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Peer-To-Peer (P2P) Carsharing: Understanding Early Markets, Social Dynamics, and Behavioral Impacts

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PEER-TO-PEER (P2P) CARSHARING:



UNDERSTANDING EARLY MARKETS, SOCIAL DYNAMICS, AND BEHAVIORAL IMPACTS

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EXECUTIVE SUMMARY

Shared mobility services have now become firmly integrated into urban transportation systems across the globe. Carsharing, bikesharing, ridesourcing or transportation network companies (TNCs), and other systems now offer urban travelers access to transportation services that had long been previously only possible through personal vehicle ownership. Carsharing is arguably the pioneer mode of the sharing economy, given it ushered in a new way of thinking and access to the private automobile in the 20th century. Since its North American inception in Montreal in 1994, carsharing has undergone several waves of innovation. With each innovation, carsharing has deployed new functionality, technology, and business models. One of the more prominent innovations in carsharing has been peer-to-peer (P2P) carsharing, which enables individuals to leverage information technology to share their personal vehicles with others in their area. The P2P carsharing industry has gone through some evolution of its own since its initial establishment. In 2017, we estimated that there were over 2.9 million individuals participating in P2P carsharing, making use of a combined shared fleet of over 131,336 P2P vehicles across six operators in North America (Shaheen, Cohen, and Jaffe, 2018).

Not surprisingly, P2P carsharing services benefit from the operational history and marketing of business-to-consumer (B2C) carsharing companies (roundtrip and one-way services). While P2P carsharing does exist in lower-density areas, the initial markets have been primarily in dense urban environments where B2C carsharing companies also currently operate, resulting in similar user populations. Since launching, operators have begun to hybridize their services with dedicated carsharing fleets, as well. This provides more certainty that vehicles will be available to meet demand, as dedicated fleets would not go “offline” when owners are using their vehicles.

Methodology

To study the effects of P2P carsharing on behavior and better understand its operational challenges and opportunities, as well as market characteristics, we employed focus groups, expert interviews, and an online survey to glean information from early P2P carsharing members. We conducted two focus groups in late-April 2013 with five individuals who were members of Bay Area carsharing companies. Focus groups probed member experiences of both

vehicle hosts (hosts) and those who access them (guests) to understand the obstacles that affect P2P vehicle sharing. The focus groups informed the design of the online P2P member survey in the United States, which explored the extent to which P2P carsharing altered member transportation patterns with respect to walking, bicycling, public transportation, personal driving, and shared-ride services. We identified benefits/positive experiences and challenges/frustrations faced by P2P hosts and guests to inform early-adopter considerations. The online survey had a total sample size of 1,151 from members of three US P2P carsharing organizations during Spring 2014 (Getaround, RelayRides – now Turo – and eGo carsharing). We conducted six stakeholder interviews with P2P operators between mid-2013 to early-2014 to provide an industry perspective on challenges and opportunities from a managerial and operational perspective.

There are some limitations to the study. Primarily, our results are based on self-reported survey data in contrast to activity data. To reduce self-selection bias among the sample, we offered a survey incentive among the respondents. While surveys lack the precision of activity data measurement, they have advantages with respect to probing causality and the reasons behind certain behavioral changes. They are also one of the most reliable ways to measure activity across a population since the respondent is the most knowledgeable as to whether P2P carsharing was a causal reason for a change in their vehicle ownership or some other travel behavior change. Where possible, we excluded responses that were implausible or outliers.

Despite these steps, limitations remain regarding the self-reporting of impacts and the causal relationship of impacts due to P2P carsharing. We were unable to include a control group of the general population due to budget limitations. It is important to note that members opt in to using carsharing systems. This is a part of the process of using carsharing and other shared mobility services. People that cannot use P2P carsharing do not sign up for the service and consequently do not experience a direct impact from it. Thus, the study results reflect the estimated impacts on individuals who have chosen to use P2P carsharing because the service provides some mobility or economic benefit.

