

Experiments in transport related choices: the influence of risk and uncertainty in determining workers' behaviour with respect to parking alternatives.

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Abstract.

Over recent years, parking policy has become a key element of urban transport policy and planning in many countries. The need of urban mobility, mostly guaranteed by private cars, impacts on the policy, and regulations of parking areas. This issue is particularly relevant to work related regular trips. Since, workers have a very rigid demand for parking spaces, and limited alternatives to private transport. Often working places have a car parking area to satisfy workers needs but when this is not provided, it implicitly conditions workers' (consumers) behaviours. The aim of this research is to analyse the trade-off between parking space availability and cost, in terms of time saving (considering time in terms of foregone earnings). This information is pivotal when designing parking policies in terms of fares, investments and regulation. The opportunity cost of saving time, having information on the availability of slots closer to the working place, is conditioned by the worker's income and earnings. Since the pivotal work of Axhausen and Polak (1991), a relevant body of literature has focused on parking behaviour, measuring many different dimensions in terms of travellers' choice of parking type and location. However, little attention has been devoted to understand how risk and uncertainty influence drivers' behaviours in parking decision. This paper presents two studies addressing this issue. Both aims to collect disaggregate data on travellers' responses to changes in parking attributes and related information. Different components of the parking activity (e.g., general in-vehicle time, parking search time, egress time) are controlled for, in relation to the characteristics of the respondent. In order to avoid heterogeneity in relation to journey purposes we focus on workers' mobility. The first study is carried out using a standard stated preference approach; the second is carried out in the laboratory. The collected data is used to build simple model of consumer's choice related to parking decision, taking explicitly into consideration both risk and uncertainty. Experiment's results are compared to the quasi-experiment's outcome in order to identify potential significant differences and, where possible, with existing revealed and stated preference results.

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Introduction.

The importance of parking areas has always attracted the interests of urban mobility policies but recently academic researches point their attention on the drivers' behaviour approaching the decision of parking. Literature's interest is on the value of travel-time saving (Moses and Williamson 1963, Becker 1965, and Cherlow 1981), an important element which reduction is seen as a benefit, and on the value drivers give to the possibility of having a definite information on the availability of parking slots.

In this paper, different aspects that can influence drivers' behaviour are analysed. Restricting the study only to one transport mode, own private vehicle (car), the research question, at which we would like to give a deep explanation, regards the definition of the price of parking for workers in terms of willingness to pay .

The aim of this study is to investigate how individuals behave when they have to face a parking decision, how they value time-saving, and information about the availability of parking areas nearby the working place.

The willingness to pay for certain information on the availability of parking opportunities is here pointed out throughout an experiment. In detail, we will obtain this information employing two complementary approaches: a natural field experiment¹ (survey) and a laboratory experiment². The outcomes of these different but complementary methodologies will help us to have a more complete and clearer idea of commuters' preferences when they face risky or uncertain³ parking decision.

Research question.

This paper argues on the commuter's parking decision that is made under risky, and uncertain situation. In order to explain how commuters behave and which factors can influence their choice we conducted two experiments, the first one is based on a stated preference questionnaire administered to drivers that commute from home to work and *vice-versa*, the second is carried out in a laboratory through the set up of an experiment. The comparison of the results enables us to identify the difference between the outcomes obtained from the two different, but at the same time complementary methodological approaches.

The aim of this work is to point out the attitude of commuters towards risky, and uncertain situation. Their conduct can be explicitly revealed through a survey, thanks to which we collect socioeconomic information and the propensity for risky or uncertain outcome, as respondents are asked to choose among different hypothetical scenarios that include slight variations of what is present in reality (Golias et al. 2002, Henser 2001, Axhausen and Polak 1991, Peter and Polak 1993). A secondary, but not less relevant, outcome is that of being able to compare the results from a natural experiment setting, and a laboratory experiment (Holguin-Veras et al. 2003 and De Jong 2012). The natural experiment allows us to observe the choices that individuals make in a natural environment but we are unable to pick the behaviour in an uncertain situation, this leads us to elect a laboratory experiment, which even in a decontextualised context, still can give us appropriate results on the decisions under uncertainty.

Before modeling the set of choices to propose the respondent, it is important to clarify the alternatives and the attribute we use in order to obtain different degrees of certainty and uncertainty. We focus on the decision about the parking mode, so it is necessary to explain the type of parking that can be chosen, and their characteristics, that determine the choice despite another one.

The parking slots are identified according to their nature, and the attributes that better identify them are: the parking ticket, the time-related variables such as the in-vehicle time, searching time and walking time to the working place.

The purpose of the paper is to understand the role that certain-uncertain information has on respondents, and to do that we introduce a new parking mode (actually not in use in the area we are considering), an SMS booking system for the parking slot that is an easy procedure that allows commuters to book in advance the slot in a particular parking area, avoiding the searching time for it and, removing any uncertainty about its availability.

The trade-off between parking ticket and time-variant variables (as the walking time or the searching time) emphasizes the different degrees of uncertainty and risk. It is known that certain information, as long as the travel time variation, is perceived as a cost for commuters (Axhausen and Polak 1991, Peter and Polak 1993). Comparing their combinations we are able to define different degrees of knowledge, from known certainty to unknowable uncertainty, essentially moving from a slot booked by an SMS to a metered slot the ticket price will decrease and simultaneously the risk of not finding an available parking will increase.

