Doctoral Dissertation
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Switching intentions towards car sharing
Analysis of the relationship with traditional transport modes

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Summary

Nowadays car sharing is widespread in several countries; in particular, in Italy, it has been introduced since few years. Advantages of this mean were estimated and reported by many authors. Car sharing can potentially reduce the number of owned cars, the number of performed trips and the relative distance, partially decreasing traffic congestion. Moreover, it contributes to a reduction in energy consumption of travelling, especially through the introduction of electric vehicles in the fleet. However, the quantification of these impacts is often difficult and uncertain. In addition, car sharing can significantly alter the modal share of travellers, since it can substitute or complement existing travel means, with relationships that are still not clear and often site-specific. Previously described benefits can be effective only if car sharing is able to attract private car drivers and, therefore, if it does not substitute other existing sustainable modes (such as public transport, bike and walking). Therefore, estimating and analysing travel demand of this mode is important to evaluate these impacts, thus providing sound basis to policy makers and local authorities, who have to decide whether to address public resources to promote car sharing and to provide travellers with a range of mobility options which can accommodate all their mobility needs.

The aim of the present work of thesis is to identify factors affecting the choice to adopt car sharing and to analyse the relationships of complementarity and/or substitution between car sharing and existing travel modes. Unlike previous works, the effect of car sharing is modelled by separately considering the shift from private car, public transport, bike and walking. Therefore, through the proposed approach, the use of car sharing can be promoted or avoided, by varying mode-specific factors. In the present work of thesis, data from a travel survey carried out in the Turin Metropolitan Area are used. The survey was administered to a representative sample of the population living in the study area, thereby outcomes of analysis can be generalized to the whole universe of individuals in the area under analysis. Socio-economic characteristic of respondents, their travel diary and related activity patterns spanning over the 24 hours before the interview were collected. Moreover, stated-preference experiments were administered to investigate mode switching attitudes for a randomly selected trip chain, which was effectively performed by the interviewed, thus allowing to obtain reliable results.

In order to reach the aim of the present work, statistical analysis, discrete choice models and data mining techniques are adopted. In particular, first statistical methods are applied to preliminary analyse results of the travel survey, depicting an overview of the current reported scenario. After that, two logistics regressions are implemented, in order to identify users' characteristics that might affect

the choice to join a car sharing program and to understand how the characteristics of potential users of car sharing interact with both trip attributes and past and future multimodality behaviours.

Then, in order to predict potential trips carried out on car sharing and to analyse which factors might affect the decision to switch to this mode, three kinds of approaches were developed: a traditional econometric model (a logit model), a data mining technique (Decision Tree model), and a descriptive visual approach. The three proposed methods differ in their basic assumptions; therefore, each approach faces the problem from a different perspective, whereby many results were obtained enriching the analysis about switching intentions towards car sharing. Results of the proposed approaches are complementary and others are common. In particular, the visual approach provided preliminary descriptive analysis on the effect of trip attributes. Moreover, logit models were helpful to understand the effect of different exogenous variables and to derive further information to forecast the consequences of the introduction and diffusion of car sharing on future scenarios. On the other hand, results from Decision Trees were used to identify the non-continuous effects of different variables, by estimating specific thresholds for each factor. However, an overall view of the results of the methods is useful to identify the best ambit of use of each travel means, namely the characteristics of trips which best fit to a specific mode. In this way, it is possible to clarify how car sharing can be effectively introduced to maximize its positive impacts. In addition, alternative mobility scenarios are generated using the estimated models, in order to maximize the number of trips switching from private car towards car sharing and minimize those from public transport and active modes. The results of each scenario are used to analyse the modal split and the effect of car sharing in the use of public space.