

Article

Urban Congestion Charging Acceptability: An International Comparative Study

Mohamad Shatanawi ^{1,*} , Fatma Abdelkhalek ² and Ferenc Mészáros ¹

¹ Department of Transport Technology and Economics, Faculty of Transportation Engineering and Vehicle Engineering, Budapest University of Technology and Economics, 1111 Budapest, Hungary; fmeszaros@mail.bme.hu

² Institute of Mathematics, Faculty of Natural Sciences, Budapest University of Technology and Economics, 1111 Budapest, Hungary; fatma@math.bme.hu

* Correspondence: mshatanawi@edu.bme.hu

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Abstract: The congestion charging scheme is regarded as a successful measure to reduce traffic-related problems. However, low general acceptability of the public for implementing such a scheme is a barrier against its success. In this research, an online pre-designed survey was conducted in five capitals (Budapest, Tunis, Amman, Ulaanbaatar, and Damascus) to define the factors that affect congestion charging acceptability the most. The results of relationships between the studied factors like travel behavior and acceptance of the congestion charging scheme show an irregular pattern in each city. It indicates that the identity of each city and its general policy implications determine which factors significantly affect the public acceptability of congestion charging scheme. In Amman and Budapest, most of the predictors have no statistical effect on the schemes' public acceptability. Consistent with previous researches, on the other hand, the results demonstrate that the schemes' effectiveness is crucial and affects the acceptability significantly in all cities. At the same time, it shows that the "prior scheme knowledge" factor has a significant direct effect on the acceptability level in three cities (Damascus, Tunis, and Ulaanbaatar).

Keywords: congestion charging; acceptability; knowledge; comparison; attitudes

1. Introduction

Several economists and specialists in transportation consider congestion charging as a measure that can be used successfully to reduce congestion and its related problems [1]. Implementation of a congestion charging scheme in London, Stockholm, and Milan shows promising results. Respectively, 18%, 18%, and 14.2% reduction in traffic entering the congestion zone was assessed during charging hours [2]. However, there is an obstacle to the implementation of such a scheme; that is public acceptability [3,4]. Motorists are not used to paying for road use; moreover, they consider it as a preserved right to use the road freely [5,6]. For instance, the congestion charging scheme failed in the Netherlands, Copenhagen, and Edinburgh due to the lack of acceptability [7]. However, the low level of acceptability can be raised if the authorities properly introduce the congestion charging scheme by providing enough alternatives, considering fairness and using of revenues properly, as in the case of Stockholm and Milan [8].

Many researchers studied the acceptability of congestion charging within the societies using different approaches. For instance, the acceptability of congestion charging for people aged above 60 is affected significantly by social norms and pro-social values [9]. People who expect the implementation of congestion charging and see it as a fact are more open to accepting it than the people who are uncertain about its implementation and consider it escapable [10]. A study to explore the possibilities

for implementing a congestion pricing scheme in Brisbane, Australia shows that females are more receptive to the application of the scheme than males. People who use cars for commuting are more reluctant to accept the scheme than those who use other means like public transport [11]. Although the stakeholders in Spain are aware of the effect of traffic-related problems (environment and safety), they disagree with paying a toll to reduce them. This indicates that problem awareness does not affect the acceptability level; however, if the drivers feel that the congestion charging scheme is fair and the toll amount is appropriate, it would be more acceptable [12].

A study about the review of implemented congestion charging scheme's success in Singapore, Stockholm, Milan, and London concluded that people generally oppose a policy whose benefits are uncertain, and an increment of financial burdens is expected. This indicates that the lack of publicized information about the effectiveness of a scheme can be a significant reason for its rejection [13].

The acceptability of a congestion charging scheme also depends on personal-outcome expectations. People will better accept the scheme if they expect a positive impact of the reduction in traffic and environment-related problems for them [14–16]. However, it does not necessarily mean that people will change their private travel habits and patterns if they accept the congestion charging scheme [17]. A study about factors affecting congestion charging acceptability in China [18] concluded that freedom and fairness with its two components, that is, vertical equity and horizontal equity (e.g., revenue distribution), are the most related factors to acceptability. However, the effectiveness of the scheme was not a key factor for congestion charging acceptability.

A similar result of fairness and effectiveness was found in earlier research [19]. The authors also added that the income level of different groups in the society does not affect the acceptability of congestion charging significantly. However, if the scheme is implemented, the low-income group is more motivated to change its travel behavior to other transport modes like buses [20]. In contrast, high-income groups showed a tendency to keep using a passenger vehicle. Research about the acceptability of congestion charging in Athens indicated that respondents with high household income, age between 35 and 64 years, and those who have a higher value to time than the cost of congestion kept traveling through the charging zones using their cars [21]. As individuals' willingness to pay and the toll amount is essential for the acceptability of a congestion charging scheme, a study in Bosnia and Herzegovina determined that drivers have a range of possible limits for the toll amount [22]. Moreover, the drivers who drive during the weekdays are more willing to pay twice as much as those who drive during the weekends. Furthermore, the same research found a weak relationship between the purpose of the trip and the willingness to pay.

