Transportation Research Part A 46 (2012) 421–434

Contents lists available at SciVerse ScienceDirect

Transportation Research Part A

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

Synopsis of users' behaviour of a carsharing program: A case study in Toronto

Cindy Costain, Carolyn Ardron, Khandker Nurul Habib *

Department of Civil Engineering, University of Toronto, 35 St. George Street, Toronto, Ontario, Canada M5S 1A4

ARTICLE INFO

Article history:
Received 28 July 2011
Received in revised form 21 October 2011
Accepted 17 November 2011

Keywords:
Carsharing
Travel demand
Trip frequency
Vehicle type choice
Travel behaviour

ABSTRACT

The paper presents a comprehensive investigation of the behaviour of carsharing members through the analysis of administrative datasets of a dominant carsharing program in Toronto. The key objective of the investigation is to enhance our understanding on carsharing behaviour in the City of Toronto. Unlike other studies on carsharing, this paper intends to build a comprehensive understanding of the multiple dimensions of users' behaviour including attitude towards environment, attitude towards safety, frequency of usage, membership duration, vehicle type choice and monthly demand, in terms of total vehicle-kilometre and vehicle-hour travel. The paper uses both descriptive and econometric approaches for in-depth investigations. One of the key contributions of the paper is linking carsharing with carbon offsetting. Investigations reveal that carsharing members are in general environmentally conscious people and are willing to pay for carbon offsetting if given an option. However, having the carbon offsetting option also encouraged a higher amount of driving per month. Results show that carsharing is most often used for off-peak period travel or on weekends, when transit service is poor and traffic congestion is low. The majority of trips made by carsharing members are short-distance trips. It is clear that carsharing is providing a segment of the population with enhanced accessibility and mobility and thus playing an important role in providing a seamless, integrated transportation service in the City of Toronto.

1. Introduction

Urban carsharing services allow individuals to gain the benefits of private vehicle use without the costs and responsibilities of vehicle ownership. Carsharing is becoming increasingly popular as an alternative urban mode of transportation in many cities around the world. Although relatively new compared to in Europe, carsharing is gaining considerable momentum in North American cities (Cervero and Tsai, 2004; Zhou et al., 2008). Shaheen et al. (2009) provide a comprehensive overview of the history and evolution of carsharing in North America. Since the beginning of organised carsharing activities, it has been the impression that carsharing can encourage sustainable travel behaviour by reducing the necessity of owning personal vehicles as well as promoting dense urban forms. In an earlier study, Fellow and Pitfield (2000) argue that carsharing can create a very high net benefit to society, comparable to investing in building new roads. Literature routinely explains carsharing in the context of sustainable mobility and reduction of environmental impact of urban transportation (Steininger et al. (1996), Cervero et al. (2007), Firnkorn and Muller (2011), etc. are few recent examples). However, the relationship between carsharing, sustainable transportation behaviour (such as public transit usage) and urban form are not properly understood as of yet.

* Corresponding author. Tel.: +1 416 946 8027; fax: +1 416 978 6813.
E-mail addresses: c.costain@utoronto.ca (C. Costain), carolyn.ardron@utoronto.ca (C. Ardron), khandker.nurulhabib@utoronto.ca (K.N. Habib).

0965-8564/$ - see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.tra.2011.11.005

