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Carpooling and carpool clubs: Clarifying concepts and assessing value enhancement possibilities through a Stated Preference web survey in Lisbon, Portugal

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ABSTRACT

The increase of urban traffic congestion calls for studying alternative measures for mobility management, and one of these measures is carpooling. In theory, these systems could lead to great reductions in the use of private vehicles; however, in practice they have obtained limited success for two main reasons: the psychological barriers associated with riding with strangers and poor schedule flexibility. To overcome some of the limitations of the traditional schemes, we proposed studying a carpooling club model with two main new features: establishing a base trust level for carpoolers to find compatible matches for traditional groups and at the same time allowing to search for a ride in an alternative group when the pool member has a trip schedule different from the usual one. A web-based survey was developed for the Lisbon Metropolitan Region (Portugal), including a Stated Preference experiment, to test the concept and confirm previous knowledge on these systems' determinants. It was found through a binary logit Discrete Choice Model calibration that carpooling is still attached with lower income strata and that saving money is still an important reason for participating in it. The club itself does not show promise introducing more flexibility in these systems; however, it should provide a way for persons to interact and trust each other at least to the level of working colleagues.

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1. Introduction

The continuous rising of car use deriving from urban sprawl and car ownership growth is still making traffic congestion more frequent in urban areas (Bukold et al., 1996; Schrank and Lomax, 2005). The majority of trips are single occupant vehicle trips (SOV) resulting in more cars for the same number of persons. In 1990, approximately 90% of the work trips and 58% of the other trips in United States were done in SOV (Shaheen et al., 1999). Numbers of 1997 show that the average occupancy rate of the automobiles in commuting trips for the 15 countries of the European Union was, at that time, in the interval between 1.1 and 1.2 persons per vehicle (IEA, 1997). Hence the problem is not so much car ownership increase but mainly the way the automobile is used, and when it is used, "A good deal of the demand for transport is concentrated on a few hours of the day, in particular in urban areas where most of the congestion takes place during specific peak periods" (Ortúzar and Willumsen, 2001), generally the morning and evening commuting periods.

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Carpooling is considered an interesting Transport Demand Management (TDM) tool that has produced some diminishment in the number of SOV trips in the past, mainly when applied to employment centers where persons have their companies in common (Wartick, 1980; Willson and Shoup, 1990; Bianco, 2000). The other alternative is household carpooling, yet this has proven to be very inefficient in decreasing work related auto trips (Bard, 1997; Morency, 2007). An increase in scale of participation, from companies to large-scale systems, has always been the objective of public policy making. Still, early research has shown that this is difficult to achieve due to the high probability of sharing the vehicle with a non-acquaintance (Duecker et al., 1977).

On the other hand, the classical carpooling systems have low flexibility, particularly in handling schedule variations and destinations that persons sooner or later will have, which is aggravated by the dependence on other persons that carpooling entails (Stephen and Duecker, 1974; Margolin et al., 1978; Concas and Winters, 2007). This has resulted in only a small percentage of the persons who make a positive change in commute-mode to carpooling to stay with this new mode until they are not traveling to their workplace anymore (Smith and Beroldo, 2002).

The question that arises out of the previous research is if there is any way to improve carpooling attractiveness and resilience by considering a different form of organizing and promoting this transport alternative. Most of the research projects on this subject were published in the seventies and eighties; thus, there is the need for further exploration of the sources for its lack of success in reaching ways to improve carpooling usage.

We were moved by the will for proposing a new model for a carpooling systems' organization which could overcome the limited results from past applications. We took advantage of the relative inexperience with carpooling systems in the Lisbon Metropolitan Area (LMA) in Portugal with three million inhabitants (the largest in the country) to evaluate the main motivations and deterrents to carpooling. In this, we tried to assess which demographic characteristics and commuter situations would be more favorable to the acceptance of carpooling.

We started by reviewing the state-of-the-art and state-of-the-practice of carpooling systems in order to derive the attributes of a carpooling club which could, in theory, overcome previous limitations of this transport alternative. To test this structure, a web-survey was set up on the internet comprised of two sections: the first, for collecting socio-demographic and usual commuter trip data and the second, with a Stated Preference (SP) experiment presenting four binary choices for each respondent comparing his current driving situation and an alternative with external (non-household) carpooling.

The paper is organized in the following way: in the next section, the carpooling structure in the form of clubs is derived from past experience and research. Then, a review of the main factors found to influence carpooling in the past is presented in order to support the survey design. This is followed by the construction of the SP web survey that was made available on the web for the Lisbon region. Next, the Discrete Choice Model (DCM) estimated with the SP data is presented. The article continues with a detailed analysis of the main results and finishes with a discussion and conclusion on its main findings.

2. Deriving a carpooling structure in the form of clubs

After reviewing the previous studies, two main problems came out to be the most limiting factors for carpooling: the psychological barrier of riding with strangers, which is necessary for expanding the scale of the systems; and poor schedule flexibility, where near term schedule changes are very difficult to be managed by traditional systems.

In order to cope with these two main problems, we researched a structure for managing carpooling in the form of clubs, which aims working upon schedule flexibility and psychological issues in different perspectives with the purpose of bringing more participants to this transport option.

For managing schedule variations, the club can be set to manage both traditional stable groups and a dynamic ridematching service in the same structure taking advantage of their compatibility. Traditional stable pool groups would be the core of the system, and when space is available in a group, it can be allocated dynamically to an occasional demand from a person who normally belongs to another pool in the club (Correia and Viegas, 2009).

Dynamic ridematching services or instant ridesharing have been tested before, mainly in the United States, but they have proved to be very ineffective when applied independently (Giuliano et al., 1995; Haselkorn et al., 1995; Dailey et al., 1999). From the physical dimension perspective, the technology that is needed to implement these systems exists and is ready to be deployed (Hartwig, 2007). Its success, however, strongly depends on the willingness to share a ride with a possible stranger, and this has proven critical for the development of the concept.

The club structure that is proposed and was tested is based on users who can act both as passengers and drivers. This is actually placing a constraint, which has been recognized to influence carpooling propensity, but our goal was to design a club aiming at higher occupancy rates, improving commuter trip sustainability. So, the main target was to reduce the number of SOVs by bringing those solo drivers into the club, and it was assumed that all these club members could act both as drivers and as passengers.

From a psychological standpoint, the club structure aims to provide a common minimum level of trust between its members by filtering and accompanying all the groups. We want to test if this can provide sufficient confidence in order to make it easier to accept persons who are not acquaintances.

Previous research has focused on these issues and their impact on carpooling performance. Early on, Kurth and Hood (1977), found that appeals to self-interest made through work organizations were more effective than other means of encouraging carpooling not only because the poolers have similar work schedules, but also because the work organization

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