The usage of revenues from congestion charging affects acceptability; consequently, the whole package needs to be clearly and transparently explained to the public. Moreover, collected revenues should be used in projects and matters that directly benefit the users, such as improving public transport, reducing the tax on users, expanding the road capacities, etc. [23,24]. Results of a survey show that revenue allocation plays a vital role in the acceptability of the congestion charging scheme, and the revenue allocation for the transport system or reducing taxes of car owners are the most preferred options [14].

The European Union funded a large project called "Acceptability of Fiscal and Financial Measures and Organisational Requirements for Demand Management" (AFFORD). Measuring the urban transport pricing acceptability was part of this project in four European cities (Athens, Como, Dresden, and Oslo) in which the most affecting factors were defined [25]. A replication of this study was conducted in Vienna [26,27]. The current research follows their approach by partially applying the survey in five capitals around the world (Budapest, Hungary; Tunis, Tunisia; Amman, Jordan; Ulaanbaatar, Mongolia; and Damascus, Syria). The reason for choosing an already existing model instead of developing an entirely new methodology is that a unique procedure was followed in the mentioned research. It was utilized to find the factors affecting acceptability to compare the main findings with the previous work and the acceptance of the subject model in the scientific field as it was replicated in other cities (e.g., Vienna) too.

The authors of the AFFORD project compared two different strategies of congestion charging. The first is a “strong” strategy, and the second is a “weak” strategy where the motorists pay to a lower extent than the “strong” strategy. This study only focuses on the “weak” one. The proposed strategy in this research was designed adequately by checking the previous studies about congestion charging in the selected capitals, comparing it with any existing scheme within each country, and consulting with experts and specialists in transportation and economics to validate the chosen values of the amount of the tolls. Accordingly, it is assumed to avoid any bias in the reported results, which may occur as a result of an aggressive strategy or underestimated one.

This study is unique dealing with a cross-country survey inside Europe (i.e., Budapest), and outside (i.e., East Asia: Ulaanbaatar, North Africa: Tunis, Middle East: Amman and Damascus). The results will provide a more substantial base in finding the individual factors affecting the acceptability. Moreover, it will help in assessing the usability of the underlying model by comparing the main findings of the previous studies with our results, especially since the last three mentioned studies (i.e., the AFFORD and Vienna projects) were conducted only in European cities.

Some of the selected cities (e.g., Amman, Tunis, and Damascus) share similarities such as the share of transport mode, socio-economic characteristics, and residents’ habits. Moreover, in the past few years, both Tunis and Damascus have been engaged in an analogous political situation, the so-called “Arab Spring”. On the other hand, the selected cities Budapest, Ulaanbaatar, and the other three also have many differences. We believe that introducing this study on a large scale will provide a comprehensive understanding of the factors affecting the acceptability of the congestion charging scheme among different societies and under different conditions.

The major contribution of this paper is threefold: firstly, it measures the current level of the acceptability of congestion charging in the surveyed cities. Secondly, it identifies the main factors affecting the acceptability of the congestion charging scheme in the studied cities. Thirdly, it provides a broader scope for testing the underlying model in different environments and societies.

The paper is organized as follows. In Section 2, we summarize the theoretical background of selected factors. In Section 3, the methodology and description of the statistical analysis we applied are presented. In Section 4, the results of surveys in the studied capitals are shown. Finally, Section 5 presents the discussion and conclusions.

2. Theoretical Background

In this section, the factors assumed to affect the acceptability of congestion charging are discussed from a theoretical point of view [4,25,28]. Later, we have described the empirical analysis of data collected from the five countries and related it to the theory here to identify which factors are primarily related to acceptability.

2.1. Sensing Traffic-Related Problems

Sensing traffic-related problems is assumed as an essential factor to increase the acceptance level of a proposed policy or strategy which aims to solve these problems. When people evaluate traffic-related problems, like air pollution, as dominant or severe problems for society in general, it is assumed that the acceptance of a policy to solve the problems will be higher. The impact of these problems differs according to the individual’s background, education, owning a vehicle, etc. [29,30]. A study in Leeds and London revealed that the acceptability of congestion charging increases with traffic delay reduction. Moreover, as compared with Leeds, people in London show more acceptance for congestion charging due to more significant traffic problems [31]. However, people also expect other solutions such as improving soft mobility situations and not paying for using the road, which was already free [28]. In our research, we found the traffic-related problems are retrieved in two factors by using the factor analysis technique: (1) Service Factor, such as inadequate public transport system, and (2) Environmental Factor, like traffic noise.

