Transport Policy 63 (2018) 157–164

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Modelling user perception of taxi service quality

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ARTICLE INFO

Keywords:
Taxi
Service quality
Ordered probit
Random effect
Systematic variation in taste

ABSTRACT

This article presents a research study on modelling taxi user perceived quality. Following a thorough review of the available international literature, relevant variables are individualised using focus groups of taxi users, and a satisfaction survey is designed. The resulting data are used to estimate two types of ordered probit models, which consider systematic and random variations in taste: on the one hand, a model that provides attributes and their influence on the perceived quality of taxi service when no previous information about the system is available and, on the other hand, a model that considers their changed perception after being informed about the attributes that could affect the system's perceived quality. The results mention the attributes that the users normally value and those that they would value after being asked to reflect on them.

It is worth noting that waiting time is the most important factor for frequent users, and journey time is highly valued by almost all users, along with safety, accessibility and comfort. Surprisingly, the fare is not usually as important as at the first thought. The results of this type of study are valuable because they allow us to understand and improve the system depending on user preferences, thereby improving the quality of services and increasing the demand.

1. Introduction

The constant growth in the number of private vehicles travelling on urban roads causes problems such as noise, congestion, pollution and traffic jams. All administrations address these issues by promoting sustainable mobility, a policy fundamentally based around the use of public transport. These goals can be achieved by using management tools to support policy application while optimising the use of available resources. The first step in guaranteeing sound resource management consists of applying user and journey characterisation studies to determine how users perceive the quality of service when deciding to make their journeys by public transport.

From a point of view of sustainable mobility, the taxi is not the best way to travel around an urban area; nevertheless, it has its environmental advantages in that people will generally use it to avoid problems associated with parking and for its speed and ease of use. Taxi use avoids the creation of 'parasitic traffic' due to cars cruising for a parking place, and it frees up public space because one vehicle provides a service to many users who have not used their own vehicle and who would otherwise be occupying street space and ultimately a parking space. To encourage continued public use, the service needs to operate in accordance with certain quality standards that would be better under public control.

This article proposes an overall methodology for studying the quality of service perceived by taxi users. The methodology includes the design of a satisfaction survey and the use of ordered probit models on the data collected to propose marketing strategies aimed at increasing taxi use.

The paper is structured as follows: the introduction is followed by an analysis of the state of the art, and then, the methodology used is presented, which includes the design of the questionnaire and an explanation of the models used in the analysis of the data collected. A case study is then described, and the results are analysed. This is followed by the most important conclusions drawn from the work.

2. State of the art

The perception and understanding of user behaviour relative to service quality is vital in researching any mode of transport (Tam et al., 2008; dell'Olio et al., 2011). An abundance of literature is available on the methodologies for evaluating the perceived quality of service of transport modes. These were based mainly on the debate and application of two of the most well known and most widely used methodologies: SERVQUAL (Parasuraman et al., 1988) and SERVPERF (Cronin and Taylor, 1992).

Alternative approaches were applied later: the use of neuronal networks (Behara et al., 2002; Garrido et al., 2014), discrete choice models

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https://doi.org/10.1016/j.tranpol.2017.12.011
Received 11 January 2016; Received in revised form 11 October 2017; Accepted 6 December 2017

(Hensher and Prioni, 2002; dell'Olio et al., 2010; Eboli and Mazzulla, 2008, 2014; Echaniz et al., 2017), the use of mixed data from passenger perceptions (subjective and objective measures) and transit agency performance measurements (Eboli and Mazzulla, 2011), structural equations (De Oña et al., 2013) and classification tree techniques (de Oña and de Oña, 2015). An extensive review can be found in the studies by de Oña and de Oña (2014) and Barabino and Di Francesco (2016).

However, few works have concentrated on evaluating the importance of perceived quality on the demand for taxis. Yao and Ding (2011) stated that despite the scarcity of publications about the subject, many cities around the world (e.g. Singapore, Shanghai, Hangzhou or Hong Kong) periodically check the prevailing perception of taxi service quality. However, they also explain that no research has shown that the variables being measured in these studies really show the true quality perceived by users.

Despite being in a different context, we found a clear example of the importance of choosing the right variables for measuring the quality of service in the research study by Tan et al. (2014). They held focus groups (FGs) to find the key factors and attributes for measuring the quality of service in the Chinese fast food restaurant sector before applying the widely used DINESERV method (Stevens et al., 1995). They found that additional variables should be added to the standard method to adapt it to a different cultural context. As will be explained later, in the taxi service case, the cultural and economic context has a significant bearing on the importance of the variables perceived by users as well.

