is connected to the social level of the holder. Furthermore, the frequent weekly taxi use as well as the belief that the ridesharing service does not differ in anything from a taxi scenarios lead to an increase in the preference of ridesharing services. This finding could be due to the fact that in Greece ridesharing service is confused with taxis and they are considered the same.

3.2 Future use of ridesharing services

The second regression analysis related the future use of ridesharing services to several explanatory variables. For this model, the dependent variable was defined as “Do you think that you may consider using ridesharing in the future?”. The model parameter estimates are summarized in Table 3.

Table 3. Binary logistic regression results

Abbreviation	Coefficient	Std. Error	Significance	Odds Ratio	Wald
Gender	,521	,239	,029	1,684	4,745
Age	-,426	,148	,004	,653	8,301
Are you aware of ridesharing	-,648	,150	,000	,523	18,741
ridesharing would be useful for the case of Athens	-1,298	,146	,000	,273	78,994
sharing a ride in a private car with people you may not know	-1,135	,189	,000	,321	36,241
How much do you spend for transportation per week	-,798	,160	,000	,450	25,003
Journeys_work	1,073	,192	,000	2,923	31,246
Flexibility	-,660	,135	,000	,517	23,717
Comfort	,405	,107	,000	1,499	14,340
Constant	10,086	,860	,000		137,632

Firstly, it is of particular interest the relationship between the journeys made for work and the intention to select ridesharing services as a means of transport for these journeys. Increasing the number of weekly journeys for work seems to lead to the choice of the particular means of transport. It was found that routes of more than twelve per week for work and education lead to a choice of ridesharing of more than 60% for men up to thirty and 70% for women up to thirty. This observation could be attributed to the fact that work routes have typically very specific features. Furthermore, a revealing discovery is the almost zero intention of choosing a ridesharing service by travelers of any age when they spend more than twenty euros for their weekly journeys. At the same time, the smaller the amount they intend to spend, the more likely they are to choose the ridesharing service. Indeed, young people up to thirty years old seem to opt for ridesharing at a rate of 100%. Additionally, the intention of choosing a ridesharing service increases as much as the comfort is considered to be important at a high level for the choice of means of transport. Further results emerge from the examination of the rest of independent variable coefficients.

In particular, women and young people up to thirty years old intend to use ridesharing services to a greater extent than men and other age’s travelers respectively. It is noteworthy that commuters over the age of thirty-five show almost zero intentions to use ridesharing in the future (Fig. 5). 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.

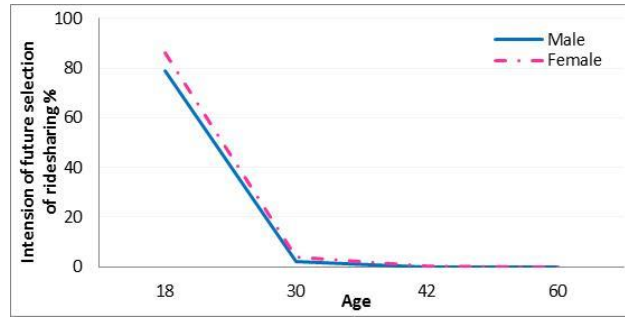


Fig. 5 Change of intention to choose ridesharing services according to the age of the commuters

In addition, an increase of the transition time and the number of weekly journeys for work or education purpose as shown in Fig. 6, seem to lead to the choice of ridesharing services. Probably this is due to the fact that many weekly trips to work are linked to more than two trips per day, which may require speed and flexibility, features that the private vehicle and public transport cannot offer due to the need of parking and the waiting time at the stop, as well as any necessary transfers, respectively. On the contrary, ridesharing services accommodate these features, since they offer door-to-door travel with minimal waiting time.

