Transport Policy 51 (2016) 158–164

Contents lists available at ScienceDirect

Transport Policy

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

Carsharing and sustainable travel behavior: Results from the San Francisco Bay Area

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ARTICLE INFO

Available online 3 March 2016

Keywords:
Carsharing
Shared mobility
Sustainable
Travel behavior
Vehicle ownership
Hybrid vehicles
Electric vehicles

ABSTRACT

Over the past decade, carsharing has grown considerably in the United States, particularly in major metropolitan areas. This innovative business model offers individuals the opportunity to rent cars by the hour, providing them with greater flexibility for their mobility. Previous work on carsharing suggests that its adoption leads to a decline in household vehicle ownership, vehicle miles traveled, and associated greenhouse gas emissions. Utilizing representative data from the 2010–2012 California Household Travel Survey, this paper presents an analysis of travel behavior and vehicle ownership among carshare members versus non-members in the San Francisco Bay Area, focusing on a subsample of the population with access to carsharing at the U.S. census tract level. Consistent with previous findings on vehicle reduction, these results show that carsharing members own significantly fewer vehicles than non-members. However, lower levels of vehicle ownership are only found among households living in urban areas. In dense, urban neighborhoods, households with carsharing membership own 0.58 vehicles per household as compared with 0.96 vehicles of a control group. Suburban carshare members drive less than their non-carshare member counterparts – although the extent to which this difference can be attributed to self-selection it is unknown. This study also finds that among carsharing households that do own vehicles, a greater share of those vehicles are alternative vehicles (e.g., hybrid, plug-in hybrid electric, and battery electric). Among vehicles owned by the subsample examined in this study, electric drive vehicles represent 18.3% of those owned by carshare member households, as compared with 10.2% of the vehicles owned by non-carsharing households. This analysis finds that not only are urban carshare members likely to own fewer vehicles than the rest of the population, if they do own vehicles, they are more likely to own a vehicle with a smaller environmental footprint.

1. Introduction

Growing concerns about the energy and climate impacts of the transportation sector have prompted governments and cities to consider a broad array of strategies for a more sustainable transportation future. Alternative fuel vehicles, such as hybrid and electric vehicles, offer one pathway to reduce the greenhouse gas (GHG) emissions of personal transportation. An additional strategy that has potential to curb travel demand (and its associated energy and climate impacts) is carsharing—a model where users can rent cars for short periods of time. Previous research suggests that by providing occasional access to a personal vehicle, carsharing programs reduce automobile ownership as well as total vehicle miles traveled (Martin et al., 2010; Martin and Shaheen, 2011b). Furthermore, policies implemented in California suggest that carshare fleets offer an opportunity to introduce alternative, lower emission vehicles to a broader consumer base.

Over the past decade, carsharing has grown significantly in popularity, particularly in recent years. Between January 2012 and January 2013, carsharing membership grew 24.1% in the United States. In January 2013, there were over 1 million carsharing members in North America and 15,603 shared vehicles (Shaheen and Cohen, 2013b). The carsharing business model tends to work more effectively in metropolitan cities, where limited parking can lead to increased costs of personal vehicle ownership and higher population density allows for more efficient placement of shared vehicles. Previous research also suggests that carsharing may be complementary with public transit.

Recent California policies provide a link between carsharing and the adoption of alternative vehicles. Through the California Zero Emission Vehicle (ZEV) program regulations, auto manufacturers can earn transportation system credits by placing ZEVs and plug-in hybrid vehicles (PHEVs) in carsharing programs, effective 2012–2017 (California Air Resources Board, 2011). The initial motivation behind this program was to increase exposure to

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http://dx.doi.org/10.1016/j.tranpol.2016.01.013
0967-070X/

new technologies without requiring vehicle purchase. Under the newer Clean Vehicle Rebate Project (CVRP), carsharing organizations are also eligible for rebates by placing ZEVs and PHEVs in their California vehicle fleets (California Air Resources Board, 2013). Although several policies have been implemented that link carsharing and alternative vehicle placement, there is limited research on the extent to which these policies influence alternative vehicle adoption among consumers.

This study presents a comparison of the demographics and travel behavior of carshare members versus non-members utilizing data from the 2010–2012 California Household Travel Survey (CHTS). The CHTS collects detailed information about household demographics and travel activity for the purposes of modeling statewide and regional travel and GHG emissions. Rigorous sampling methods are employed in order to match key demographic and household population distributions. In the most recent survey, respondents were asked whether they were a member of a carsharing organization. Utilizing the response to this question, as well as detailed household and individual data, this analysis examines the differences in demographics, travel mode choice, and automobile ownership between carshare members and non-members.