Social and Environmental Impacts: Online Survey

The survey found that P2P carsharing had an impact on member travel and vehicle ownership. P2P carsharing members had slightly higher incomes relative to the US population. They tended to be white, male, younger, and more educated than the general population. In particular, 86% had a graduate degree or higher. About 55% of respondents were active with their membership, using the system once per month or more. The most frequent users (8% of the sample) employed the system five or more times per month. P2P carsharing was most commonly used to serve basic needs, including running errands. Long distance recreational trips were the second most common reason. We also evaluated high frequency users as a distinct subgroup (those who took five or more trips per month). This group's trip purposes skewed more toward practical applications, such as errands and shopping. The survey sample likely represents a more active share of the sample population relative to the overall sample population of members.

Public Transit Use

P2P carsharing had mixed impacts on public transit use. Most respondents reported no major change in public transit use as a result of P2P carsharing. Those increasing and decreasing their bus and rail use were closely balanced in number, with 9% increasing bus and 10% decreasing use. Similar effects were found with rail, as 7% reported increasing rail use, while 8% reported decreasing it. High frequency users had more exaggerated effects in both directions, with slightly more respondents reporting an increase versus a decrease in bus (22% vs. 21%) and rail (16% vs. 13%) use. Thus, there was not a notable net increase or decrease in public transit usage.

Taxis, Ridesourcing/TNCs, and Other Shared Modes

Taxi use showed a net decline among all respondents, whereas there was no net change in the use of ridesourcing/TNCs. In contrast, carpooling showed a net increase among the sample, suggesting that P2P users were likely traveling with multiple occupants. Results also showed that members reported making more trips as a result of P2P carsharing. On balance, more respondents in the sample reported an increase in driving due to P2P carsharing than driving less (27% vs. 20%). Among high frequency users, the difference was smaller (36% vs. 34%).

In addition, P2P carsharing was used in conjunction with other shared mobility services. Respondents reported that 14% were members of at least one other P2P carsharing service, 43% were members of at least one other carsharing organization, and 78% had used at least one other shared mobility service. Many P2P carsharing members were also frequent users of Lyft and Uber, broadly suggesting that they used a portfolio of shared mobility modes to meet their transportation needs.

Vehicle Ownership

Vehicle ownership impacts are described by the circumstances in which respondents joined P2P carsharing. Most joined P2P carsharing for purposes that were not motivated by replacing a personal vehicle. The largest cohort, 46% of respondents, did not have a vehicle and joined P2P carsharing to gain additional mobility. Another 20% joined to earn money sharing their vehicle, while 15% enrolled for circumstances related to suppressing a vehicle and 2% reported joining so they could sell a vehicle. A follow-up question on each issue confirmed these proportions, as about 3% of respondents reported that they had sold a vehicle since joining P2P carsharing, and noted this was due to P2P carsharing. A separate question found that 14% of respondents would have probably or definitely needed to acquire a car, if their specific P2P carsharing service disappeared. It is important to recognize that stated impacts may be non-representative of the general population of P2P carsharing members due to possible survey response bias.

Vehicle Access

We also evaluated whether there were common challenges with accessing P2P carsharing vehicles, and 48% felt that it was easier than expected, compared to just 15% who thought that sharing vehicles was more difficult than they expected. The biggest challenge for vehicle guests was vehicle availability as well as traveling to access the auto. Most respondents (80%) preferred automated access to the vehicles in contrast to an in-person key exchange (which was more common at the launch of P2P carsharing services), if it were available.

Transportation Expenditures

P2P carsharing caused some people to spend more money on transportation, while others spent less. Slightly more respondents reported spending less due to P2P carsharing versus spending more, but a majority of respondents reported spending about the same.

Operator Expert Interviews: Opportunities and Obstacles

We interviewed operators to explore industry issues, barriers, and opportunities. Operators reported that P2P carsharing exhibited great potential, while serving the mobility needs of the public. They recognized that P2P carsharing had the potential to serve rural environments as well, but noted the challenges of reaching these areas for a number of reasons. One of the most prominent reasons was lack of awareness (and interest) within these markets. Within rural areas, sharable personal vehicles are spread out geographically, and they are also needed to meet virtually all transportation needs. As a result, P2P carsharing has predominantly focused on urban markets.