2.2. Traveling Behavior and Attitude

Commuters have different travel habits, and they look for different goals. This research compares the positive traveling attitude which includes collective social benefits in the long run (e.g., “I want better air quality in the city”) and the negative travel attitude which concentrates on the personal outcome in the short run. For example, Figure 1 displays the mean values of two statements out of eight that were designed to explore the respondents’ travel attitudes. The question was measured using a Likert four-point scale from “Unimportant” to “Very important”. This comparison is derived from the concept of social dilemmas [32,33]. The assumption is that if commuters have a more positive traveling attitude, they will be more open to accepting the congestion charging because of its benefits to society. In contrast, the ones with negative travel attitude will most likely reject it as it restricts their mobility freedom and costs them more money.

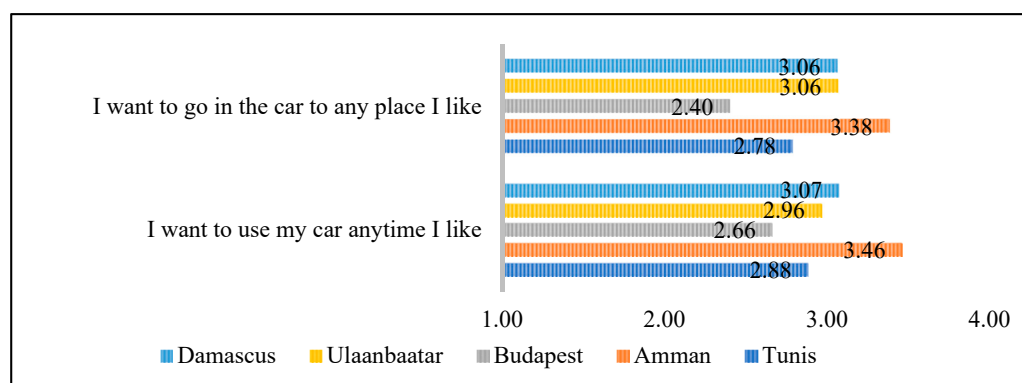


Figure 1. Negative travel attitudes.

2.3. Knowledge

The availability of information regarding the proposed scheme is assumed to raise people’s awareness about its effectiveness and benefits. Therefore, the raise of acceptability for a congestion charging scheme is expected [34]. However, this is not always the case because a high level of information may lead to higher assessment and consequent rejection of the scheme [4]. This research focuses on subjective knowledge (i.e., what the respondents think they know about the scheme) because it is more related to the acceptability [35].

2.4. Effectiveness of The Scheme

Authorities apply the congestion charging scheme in a city to meet specific goals, such as improving the environmental condition or solving problems like reducing congestion. The degree to which the goals are achieved is called “Perceived Effectiveness”. This is very important and related to the acceptability of the scheme. Previous studies show that people with higher expectations of the scheme’s effectiveness are more willing to accept the measures. Moreover, this research distinguishes between perceived and personal effectiveness. The latter focuses on the individual change in travel behavior due to the implementation of the scheme; in other words, the tendency of the people to reduce the number of their trips using their passenger cars [29,36]. For instance, one of the questions discussed the effect of applying a road pricing scheme on the respondents’ trips, and Figure 2 shows the mean answer values.

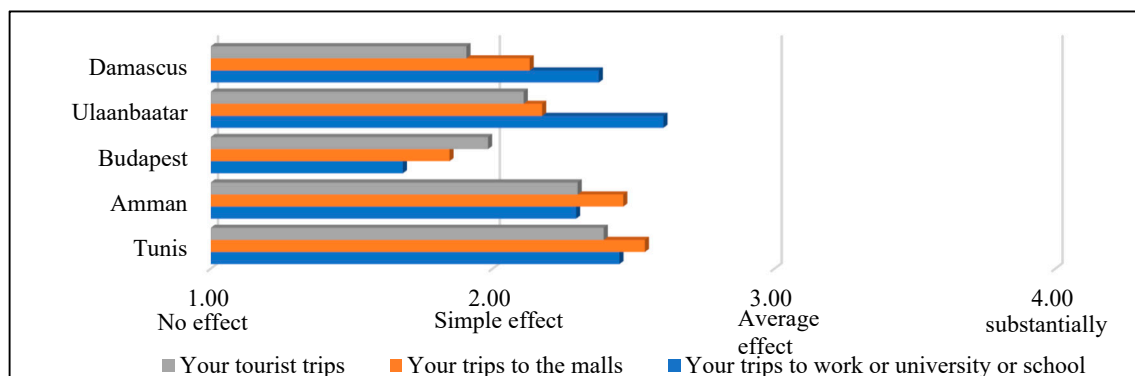


Figure 2. Expected effects of road pricing scheme on personal trips.