The remainder of this paper is organized as follows. Section 2 provides further review of the literature on carsharing and automobile ownership. Section 3 describes the methodological approach and CHTS data set utilized in this analysis. In Section 4, we present a comparison of carshare members and non-members, in terms of their demographics and travel behavior measures. Section 5 discusses the key findings from this analysis and potential policy implications.

2. Literature

Since the introduction of carsharing, a growing body of literature has emerged that examines the demographics of carshare members, as well as the potential impacts of carsharing on automobile ownership and travel behavior. Several early studies on carsharing were conducted by Cervero when City CarShare was launched in San Francisco in 2001, based on surveys of members (and non-members) three months, nine months, and two years into the program (Cervero, 2003, Cervero and Tsai, 2004, Cervero et al., 2007). Cervero found that early carshare adopters were in their thirties and had moderate incomes. Roughly three-quarters of these early adopters came from zero-vehicle households. While initial results indicated that carsharing appeared to induce travel by automobile among adopters (Cervero, 2003), subsequent surveys revealed that as carshare adoption spread, members were 12% more likely to shed a vehicle, and on average experienced a net reduction in vehicle miles traveled (VMT) (Cervero et al., 2007).

Carsharing has grown substantially over the past 20 years, and recent research on the demographics and travel behavior of carshare members point to fairly similar results. Martin and Shaheen conducted a survey of several North American carsharing organizations, gathering demographic, vehicle ownership, and travel data (Martin et al., 2010, Martin and Shaheen, 2011a). Based on their 2008 survey, carshare members were found to be relatively young (67% between age 20 and 40), well-educated (84% with at least a bachelor's degree), and have moderate incomes (43% with incomes less than $60,000). Martin and Shaheen found that joining carsharing had a significant impact on vehicle holdings. In the U.S., the average number of vehicles per household was 0.55 for respondents before joining carsharing, and was reduced to 0.29 vehicles per household after joining. While a fairly large percentage of members (62%) reported that they were zero-vehicle households before joining carsharing, this number increased to 80% of households who reported that they fell into this category after becoming carsharing members.

Another dimension of travel behavior explored in the 2008 survey by Martin and Shaheen was the impact of carsharing on public transit and non-motorized travel (i.e., walking and bicycling). This study found that there was a slight net decrease in public transit use, and a significant increase in walking, bicycling, and carpooling after individuals joined carsharing. (Martin and Shaheen, 2011a). However, there were significant variations in travel behavior across the different carsharing organizations whose members were surveyed. Another study by Stillwater et al. examined the relationship between carsharing and public transit use, finding similarly ambiguous results (Stillwater et al., 2009).

A final topic that is of particular interest is the presence of hybrid, and more recently electric vehicles (EVs), in carshare organization vehicle fleets. Experts worldwide predict that emerging trend will be the expansion and integration of alternative fuel vehicles into these fleets (Shaheen and Cohen, 2013a). Literature suggests that policies focusing on these early adopter niches are more efficient (Green et al., 2014). While there are policies that link carsharing and alternative vehicles (hybrid, PHEV, and EV), there is relatively little research investigating the utilization of these vehicles and the extent to which their exposure through carsharing leads to greater adoption. On the general topic of alternative vehicle penetration, previous research has demonstrated that higher hybrid market penetration yields higher valuation of hybrid vehicles through the “neighbor effect” (Axsen et al., 2009).

Much of the previous work on carsharing has focused on the demographics and travel behavior solely of members, based on convenience samples where carsharing credit is offered as a response incentive. This paper aims to build on the existing body of literature by examining a statistical sample of the general population that includes a significant percentage of carshare members. In doing so, this study provides an analysis of the differences in demographics, travel mode share, and automobile ownership between carshare members versus non-members.

3. Methods and data

3.1. California household travel survey

This paper presents a comparison of carshare members versus non-members in the San Francisco Bay Area using data from the 2010–2012 California Household Travel Survey (CHTS). The purpose of the CHTS is to collect in-depth information about household travel and activity patterns, which is then used to estimate, model, and forecast statewide and regional travel. The survey collects detailed information about the characteristics of households, including socio-demographic data such as education, income, and household structure. Respondents are also asked to report various travel-related data, including the number and type of vehicles owned, and the completion of an activity diary to record travel behavior. In the most recent CHTS, for the first time respondents were asked whether or not they were members of a carsharing organization, such as Zipcar or City CarShare.

Led by the California Department of Transportation (Caltrans), the 2010–2012 CHTS was sponsored the California Strategic Growth Council, California Energy Commission, and several regional transportation planning agencies, including the Metropolitan Transportation Commission (MTC) of the nine-county San Francisco Bay Area. The region is comprised of the Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties.

The 2010–2012 CHTS was conducted between January 2012