Operators also noted a few key barriers to P2P carsharing use, including providing predictability and reliability of experience within a vehicle fleet that is diverse in age, interior quality, maintenance, and driving feel. Insurance was another reported challenge, which has been provided by a variety of arrangements across the industry. Management of these issues has stabilized in recent years, as operators have found ways to exist (sometimes imperfectly) within industry frameworks, both in accordance with state policies (California, Oregon, Washington State) and in nearly all of those without explicit P2P carsharing legislation. Still, the provision of insurance remains as an evolving dynamic within the shared mobility industry. Further, while San Francisco has established specific regulations that allow owner-operated carsharing fleets to avoid parking restrictions, that program does not extend to P2P carsharing. Thus, there are little to no regulatory models nationwide to help hosts and guests locate reliable parking, a clear deterrent to participation.

Focus Groups

We conducted two focus groups to identify qualitative insights from vehicle guests and hosts contributing to P2P systems. Focus group participants identified the unique issues faced by hosts

and guests. For example, key concerns before joining P2P carsharing included: trust, vehicle cleanliness, and the logistics of granting access (i.e., meeting the host/guest, etc.). Focus group participants did note overcoming these initial concerns. Vehicle hosts generally felt that they were getting their money's worth from granting access to their vehicles. At the same time, they also acknowledged that their participation in P2P carsharing had some upfront costs (e.g., a car kit installation), and their participation made them more cognizant of vehicle maintenance.

Advantages

Focus group participants noted some advantages of P2P carsharing. Vehicle hosts reported a key motivation was earning extra income from their vehicles. They also acknowledged contributing to the broader sharing economy—a concept they supported. They considered general advantages including: 1) helping with vehicle access, 2) sharing luxury vehicles with others, and 3) contributing to a better environment. Members of the guest focus group noted the flexibility of P2P carsharing pricing policies, which could be more favorable for taking longer-distance trips than the price of roundtrip carsharing in comparison. Vehicle guests viewed P2P carsharing as cost efficient and convenient, like B2C carsharing. It removed their need to worry about vehicle theft, parking, street cleaning, or other concerns associated with personal vehicle ownership. P2P carsharing vehicle guests also noted that they had access to a wider variety of vehicles than many other shared mobility options (e.g., one-way and roundtrip carsharing, scooter sharing, and bikesharing).

Disadvantages

Focus group participants noted a few disadvantages of P2P carsharing. Hosts mentioned that they experienced an occasional lack of access to their own vehicle while it was being used. This led them to use more public transit or other active modes. Hosts also expressed some risk and concern over vehicle damage, although none of the participants had reported any. For P2P carsharing vehicle guests, most of the challenges reported related to coordinating vehicle access, such as inquiring about a vehicle and not receiving a reply from the host. Others reported that there was an inconvenience associated with scheduling and coordinating with vehicle hosts for a key transfer (in the absence of automated access).

Conclusion

P2P carsharing systems expanded the reach of carsharing by integrating personally owned vehicles. This study provides insight into the nature of impacts that early P2P carsharing had on the travel behavior of vehicle guests and hosts. P2P carsharing uniquely fits demand within shared mobility services. It was the first shared mode to provide access to a diverse array of P2P vehicles, across a varied geographic environment. The study results suggest that extensively expanding this model outside the urban core may be more challenging than initially expected, where acceptance and use of carsharing encounters a number of barriers. This study also shows that such access enables some households to reduce their vehicle ownership, and more prominently, avoid the need to acquire a vehicle. P2P carsharing further provides access to vehicles that are enjoyable to drive and potentially more challenging to access through traditional car rental arrangements (e.g., Tesla and other high-end brands). At a more fundamental level, P2P carsharing may have provided a means for people to access unique vehicles for long-distance travel, while at the same time permitting hosts to reduce ownership costs and/or monetize otherwise idle assets. Thus, P2P carsharing is a form of shared mobility that enables behavioral changes among some members that advance positive social and environmental goals.

Looking forward, P2P carsharing's reception, benefits, drawbacks, and public policies relate to the coming deployment of Automated Vehicles (AVs). Shared AV (SAV) models include two forms of automated P2P carsharing (Stocker and Shaheen, 2018). The first possibility is individually owned AVs made available for on-demand use by a third-party operator. Similar to P2P carsharing in its current form, this model would entail a private operator managing financial transactions. The second, more untested scenario is P2P AV carsharing with decentralized operations, which means that guests would make use of some form of accessible and open source reservation and payment system (possibly involving blockchain) to share individually owned AVs.