2.5. Ascription of Responsibility

Defining who is responsible for causing the traffic-related problems and who is responsible for solving them is essential and related to the acceptability of congestion charging schemes. The hypothesis is that if people feel themselves partially or entirely responsible for causing these problems, they feel that they should take part in solving them, and their acceptance level will be higher. Similarly, those who consider the government or others as responsible for these issues have lower acceptability [18,34,37]. However, other studies showed that the feeling of responsibility does not significantly affect the acceptability of a pricing measure, and this factor is considered negligible [12,38]. This research examines responsibilities sharing between the authorities and individuals according to the respondent's perspectives. We correlated the responsibility factors with the acceptability of the congestion charging scheme.

2.6. Social Norms Concerning Pricing Measures

The willingness to comply with a new pricing measure can be determined through the social norm or the expected social pressure. We asked respondents' perspectives about the acceptance of their family members and close friends for the congestion charging scheme. The assumption is that the expected social pressure affects the individual's opinion about the acceptance of the congestion charging scheme [3]. Thus, an individual's acceptability will be higher if the perceived social norm is in favor of applying it [4].

2.7. Background Characteristics

In the last section of the questionnaire, the respondents were asked about gender, age, income, employment status, and owning a car. In each city, income is measured according to the standard of living on a 5-level scale: from 1—"lowest income level" to 5—"highest income level". Similarly, age was recorded on a 3-level scale, (1) 20–30 years old, (2) 31–40 years old, and (3) older than 40. Generally, these indicators play an essential role in shaping the individual culture and the general way of thinking. Other researchers found that there are direct and indirect relationships between background variables and acceptability levels. As mentioned in the introduction, for example, males are more likely to reject the scheme than females, and income does not significantly affect the acceptability of such a scheme [19,39]. Moreover, other studies connect the socio-economic variables to the factors that may affect acceptability, such as perceived effectiveness. Ref. [40] (p. 13) found that "gender, age, and education level have a significant effect on the perceived uncertainty about the effectiveness and fairness of congestion charging".

3. Methodology

3.1. Sampling and Survey Instrument

The questionnaires were distributed randomly in the five cities using Google Forms. Time filter was considered to validate the responses, and responses completed within 10 min were eliminated from the analysis. The overall sample number was 1229. The study was based on an online survey tool. The online survey targeted specific audiences who have internet access and may not be representative of the distribution of populations. However, it is faster, cheaper, more convenient, and more accurate in our understanding. Basically, the questionnaire was based on a pre-designed survey of [25], which focused on a modified version of the “weak” pricing strategy. In Amman, data were collected during March and April 2018, and in the other four cities simultaneously from November 2018 to January 2019.

3.2. Quantitative Data Analysis Methods

Survey data with a high dimension is subject to a multicollinearity problem between the measured variables [41]. In addition, it is preferable to deal with fewer dimensions without losing much information. Accordingly, dimensionality reduction is important, but critical [42]. A multivariate statistical approach factor analysis is one of the most popular methods used for this purpose. It describes the variability among the correlated observed variables through a lower number of uncorrelated latent variables (known as hidden variables or factors) [43]. The number of these hidden variables/factors are obtained from one or more indicators.

Specifying the appropriate number of factors (K) that retains an adequate explanation of the data is not usually obvious. Therefore, principal component analysis (PCA) helps in setting this number [20]. Besides, the statistic called “Cronbach’s Alpha” measures the internal consistency of amalgamation of several questions into one factor. Furthermore, the Kaiser–Meyer–Olkin (KMO) statistic measures the data adequacy for conducting factor analysis [43].

Another basic and common multivariate statistical method is multiple regression modeling. This technique is a predictive analysis that allows researchers to study the relationship between one or more dependent variables and p number of independent variables. After checking the model assumptions (the linear relationship between the dependent and independent variables; the error terms are normally distributed and at the same time independent of the explanatory variables; no multicollinearity between the explanatory variables), constructing a multiple regression is legitimate. The regression model equation is as follows:

$$Y = B_0 + B_1X_1 + B_2X_2 + \dots \dots + B_pX_p + e, \quad (1)$$

where Y is the dependent variable; X_i : $i = 1, \dots, p$ are the explanatory variables considered in the model; B_i : $i = 0, \dots, p$ is the regression coefficient that measures the change of dependent variable according to the change of the explanatory variables; and e is the error term (residual) which measures the difference between the predicted and observed values of the response variable.

To answer our research questions, we first conducted the descriptive statistics (percentage distribution contingency tables/bivariate analysis) to create a profile for each city and compared it between the cities. Then, we used the factor analysis technique to create outcome measurements. Finally, the multivariate analysis (multiple regression) was considered to examine to what extent the outcome factors affect the public acceptability of the road pricing scheme within each city.