The first studies the authors are aware of that refer to the quality of a taxi service were from the early 1970s, and all of them were related to regulating or liberalising the service (Douglas, 1972; De Vany, 1975; Abe and Brush, 1976; Foerster and Gorman, 1979; Paratransit Services, 1983; Frankena and Pautler, 1984; Moore and Balaker, 2006; Yang and Yang, 2011). In most of these studies, quality of service is expressed in terms of taxi user waiting time, which is a relevant variable used in the design, modelling and market research of the sector (Yang and Wong, 1998; Yang et al., 2000; Wong et al., 2001; Wong et al., 2008; Kim et al., 2011); however, the perception of the users themselves and the consideration of certain other variables other than the waiting time have not been so widely studied. This fact was confirmed by Tam et al. (2010) who incorporated satisfaction as a latent variable among the explanatory variables in a mode choice model on the entrances to the Hong Kong international airport. A noteworthy improvement in specification and estimation was found, showing that satisfaction makes an important contribution.

The importance of customer satisfaction has increased recently because of the appearance of new competing players in the taxi sector. Wallsten (2015) analysed the competition between taxi services and ride-sharing services such as Uber. He used two case studies, the city of New York and Chicago, and analysed the evolution of the number of complaints. He found that this new sharing mode has considerably reduced the number of complaints in both cities, or, at least, the particular complaints related to service facilities. Furthermore, the author found that the results from both cities were consistent with the idea that taxis respond to new competition by improving quality.

One of the first studies to cover a wide range of variables for measuring the quality of service was done by Yao and Ding (2011). They evaluated perceived quality and user satisfaction by weighting the SERVPERF method using the data from 230 questions asked to taxi users in Hangzhou (China). The 22 variables analysed, adapted for the taxi service, were grouped into five dimensions: tangible, assurance, reliability, responsiveness and driver empathy. The drivers' knowledge of routes was a determining factor (they explain that this was to be expected as it determines how long the journey will take or how much it will cost), and all the variables related to driver behaviour were highly valued by the users.

The importance of these variables is consistent with the research of Li and Song (2011). They applied entropic weighting to find the relative weight of each quality variable and the well-known TOPSIS method (Hwang and Yoon, 1981; He et al., 2009) to find the satisfaction index of each explanatory variable. Twenty-two variables were analysed, and the quadrant method was used to combine the two factors and evaluate the results. According to this method, the authors recommended the improvement of factors related to information, vehicle performance and driver behaviour. Dachyar and Rusydina (2015) added the corporate image as a significant variable to improve customer satisfaction and loyalty in Jakarta.

Recent studies have correlated the user perception of performance and quality of service variables with their socioeconomic characteristics. Techarattanased (2015) and Shaaban and Kim (2016) analysed the taxi services in Bangkok and Doha, respectively. The former applied the SERVQUAL-based approach and the latter proposed a SEM-based approach. The results of both studies are conditioned to the socioeconomic context of case studies; however, both studies found driver behaviour to be an important variable, among others, to improve both the quality of service and user loyalty, and they stated that travel cost was statistically significant only for low-income level users. However, in Doha case study, Shaaban and Kim also highlighted accessibility to taxi ranks as a key variable.

As can be seen, there are several approaches for modelling the quality of taxi services. The importance of the variables analysed is strongly dependent on the cultural and socioeconomic context. However, the variations in the user perception of these variables have not been studied in detail. The present research tends to fill this gap by combining (i) a previous analysis based on FGs for choosing the right variables to measure and to provide the input for the final user survey (revealed preference survey) and (ii) an approach based on applying ordered probit models that consider systematic and random variations in taste.

The aim of this paper is to make progress on all the previous studies in the following ways:

a. Propose a robust quality evaluation method for finding the attributes valued by users and the attributes they would value if they had previous knowledge about them.
b. To create a method not based on synthetic indices with the inconvenience of not being able to determine the statistical relevance of the quality attributes, but on an ordered probit model, which is also a compartmentalised model.
c. A method that can capture systematic variations in user tastes, an important factor given that it allows administrations to implement direct marketing policies aimed at certain sections of users.

3. Methodology

When modelling the quality of service as perceived by users, it is important to remember that perceptions are qualitative, and therefore, the determinant variables for consideration when designing the satisfaction survey were found to involve the qualitative methodology of FGs formed of taxi users.

The main objective of holding the FG was to help the planners design the surveys. The FG is one of the qualitative tools used in social research for the process of citizen involvement. The FG allows social discourse to be reproduced on a small scale by selecting suitable participants (eight or nine members) defined according to the objectives of the study (Ibeas et al., 2011).

For the questionnaire designed in this research, the judgement of quality varied on a scale of five levels ranging from 'very bad' to 'very good'. The model proposed in this article is based on the McKelvey and Zavoina (1975) specification, who defined the ordered model as a latent regression adapted to ordinal outcomes. In the taxi user perceived quality study, the semantic and qualitative responses of the scale defining the overall service are converted into four discrete but ordinal numerical values ('very bad-bad', 'regular', 'good' and 'very good', and as there were very few replies scoring 'very bad', this particular category was merged with 'bad') and introduced as the dependent variable following expressions (1) and (2) below (Greene and Hensher, 2010):