Personal ownership of AVs is still generally considered years away (although AV testing has increased dramatically), but there is little question that the embrace of P2P carsharing by today's cities will affect the pace and nature of SAV roll-out. Thus, the current findings presented here

not only shed light on P2P carsharing in its current form, but they also serve as a prelude to the benefits and effects on travel behavior for future iterations of carsharing. Indeed, if SAVs deliver a cheaper transportation option per mile, are able to self-drive to wherever a guest is located, and are also markedly safer (capabilities touted by its proponents), then P2P carsharing may become considerably more attractive to urban residents and deliver even further benefits in vehicle suppression, shedding, and with GHG reductions.

Table 1: Summary of Key Study Findings

Survey Respondent Demographics	<ul style="list-style-type: none"> - Respondents were younger, more likely to be male, more highly educated, and higher earners than the general population. - 55% of respondents used carsharing at least once per month and 8% used it five or more times per month.
Changes to Travel Mode	<ul style="list-style-type: none"> - There were no large net changes in public transit usage. - Taxi usage had a net decline among users, but ridesourcing/TNCs use remained the same. - Overall, the number of driving trips increased among users, but that difference was small among the most active users (i.e., the 8% of members who used the service five times per month or more).
Vehicle Ownership	<ul style="list-style-type: none"> - A small percentage of respondents (3%) indicated they sold a vehicle because of their carsharing membership. - A larger, but still small percentage (14%) of respondents indicated that they held off purchasing a vehicle since starting their carsharing membership.
Advantages (Guest)	<ul style="list-style-type: none"> - Access to a wide range of vehicles (including high-end and zero-emission models) - Avoid hassle/costs of parking, maintenance, insurance
Advantages (Host)	<ul style="list-style-type: none"> - Earn revenue on existing, often little-used assets - Contribute to the “sharing economy,” providing mobility access to others
Barriers/Concerns (Guest)	<ul style="list-style-type: none"> - Traveling to cars in system to begin usage - Key pick-up and drop-off (strong preference for automated vehicle access) - Lack of reliable response from car host following a sharing request
Barriers/Concerns (Host)	<ul style="list-style-type: none"> - Damage to vehicle - Insurance frameworks, which vary by jurisdiction - Inability of host to use car during usage periods

1. INTRODUCTION

It has been over 20 years since carsharing first emerged as an innovative transportation mode in North America. Beginning in Montreal, Quebec in 1994, carsharing has since spread across the continent, populating cities across Canada and United States (US), Mexico City, and college towns in both the US and Canada. For over 15 years of this history, carsharing had been implemented in almost entirely a singular form as roundtrip carsharing. Carsharing operators would enroll members, and members would access operator-owned vehicles through reservations at pre-established and fixed locations. Roundtrip operators would require members to return the vehicle to a dedicated parking space to complete a reservation.

While this form of carsharing has maintained its presence and relative growth over the years, carsharing more broadly has also undergone an evolution in the types of operational models. This evolution most notably began to take hold in 2009, today, there are three additional forms of carsharing beyond the roundtrip model. They include: 1) one-way or point-to-point carsharing (launched in Austin, Texas in 2009); 2) peer-to-peer (P2P) carsharing in which individuals access a privately owned vehicle fleet through a third party (launched in 2010 in Cambridge, Massachusetts); and 3) fractional ownership (launched in Stockholm, Sweden) in December 2014, where individuals co-lease or subscribe to a vehicle (Symes, 2014; Shaheen et al, 2012). Both P2P carsharing and fractional ownership are peer-to-peer business models--where the consumer is providing the supply, and the system facilitates the exchange. Both roundtrip and one-way carsharing are business-to-consumer models (B2C) in which the system provides and owns the assets used by the consumer.

P2P carsharing (which also been called personal vehicle sharing) systems bring personal cars into the network of carsharing vehicles. P2P carsharing systems allow hosts of personal vehicles to share them with other people for an established price. The hosts typically define schedules for when the vehicle is available and can confirm or deny member requests for access. Hosts receive a share of the money that the guest pays for their vehicle use, which encourages host-side participation, and lowers their vehicle ownership costs. While P2P carsharing emerged early this decade, it is important to recognize that versions of it were introduced in Boulder, Colorado,

New York City, and Germany as early as 2001. In Boulder, P2P vehicles were integrated into an operator-owned roundtrip carsharing fleet. In NY and Germany, a P2P marketplace was introduced that facilitated direct P2P vehicle exchanges between individuals via the Internet (Shaheen et al., 2012).