3.3. The Proposed Strategy

The proposed strategy aims to reduce traffic-related problems such as congestion, air pollution, etc. where the movement of the vehicles will be controlled through cameras registering the vehicle's movement (in and out) of the restricted zone. The charging areas "restricted zones" were not precisely defined in each city to avoid uncertainty resulting from respondents' unfamiliarity with a specified zone. Moreover, the suggested fees vary according to the time of the day, as shown in Table 1. On the one hand, the amount of fee was suggested according to (1) previous research proposals, (e.g., [44] (p. 51)); (2) similar implemented toll charging schemes (e.g., in Tunisia, motorists are charged for using the highway); (3) consulting experts about the most suitable toll amount. Due to the difficulties in finding the real congestion times in selected capitals, it is considered theoretically that the peak morning and evening periods are the most congested times. Therefore, the highest toll amount was assigned to these times. This made the proposed scheme easily understandable for the respondents. The respondents were informed that half of the generated revenue from implementing the scheme would be used for improving public transport, and the other half would be earmarked for the enhancement of the road network.

Table 1. The Proposed Pricing Strategy.

Time	Congestion Fee				
	Budapest	Amman	Tunis	Ulaanbaatar	Damascus
From 06:00 to 09:00	450 HUF ^a	1.0 JOD ^b	1.0 TND ^c	2000 MNT ^d	600 SYP ^e
From 09:00 to 15:00	300 HUF	0.5 JOD	0.5 TND	1000 MNT	300 SYP
From 15:00 to 18:00	450 HUF	1.0 JOD	1.0 TND	2000 MNT	600 SYP
From 18:00 to 21:00	300 HUF	0.5 JOD	0.5 TND	1000 MNT	300 SYP
From 21:00 to 06:00	Free of Charge				

a,b,c,d,e prices according to Google (18 July 2019). a. 1 HUF = 0.003 Euro; b. 1 JOD = 1.26 Euro; c. 1 TND = 0.31 Euro; d. 1 MNT = 0.0003 Euro; e. 1 SYP = 0.0017 Euro.

4. Results

4.1. Descriptive Statistics

The contingency table illustrates the percent distribution of the background characteristics "city profile" of each city (see Table 2). As shown, most of the background measurements differed significantly from a city to another. For example, a total of 60% of all respondents own a car. This percentage differed significantly for different cities. The highest percentages were noted in Ulaanbaatar and Amman (67.7% and 67.3%, respectively) and the lowest percentages in Budapest, Tunis, and Damascus (49.6%, 55.8%, and 57%, respectively). Consequently, people in Ulaanbaatar and Amman are more likely to use their cars than in other cities (59.7% and 64.6%). On the other hand, the majority in Budapest (64.5%) use public transportation more often. In all cities, people were less likely use soft mobility (bike/foot) means, especially in Amman, where less than 3% use it. The scheme knowledge varied significantly from a city to another. More than 60% of the people in Damascus reported that they had prior knowledge of the scheme, while this percentage was around 50% in Budapest and Ulaanbaatar and 47% in Tunis. Amman reported the least knowledge percentage, with 38%. Moreover, the mean of scheme acceptability was higher where the scheme knowledge was higher. Specifically, Damascus ranked first with an acceptability mean of 2.9, while Amman was the last with a mean of 2.1.

Table 2. Background characteristics/measurements “Cities profile” (%).

Background Characteristics/City	Amman	Damascus	Tunis	Budapest	Ulaanbaatar	Total
<i>Gender</i>						
Male	62.3	55.4	55.2	58.2	54.7	57.2
Female	37.7	44.6	44.8	41.8	45.3	42.8
<i>Age ***</i>						
20–30	54.3	34.0	51.3	64.3	48.2	50.4
31–40	27.9	31.6	22.9	21.7	39.4	28.7
41+	17.8	34.4	25.8	14.1	12.4	20.8
<i>Employment Status ***</i>						
Working	59.1	73.0	63.3	52.0	77.9	65.1
Student	31.6	16.4	20.4	44.8	16.9	26.1
Other	9.3	10.7	16.3	3.2	5.2	8.9
<i>Income ***</i>						
Lowest	26.7	17.3	11.7	34.6	10.9	20.3
Low	39.5	44.3	13.9	41.3	6.9	29.2
Middle	25.9	19.8	39.9	18.3	35.5	27.8
Highest	7.8	18.6	34.5	5.8	46.8	22.7
<i>Mobility ***</i>						
Car	64.6	45.0	50.7	20.6	59.7	48.0
Public Transportation	32.9	39.3	31.5	64.5	28.2	39.5
Foot/Bike	2.4	15.7	17.8	14.9	12.1	12.5
<i>Owning a car ***</i>	67.3	57.0	55.8	49.6	67.7	59.5
<i>Driving license ***</i>	88.6	78.6	87.8	78.3	89.5	84.5
<i>Scheme Knowledge</i>						
Knowledge ***	38.3	63.2	47.2	50.6	53.2	50.4
<i>Scheme Acceptance</i>						
Acceptability average (on a 1–4 scale) ***	2.1	2.9	2.8	2.5	2.8	2.6
Total number of responses	247	244	240	249	249	1229

Significance level: *** ($p < 0.001$).