Commuters' behaviour under risky situation can be revealed using a survey, as the guaranteed degree of knowledge is the same among the respondents, even if the hypothetical scenarios might not realistically represent the daily conditions.

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Natural field experiment : it is an experiment which employs standard subject pool but the environment is one where the subject naturally undertake these tasks and where subjects do not know that they are in an experiment." in Harrison G. W. , J. A. List (2004), pp.1013-1014.

²Lab experiment: is one that employs a standard subject pool of students, an abstract framing and an imposed set of rules" in Harrison G. W. , J. A. List (2004), pp.1013-1014.

³Risky event is defined as a situation in which individuals have a known or a knowable probability distribution, while as regard the uncertainty, individuals do not have a defined probability distribution

The survey we developed is divided into three parts:

- the first section collects the socio-economic information about respondents as the age, gender, income, number of cars in the household;
- the second section is related to the trip information, basically in this part we investigate on the reason of the trip, the duration of the trip (including the in-vehicle time, searching time for the parking and the egress time), the number of trips per week and the parking mode usually used;
- the last section essentially describes the hypothetical scenarios that the respondent could face.

We model different scenarios for a set of three different parking types. The alternatives between the parking modes are:

- technological parking type: guarantees the option of booking a parking slot by an SMS, giving to the driver a certain information about the availability of the slot;
- non-technological parking type: includes all the off-street parking types such as the garages, multiparking, etc.;
- on-street parking: is the common parking slot available on street and usually very close to the final destination.

The attributes that change across the eight cards are the ticket price (according to the different parking mode), the searching time, and the walking time to the working place. In order to test for the certain versus the uncertain we introduce a new attribute that is the parking probability, that in other words is the probability of finding the parking slot available in the option taken into account. Once the respondent makes her choice we can realize how the change in the ticket cost, jointly with the time-variant variables, had affected the final decision. The trade-off between ticket cost and time-related variables will be taken into account in our analyses.

The results of this survey are useful to segment commuters, along with their risk attitudes⁴, as for example into: commuters who prefer to pay a higher ticket with the certainty to find a slot closer to the final destination (working place); or commuters that prefer to pay a lower ticket incurring in higher searching and walking time (usually considered as costly). This underlines the propensity of commuters to rely on certain versus uncertain knowledge about the slot availability.

In the literature it has been noticed that achieving results on the propensity of respondents making decisions under uncertainty levels through a stated preference approach, it is not always an easy task.

The on-line booking system is usually known (Wang 2011, Koulayev 2009, Lee et al 2007) as a service characterised by different levels of uncertainties of risk knowledge. The uncertainty can be of different types as: known uncertainty, when the risk probability is precise and specified; unknowable uncertainty, where the risk probability is unknown to everyone or we can face an unknown uncertainty in the case the risky probability is an information not available to one but may be possessed by others.

Academics underline (Wang 2011) that certain information (known certainty) is costly (willingness to pay), and issues relate to the risk accepted by consumers are usually considered in works focused on line booking purchase (Koulayev 2009). Taking into account these works, the second part of the research, focused on the uncertainty, is conducted through a laboratory experiment.

We recruited students from the University of Bari via a mailing-list system. They were presented with a set of triple wise choice questions; each choice problem is composed of three lotteries, labelled “Lottery A”, “Lottery B” and “Lottery C”, of the kind depicted in Figure 1. Each subject has to report his/her preference between the three lotteries.⁵

The experiment was conducted at the ESSE laboratory of experimental economics at the University of Bari in March 2013 with 100 participants. In the experiment each participants were presented with the same 128 choice problems. The time taken to complete each session varied across subjects, since participants were explicitly encouraged to proceed at their own pace. The incentive mechanism was that the chosen lottery would be played for real. Specifically, whenever a subject completed the choice problem, one question out of the 128 was randomly selected, and played out for real.

Each single lottery is closely related to the situation proposed on the stated preference cards (such as: walking time, searching time and parking probability) but are obviously decontextualized, and rearranged in different terms, even if easily ascribable to the ones mentioned above.

The two approaches give us two complementary results, the one obtained by the survey points out the behaviour of commuters, as when we vary the attribute of the parking mode in the different scenarios proposed as we model for different degrees of risks, while the results obtained with the laboratory enable us to focus on the decisions made under risk and uncertainty.

⁴Risk attitude is a mind-set towards taking or avoiding a risk when deciding how to proceed in situations with uncertain outcomes, it differs from risk propensity (the attitude towards taking risk) and from risk aversion (attitude towards avoiding risk).

⁵Note that we are deliberately not allowing subjects to express indifference between lotteries. This simplifies our data analysis since, if subjects are given the opportunity to express indifference and take advantage of this opportunity, it is not obvious how one should treat such responses (see Hey, 2001). Moreover, this choice does not affect the value of the experiment to the subjects, since if subjects are truly indifferent it does not matter how they respond, given the adopted incentive mechanism.