P2P carsharing and fractional ownership open the carsharing model to a new type of “sharing” consumer. First, it brings a new array of vehicles for use in a shared environment. Luxury vehicles and other high-end sports or electric vehicles are shareable through P2P carsharing systems, while such vehicles are not economical to incorporate into a conventional carsharing system. Also, P2P carsharing has mainly operated in cities, but it offers greater potential for carsharing to expand to more remote and low-density regions that would otherwise be cost prohibitive for B2C carsharing systems. With the exception of employment centers and college/university campuses, most B2C carsharing models have not ventured far from the urban core of North American cities. Further, P2P alters the model of who gains from carsharing and how. In B2C carsharing, the economic gains to the consumer have traditionally been in the form of cost savings by avoiding vehicle ownership. But by opening the revenue earned from carsharing to the broader population of personal vehicle hosts, carsharing benefits also include revenue gain, in addition to the potential cost savings achieved as traditionally derived from B2C carsharing. Indeed, the notion of personal profit from shared mobility was established through P2P carsharing, and this has since been capitalized upon by ridesourcing or transportation network companies (TNCs), such as Lyft and Uber, where private individuals often drive their personal vehicle to provide on-demand rides.

While P2P carsharing exhibits great potential, it may not offer the same benefits or behavioral changes that have been documented in roundtrip carsharing (e.g., Martin and Shaheen, 2011a; Cervero and Tsai, 2004; and Lane, 2005, Shaheen et al. 2012). Not surprisingly, the advantages of P2P appear to be different in both nature and magnitude, based on this study.

This study provides an early understanding of how P2P carsharing affects travel behavior, including its social and environmental impacts. The study team employed a variety of methods to answer a number of questions, including:

- 1) What are the main travel behavior impacts of P2P carsharing in terms of modal shift?
- 2) What are impacts of P2P carsharing on vehicles shed and suppressed by households?
- 3) What types of trips are taken and by whom in P2P carsharing?
- 4) How do these impacts differ from hosts and guests?

To address these and other questions, we:

1. Completed a literature review on the P2P industry in North America focusing on the early experiences of the industry;
2. Conducted two focus groups (each comprised of five participants) on the differences between vehicle hosts (members who contribute their personal vehicles to P2P organizations) and vehicle guests (members who access vehicles via P2P organizations) experiences in a major US P2P carsharing organization in Spring 2013;
3. Conducted six stakeholder interviews with P2P operators and industry advocates in mid-2013; and
4. Implemented an online survey of N=1,151 members of three leading US P2P carsharing organizations between the months of March and April 2014. The survey assessed both user experiences with P2P carsharing and the extent to which P2P carsharing altered their use of other transportation modes.

In the section that follows, we provide a background on the evolution of the sharing economy (i.e., a developing phenomenon around renting and borrowing goods and services rather than owning them) in addition to the various incarnations of carsharing and opportunities for and challenges to the expansion of P2P carsharing. We then provide a presentation of the results from the P2P member survey, followed by a discussion of the operator and stakeholder interviews. We finish the report with a summary and conclusions. The focus group results are presented in the Appendix.

2. BACKGROUND

In this section, we discuss five key topics as background to this study including: 1) the sharing economy more broadly, 2) carsharing and the sharing economy, 3) fractional ownership, 4) the hybrid P2P-roundtrip carsharing model, and 5) previous research on P2P carsharing impacts.