4.2. Factor Analysis

The questionnaire consisted of 23 close-ended questions in three sections. The structure of the questions in both Sections 2 and 3 consisted of blocks of questions that measure various concepts. There were different blocks of questions concerning: (1) the “Sensing of the traffic-related problems”, “Travelling behavior and attitude”, and “Ascription of the responsibility”; and (2) the proposed congestion charging scheme and “Knowledge”, “Effectiveness of the scheme”, “Social norms concerning pricing measures”, and the usage of the revenues. Each block of questions retained two factors except acceptability, resulting in only one factor. Table 3 displays the names of outcome factors and factor analysis measures. According to the rule of thumb of Cronbach’s Alpha statistics, the reliability of composing the outcome factors indicates a good internal consistency. Moreover, the KMO results for all factors support the factor adequacy, with each factor explaining more than 50% of the total variance.

4.3. Bivariate Analysis: Hypothesis Testing

We used bivariate analysis, specifically, hypothesis testing to examine the effect of the city profile measurements on the pricing scheme acceptability factors. This technique compares whether the means of acceptability significantly differ by the profile characteristics within each city. The Independent Sample T-test was used if the profile measurement was binary, while a one-way ANOVA test was used if the profile measurement contained more than two categories (see Table 4).

Table 3. Factor analysis: Outcome factors and its internal consistency.

Factor	Number of Items	Cronbach's Alpha	KMO	Total Variance Explained
<i>Sensing Traffic Problems</i>			0.741	60.22%
Environmental	3	0.70		
Services	3	0.61		
<i>Ascription of Responsibility</i>			0.74	55.30
Government	3	0.73		
Individuals	4	0.61		
<i>Traveling Norms & Attitude</i>			0.70	54.42
Positive	6	0.70		
Negative	2	0.84		
<i>Expected Mobility</i>			0.75	55.0
Positive	4	0.75		
Negative	3	0.56		
<i>Scheme Effectiveness</i>			0.70	63.26
Positive	3	0.79		
Negative	3	0.58		
<i>Social Norms</i>				
Acceptability	2	0.70	0.72	76.80

Table 4. Mean of pricing scheme acceptability factor scores by background characteristics for cities.

Background Characteristics/City	Amman	Damascus	Tunis	Budapest	Ulaanbaatar
<i>Gender</i>		***	***		
Male	−0.508	−0.079	−0.030	0.064	0.256
Female	−0.470	0.439	0.411	−0.091	0.132
<i>Age</i>	*				*
20–30	−0.440	0.120	0.088	0.017	−0.008
31–40	−0.465	0.144	0.308	0.034	0.430
41+	−0.740	0.179	0.217	−0.138	0.253
<i>Employment Status</i>	*				*
Working	−0.633	0.115	0.046	−0.006	0.147
Student	−0.305	0.170	0.290	0.002	0.383
Other	−0.314	0.349	0.468	−0.229	0.340
<i>Income</i>					
Lowest	−0.424	0.222	0.191	−0.056	0.348
Low	−0.589	0.268	0.373	0.004	−0.305
Middle	−0.543	0.252	0.226	0.044	0.053
Highest	−0.329	−0.262	−0.056	−0.098	0.356
<i>Mobility</i>		*	*		**
Car	−0.503	0.039	−0.110	−0.328	0.061
Public Transportation	−0.550	0.218	0.381	0.119	0.493
Foot/Bike	0.078	0.313	0.255	−0.020	0.237
<i>Owning a Car</i>			***		**
Yes	−0.561	0.115	−0.057	−0.072	0.072
No	−0.378	0.191	0.456	0.074	0.459
<i>Scheme Knowledge</i>		***	***		***
Yes	−0.508	0.358	0.504	0.084	0.552
No	−0.514	−0.203	−0.123	−0.083	−0.213
<i>Total number of responses</i>	247	244	240	249	249

Significance level: * ($p < 0.05$); ** ($p < 0.01$); *** ($p < 0.001$).

As shown, the mean score of acceptability differs by the measurement profiles within each city. To illustrate, females are more likely to accept the pricing scheme than males in all cities. However, these differences are statistically significant only in the case of Damascus and Tunis (0.439 and 0.411,

respectively). Regarding age, the results differ significantly only in Amman and Ulaanbaatar with a slightly different pattern. People in Amman from all age groups do not accept the pricing scheme, while in Ulaanbaatar, people aged between 31–40 years old show more acceptability (0.430). Similarly, the acceptability between the employment status groups follows the variability pattern of the age. People in Amman with different professions show unacceptable attitudes towards the pricing scheme, while in Ulaanbaatar, they accept the scheme irrespective of their occupations; however, with different percentages. Surprisingly, the high-income level tends to have lower acceptability than other income levels in three cities. However, the acceptability does not significantly differ by income levels in any of the cities, which is consistent with the result of previous research [19].