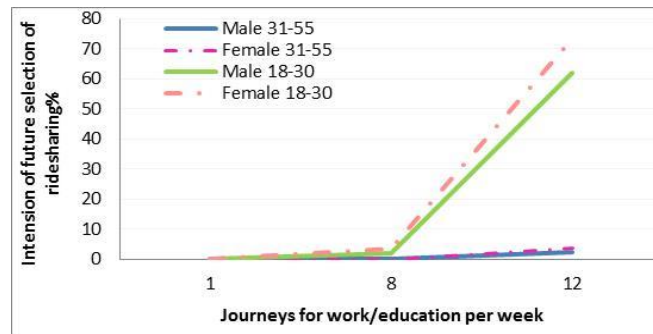


Fig. 6 Change of intention to choose ridesharing services according to the number of journeys made per week

Moreover, Fig. 7 presents that certain income categories are more willing to use ridesharing than others. Noteworthy is the almost zero intention of travelers of all ages to choose ridesharing when they spend more than twenty euros for transportation per week. A possible explanation for this trend is the conviction of travelers that the ridesharing services are not expensive, while those who can afford spending more money on their journeys will still use their private car or taxi services because they probably do not want to change their habits and feel that their private vehicle offers them the comfort they desire.

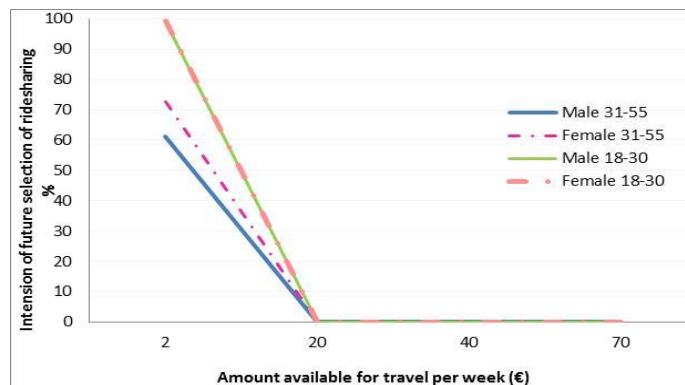


Fig. 7 Change of intention to choose ridesharing services according to the available amount for journeys made per week

4. Conclusions

This paper analyzed drivers' preferences toward ridesharing, with focus on examining whether the passengers intend to use a shared vehicle and identifying the main factors which determine the choice of ridesharing service as a mobility option. Overall results confirm the hypothesis that respondents appeared willing to use a ridesharing service in the future.

A first remark concerns the fact that due to extensive supply of taxi services around the city of Athens, ridesharing is not well-known as a potential option for traveling and also it has been confused with taxis. Therefore, the most respondents tend to use taxis, the less willing are to use a ridesharing service. Additional characteristics that influence people's preferences towards ridesharing services are cost, travel time and provided comfort of available means of transport and others. A particularly important finding is that the increase of the desire of respondents sharing a private vehicle with strangers greatly affects the intention to use the ridesharing services. In addition, satisfaction of respondents with respect to their preferred mode of travel is relatively high. This was an indication that many respondents might not be willing to shift to another mode, given current conditions in the Athens transport system.

Focusing on statistical part of the research, results confirm the initial hypothesis that gender, age and income affect the decision of choosing a ridesharing service. More specifically, model results indicate that women and young people up to thirty years old intend to use ridesharing services to a greater extent than men and other age's travelers respectively. In addition, an increase of the transition time and the number of weekly journeys for work or education purpose, seem to lead to the choice of ridesharing services. Consequently, certain income categories are more willing to use ridesharing while several other variables were found to statistically affect the probability to use ride sharing option in the future including taxi usage frequency, travel time from/to work, level of satisfaction of the current transport mode

Finally, it should be concluded that ridesharing is among those services considered by the users to contribute towards improving mobility conditions in the Athens metropolitan area. Therefore, opportunities of ridesharing if it is added to the existing transport players of the city, in a recovering transportation market, are worth investigating. In the next steps of the present research, a wider sample would help on the development of a more advanced statistical analysis methodology such as latent model analysis through Structural Equation Models. This analysis technique which suits perfectly with the scope of the present research needs a huge database on order to be implemented and will be the next scale up target of the present research.

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