2.1 The Sharing Economy

The “Sharing Economy” is a developing phenomenon built around renting and borrowing goods and services on a short-term basis rather than owning them. The sharing economy has expanded the type of assets that can be used on a shared, as-needed basis, such as personal cars, bicycles, and homes. Sharing can take place among peers (e.g., community drivers, peer-to-peer carsharing, or bikesharing) or through businesses (e.g., a carsharing operator). With further advances in technology and a developing societal paradigm in which access can be preferable and more cost effective than ownership, shared mobility services have continued to grow substantially during the early 21st century. Of course, elements of the sharing economy have been around for decades in many industries including: public transportation, hotel services, and condominium timeshares, among others. What is different today with the sharing economy is the application of information and communication technology to share assets in ways that previously were very difficult and subject to high transaction costs and barriers. For example, prior to carsharing, the sharing of a personal automobile could only be performed at a staffed rental car kiosk, complete with a separate liability agreement signed for each use. Such restrictions made rental cars only practical for out-of-town travel or very long-distance trips. Carsharing pioneered ways to smooth this transaction and make access to vehicles automated and widely distributed, permitting neighborhood applications to flourish. The sharing economy grew with roundtrip carsharing and public bikesharing as operators expanded temporary access to cars and bicycles, while taking responsibility for the ownership and maintenance of these assets. These B2C operators maintained centralized ownership of the shared assets. The evolution of these industries today brings us to services where the provision of assets is now decentralized among a collection of hosts responsible for their own assets in the system, which are peer-to-peer. These new entrants to the sharing economy include: P2P carsharing, home-sharing services such as Airbnb, and ridesourcing/TNCs (e.g., Lyft, Uber). With these new variants of the sharing

economy, the operator has become less a provider and maintainer of assets and more a facilitator of their exchange.

The sharing economy has been described as “fundamentally capitalist yet simultaneously more socially and environmentally conscious,” and it is hailed by many as an opportunity to enhance the sustainability of the current economy, while simultaneously yielding various additional co-benefits (e.g., emission reduction, fuel savings) (SPUR, 2012). High levels of online connectivity, “living local” community-oriented awareness, heightened cost consciousness, and environmental concern have aided the sharing economy in gaining traction (Shaheen et al., 2012).

2.2 Carsharing and the Sharing Economy

Carsharing is one of the more established components of the sharing economy and operates within a number of different frameworks. At present, there are four forms of carsharing: 1) roundtrip carsharing; 2) one-way (or point-to-point) carsharing; 3) P2P carsharing; and 4) fractional ownership.

A roundtrip carsharing operator is defined as a for-profit or non-profit carsharing organization that provides vehicle access on an hourly or daily basis to its members, who typically pay a monthly or annual membership fee. The carsharing organization operates a reservation system, (usually online), and manages vehicles located at designated parking spaces within local neighborhoods, college campuses, or businesses. In-vehicle technology manages access to the automobile by controlling who can unlock it and when. Traditionally, a centralized system manages the time a member can access their vehicle so that it coincides with their previously scheduled reservation. Users typically pay by the hour or by hour and mile. Today, some roundtrip carsharing organizations have begun to incorporate open-ended reservations in which the user can have unlimited reservation extensions. For example, Zipcar began to experiment with this feature in early 2016 across a number of their larger markets (Auto Rental News, 2016).

Carsharing offers consumers the ability to avoid the sunk fixed costs of vehicle ownership and still achieve auto mobility through variable costs. Prior to the availability of carsharing, even a

small to moderate amount of necessary driving effectively forced the consumer to own a car. Once upfront ownership costs were paid, the additional marginal costs of driving have been more competitive than most other modes in terms of cost and time. This dynamic gave the personal automobile an edge over competing modes for decades. Carsharing enabled those with small to moderate driving needs to achieve auto mobility without ownership. Carsharing effectively spreads fixed ownership costs over many users and reduces the economic inefficiency of personal vehicle ownership, since personal automobiles remain idle on average 95% of the time (Sonuparlak, 2011). As of January 2017, there were over 1.9 million roundtrip and one-way carsharing users in North America sharing 24,629 vehicles, across 39 operators (Shaheen and Cohen, 2017). If we include P2P carsharing (over 2.9 million individuals and over 131,336 vehicles, among six operators), total carsharing activity is estimated at over 4.8 million members and 155,965 vehicles, across 45 operators, in North America (Shaheen, Cohen, and Jaffee, 2018).