It is important to see the effect of mobility attitude on scheme acceptability. The results differ significantly with the same pattern in Damascus and Ulaanbaatar, where people who use their cars more often are less likely to accept the pricing scheme (0.039 and 0.061, respectively). In Tunis, people who use their cars do not accept the pricing scheme (−0.110). At the same time, people who support soft mobility agree on the pricing scheme (0.313, 0.237, and 0.255, respectively). Thus, owning a car is an important measurement, where people who do not own a car are more likely to accept the scheme. Nevertheless, this is only significant in the case of Tunis and Ulaanbaatar (0.465 and 0.459, respectively). Finally, prior knowledge of the pricing scheme plays a vital role in acceptability. In general, the lack of knowledge harms the acceptability mean. The results are statistically significant in Damascus, Tunis, and Ulaanbaatar, and indicate that people who have information about the scheme are more likely to accept it (0.358, 0.504, and 0.552 respectively).

Surprisingly, in Budapest, none of the profile measurements affect the mean of pricing acceptability significantly. Moreover, the mean acceptability scores for all measurements in Amman are negative. The possible reason for this negative factor scores in the case of Amman is that, at the time of distributing the survey, there was a massive protest in the whole country against the austerity policy that applied measures like increasing the prices of goods and raising the tax rate. Hence, people were reactive against any new policy imposing charges on the citizens.

4.4. Multivariate Analysis: Regression Analysis

We examined the effects of background profile measurements and some other predictors on the pricing scheme acceptability using the multiple linear regression approach. In advance, we investigated the model's assumptions for each city. The scatter plot between the dependent variable (scheme acceptability) and each of the predictors indicated a linear relationship between them, and the residuals are normally distributed. Moreover, the variance inflation factor (VIF) for each predictor in the model was less than 3. In this analysis, we focused on the factor predictors: sensing traffic problems, effectiveness of the scheme, ascription of responsibility, mobility attitude, owning a car, and scheme knowledge. The background measurements as gender and owning a car are included as binary and used as control variables in the model (see Table 5).

Consistent with the bivariate analysis, the model shows that the background measurements (gender and owing a car) affect the acceptability in the same way in Damascus and Tunis after controlling all other predictors. For example, males are significantly less likely to accept the pricing scheme than females in these two cities (−0.307 and −0.231, respectively). For owing a car, the results show that people who own cars are significantly less likely to accept the pricing scheme than those who do not own cars only in the case of Tunis (−0.339). Besides, the prior scheme knowledge remains highly significant, while a lack of knowledge negatively affects the scheme's acceptability except in Amman and Budapest. The predictor factors begin with sensing traffic problems: the environmental factor significantly affects the pricing scheme negatively only in the case of Ulaanbaatar (−0.206). Although people reported that environmental issues due to the traffic problems are crucial, they are unwilling to accept the pricing scheme. Similarly, the service factor effect is significantly negative in the case of Amman and Tunis (−0.248 and −0.181), while it is positive in Ulaanbaatar (0.111).

According to the ascription of responsibility, surprisingly, the government responsibility factor is not statistically significant in all cities. In contrast, the individual factor has a significant direct impact on all the Arab cities. This indicates that if people consider themselves responsible for solving the traffic problems, their acceptance of the scheme increases significantly.

Table 5. Multiple regression coefficients of the scheme pricing acceptability model for each city.

Background Characteristics/Cities	Amman	Damascus	Tunis	Budapest	Ulaanbaatar
<i>Gender</i>					
Male	−0.055	−0.307 *	−0.231 *	0.166	−0.039
Female +	−	−	−	−	−
<i>Owning a Car</i>					
Yes	−0.068	0.154	−0.339 **	0.106	−0.233
No +	−	−	−	−	−
<i>Scheme Knowledge</i>					
Yes	0.078	0.399 **	0.383 **	−0.021	0.553 ***
No +	−	−	−	−	−
<i>Sensing Traffic Problems</i>					
Environmental	0.045	0.057	−0.092	0.085	−0.206 **
Services	−0.248 *	0.003	−0.181 *	−0.085	0.111 **
<i>Ascription of Responsibility</i>					
Government	0.053	0.148	0.071	−0.066	−0.064
Individuals	0.193 **	0.194 *	0.127 *	−0.072	0.025
<i>Traveling Norms & Attitude</i>					
Positive	0.024	0.187 *	0.130	−0.102	0.107 *
Negative	−0.067	0.134 *	−0.024	0.077	−0.054
<i>Expected Mobility</i>					
Positive	0.089	0.154 *	0.235 **	−0.064	−0.035
Negative	0.023	−0.119	0.035	0.006	0.002
<i>Scheme Effectiveness</i>					
Positive	0.176 *	0.299 ***	0.171 *	0.277 ***	0.527 ***
Negative	0.260 ***	0.289 ***	0.175 **	0.269 ***	0.207 ***
<i>R-Square Adjusted</i>	0.29	0.51	0.38	0.25	0.40

Significance level: * ($p < 0.05$); ** ($p < 0.01$); *** ($p < 0.001$); +: Reference Category.