Huwer (2004) suggested that carsharing is suitable as a supplement to public transport, however, Stillwater et al. (2009) found that the relationship between access to public transit and carsharing activities is often ambiguous. The majority of the investigations that reveal the positive and expected effects of carsharing on mobility and urban form are often based on small sample surveys (Cervero, 2002; Huwer, 2004; Rose, 2008; Martin et al., 2010). Detailed investigations of the land use and mobility impacts of carsharing in large urban areas are difficult because of data unavailability. Carsharing is a relatively new urban mode and therefore, has a very low market share compared to the other established urban modes. Consequently, it is very unlikely that large scale household travel survey data would contain detailed information on carsharing. Celsor and Millard-Ball (2007), describe whether or not and how carsharing works in relation to household size, what mode people take to work, neighbourhood density, and vehicle ownership. Therefore, the best way to investigate the impact of carsharing in detail is through targeted sample data collection. As targeted data collection can be very costly, an efficient alternative can be examining administrative datasets of carsharing services. Such datasets are collected by the carsharing service providers for administrative and service planning purposes. Morency et al. (2007) successfully show that such administrative datasets can be very useful in understanding users' behaviour of a carsharing program in Montreal (Communauto). Morency et al. (2010) used this dataset to investigate the factors influencing activity persistency of carsharing users. Habib et al. (2009) presents an econometric model for predicting membership duration jointly with monthly activity persistency of carsharing members by using the same dataset. However, the Montreal dataset is the only one that is used for investigating carsharing behaviour as available in published literature. Therefore, the use of similar datasets from other cities for investigating users' behaviour of carsharing programs would contribute to the increasing understanding and growing body of literature on carsharing.

This paper presents the results of an investigation of carsharing users' behaviour through the examination of administration datasets of a dominant carsharing service in the City of Toronto. The administrative datasets are supplemented by aggregate zonal census and land use data to overcome the information shortage in the administrative datasets. Although the choice of information used in this study is limited by the data availability, sufficient information is available to investigate key issues of interest. Unlike all other studies on carsharing, this paper intends to build a comprehensive understanding on multiple dimensions of users' behaviour of a carsharing program. In fact, very few studies focus solely on user's behaviour of carsharing program. Among those, Morency et al. (2007, 2008, 2010) and Habib et al. (2009, 2012) are the notable ones. However, all of these previous studies focus mainly on activity persistency and membership duration of carsharing. In this paper, we extend our focus beyond just activity persistency (frequency of usage) and membership duration. We also focus on attitude towards environment, attitude towards safety, preference to vehicle type and aggregate monthly demand of carsharing. The key issues of interests that are investigated in this paper are defined in order to add to the growing literature on the relationship between carsharing, travel demand, and urban form. These include travel patterns of carsharing users, as well as the attitude of carsharing users towards the environment and sustainability. The prime objective is to define key characteristics of people using carsharing in a mixed land use city, such as Toronto. We are interested in improving the understanding of the factors that influence members to become environmentally conscious and safe drivers together with member's trips making and vehicle type choice behaviour. Results of this investigation will help urban transportation planners to better understand the characteristics and impacts of this emerging mode, as well as to devise efficient carsharing programs for large urban areas.

The paper uses both descriptive and econometric approaches for the investigation. In the case of the descriptive analysis, key variables are plotted and investigated compared to other variables. The prime objective of the descriptive analysis is to improve the understanding of overall patterns of carsharing behaviour. Following the descriptive analysis a number of decisions of the carsharing members are explicitly modelled as a function of carsharing service attributes, member's attributes and aggregate population and land use attributes. Econometric modelling techniques are used to investigate influences of these attributes on key carsharing decisions. Four types of econometric models are employed: binary logit model for binary decision modelling, parametric hazard (accelerated failure time) model for duration modelling, negative binomial model frequency modelling, multivariate regression model continuous decision modelling and multinomial logit model for discrete choice modelling. To supplement the administrative datasets, we also imputed aggregate zonal characteristics of the home zones of the member by using census and land use data of the City of Toronto. The next section of the paper presents the descriptive analysis of the case study and is followed by the econometric analyses. The paper concludes with key findings and direction for further investigations.

2. Carsharing in Toronto: A case study

AutoShare, a Toronto based carsharing company offers an alternative option to owning a vehicle and dealing with the responsibilities that come with vehicle ownership. It is located in downtown Toronto and has more than 200 parking locations across the city. The company was created in 1998, and since then, its membership has increased to more than 10,000 to date. The company is in a partnership with the organisation "ZeroFootprint" to offer the members the option of offsetting their carbon emissions for as low as 0.5¢ per kilometre. The service offered by AutoShare is based on membership of several categories. Eligible members must have a full Ontario drivers licence and be over the age of 23 with a clean driving record. After the payment of a one-time membership and application fee, a member gets access to a wide range of vehicles. Members can be an individual member or jointly share an account with household members. Members may also belong