All traveling attitude factors have a significant direct effect on scheme acceptability in Damascus, while only the positive attitude factor has the same effect in Ulaanbaatar. Moreover, the expected individual mobility upon scheme implementation (i.e., the expected positive mobility behavior where people are willing to reduce their use of cars) has a significant direct effect on accepting the pricing scheme only in Damascus and Tunis (0.154 and 0.235, respectively).

As anticipated, the scheme's effectiveness factors are statistically significant in all cities. There is a significant direct effect of the scheme's effectiveness on the pricing acceptability after controlling for all other variables. This indicates that people are willing to accept the pricing scheme if it helps in improving the road congestion issues.

In a nutshell, the model behaves differently in each city. Specifically, in Damascus, Tunis, and Ulaanbaatar, the model explains about 51%, 38%, and 40% of the variation in scheme acceptability, respectively. The model has the lowest ability to explain the variation of acceptability in Amman and Budapest, amounting to 29% and 25%, respectively. In the last case, most of the predictors in the model, except the scheme effectiveness, have no significant effect on acceptability. Accordingly, the policy conservatism and culture of fear have a significant impact on the scheme acceptability.

5. Discussion and Conclusions

The literature shows that congestion charging is considered a successful strategy to solve many traffic related problems like pollution, noise annoyance caused by traffic, delay in travel

time, congestion and road accidents, etc. [45–48]. However, the empirical studies showed that the public acceptability for implementing such a strategy is low [3]. Accordingly, low acceptability is a pivotal obstacle against implementing congestion charging schemes, especially in democratic societies. Many researchers examined the factors that affect the acceptability of congestion charging schemes, including socio-economic characteristics or other variables that affect travel behavior, and the way to improve acceptability.

However, the current research shows that the congestion charging scheme acceptability differs from a city to another and highlights the factors that profoundly affect the level of acceptability. The bivariate analysis shows some fluctuations in the variables that significantly affect the acceptability within each city. Surprisingly, none of the background characteristics have a statistically significant effect on the scheme acceptability in the case of Budapest, while only the age group and employment status significantly affect the acceptability in Amman. At the same time, Damascus, Tunis, and Ulaanbaatar share some similarities of the background characteristics that statistically affect the acceptability. This indicates that the identity of each city and its general policy implications determine which factors are important regarding acceptability of congestion charging scheme. However, the two factors of scheme's effectiveness have a direct statistically significant effect in all cities.

Fürst and Dieplinger [26,27] replicated the study of Schade and Schlag [25] in the city of Vienna, and we replicated both these studies in five capitals around the world (2018 and 2019). The current study uses the same technique; however, it introduces only one strategy which is closer to the “weak” strategy, instead of two strategies. Similar to the mentioned studies, the regression model examines the fundamental research question, “Which factors do affect the acceptability of congestion charging significantly within each city?” after controlling all other variables of the model.

Our model shows an irregular pattern of the factors that statistically affect the acceptability scheme within each city. However, it demonstrates that the effectiveness of the schemes is crucial and affects the acceptability significantly, consistent with the other researches. The “prior scheme knowledge” factor is not statistically significant in the case of Vienna, Athens, Como, Dresden, and Oslo, however, in our study, it is statistically significant in the case of Damascus, Tunis, and Ulaanbaatar. The current study emphasizes the significant direct effect between the scheme knowledge and the level of acceptability. Furthermore, it highlights the role of “travel behavior” and “individual responsibility for traffic related problems” on the acceptability of congestion charging.

In conclusion, the study uses a relatively small sample sizes of the study populations. Therefore, the results cannot be generalized to the country levels. However, it indicates the factors which affect the scheme acceptability significantly. To improve and enhance public acceptability of the congestion charging scheme, authorities should increase the scheme prior knowledge, and clearly explain the goal of implementing such a scheme and its positive effect on the daily lives. Similarly, people should feel responsible for causing the traffic related problems, which will lead to higher acceptability of the proposed scheme. This can be achieved by including the concept of externalities in the educational system and utilizing media in spreading awareness about individuals' responsibilities for solving traffic-related problems. Accordingly, these strategies will likely motivate people to change their travel habits and behavior to more environmentally friendly modes, especially if users were provided with suitable alternatives to passenger cars. This will have a significant role in improving the acceptability of the congestion charging scheme.

This research intended to study and point out generic human instincts about the proposed congestion charging scheme. However, in our opinion, it is the beauty of this research to come up with a new rational finding that people of different cities have different acceptability and response for congestion charging policy because of their own and their city's circumstances. This implies that a congestion charging scheme for any city or area should be uniquely conceived for the best results. This research will undoubtedly facilitate the study and development of congestion charging policies for other areas of the world.

Further research is to build a model that describes the acceptability of congestion charging schemes under new travel technologies. Specifically, how would congestion charging acceptability change with the emergence of autonomous vehicles and shared autonomous vehicles along with regular passenger cars?

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