P2P carsharing (also known as personal vehicle sharing) has emerged as an alternative transportation strategy that allows for the formation of carsharing networks comprised solely of personally owned vehicles. P2P carsharing enables privately owned vehicles to be made temporarily available for shared use. The hosts of these privately shared vehicles profit from transactions with guests, although in most cases, a P2P third-party company facilitates the sharing and keeps a percentage of each. As with B2C carsharing, P2P companies provide insurance and operate websites to connect vehicle hosts with guests. P2P carsharing services have benefited from the operational history and marketing of B2C North American carsharing companies, particularly in markets with previous, extensive exposure to other shared mobility services. Vehicles shared within a P2P platform can be older than those that comprise B2C carsharing fleets, since any vehicle host can enter their vehicle into the fleet (within reason). Because the network is determined by the location of vehicle hosts, P2P carsharing can offer a greater selection of pick-up and drop-off locations, vehicle types, and daily and hourly usage prices than roundtrip and one-way carsharing. While the potential for P2P carsharing to expand into lower-density areas exists, the initial target markets have been primarily in dense urban centers where roundtrip carsharing companies currently operate, resulting in similar user populations.

The P2P carsharing industry has gone through some evolution of its own since it initially launched in 2010. In March 2012, we estimated that there were approximately 10,000 individuals participating in P2P carsharing and a shared fleet of over 1,500 P2P vehicles. In June 2013, there were nine P2P operators (pilot or full operations) in North America. In January 2017, a review of the industry suggests that there were over 2,900,000 individuals participating in P2P carsharing and a shared fleet of 131,336 P2P vehicles among six operators in North America (Shaheen, Cohen, and Jaffee, 2018).

By directly connecting vehicle hosts with would-be guests, some argue that P2P carsharing is a more direct manifestation of collaborative consumption than roundtrip or one-way carsharing (Sands, 2012), as it promotes the sharing of already owned underused assets in contrast to a company-maintained vehicle fleet. In addition to facilitating the sharing of existing resources, the P2P model can significantly reduce operating costs: vehicle capital comprises almost 70% of total operating expenses for roundtrip carsharing companies, for example (Shaheen et al., 2012).

A few years after its deployment, P2P carsharing started to transition from short-term uses to longer duration trips (Geron, 2013). This represented a shift away from the conventional short-term use that roundtrip and one-way carsharing serves. In September 2013, longer duration/non-hourly trips were reported to comprise 95% of the P2P company RelayRide's¹ marketplace, leading the company to discontinue hourly pricing altogether (Haddad, 2013). The company also discontinued installation of auto-entry technology within P2P vehicles because: 1) the technology installation was too expensive, and 2) the company wanted to preserve the face-to-face interaction between hosts and guests (Geron, 2013).

While P2P has received the most attention in personal vehicle sharing, there are other variations and models in this sector. Some of these lesser-known variations include fractional ownership and hybrid P2P-classic carsharing. These variations are described in the subsections that follow.

¹ Now called *Turo*.

2.3 Fractional Ownership

Fractional vehicle ownership is a model of owning a vehicle among a small group of people. As a concept, fractional ownership can be deployed in a variety of ways. One way is that a third party could provide the vehicle to a group of people for a flat lease rate. This rate would cover fixed costs such as maintenance, depreciation, insurance, taxes, and other fixed costs. The group of people using the car would generally be restricted to a much smaller size than typically found in a carsharing system (say 10 or less). The lease payments to the operator may or may not cover gasoline expenses. If it did not, this would be the separate responsibility of the vehicle lessees. The individuals have “rights” to the shared service in exchange for taking on a portion of the expense. This can be facilitated through a dealership or a partnership with a carsharing operator under which cars are purchased and managed by the carsharing operator. This enables individuals to access vehicles that they might otherwise be unable to afford (e.g., higher-end models, electric vehicles, etc.) and likewise result in income sharing when vehicles are used by non-hosts or those outside the lease. Conceptually, fractional ownership might be thought of as a single carsharing vehicle, within a closed, pre-defined user group.

Fractional ownership is one model of the sharing economy that has thus far gained limited traction. One possible reason for this is the restricted user base and limited flexibility offered by the model. If a member of the group departs the agreement, the company or the remaining lessees are required to pick up the remaining costs. Because the vehicle owned must be positioned close to the collective homes of the lessees, there is a restricted population available to replace the departed member. These restrictions make fractional ownership less flexible than existing carsharing models, with limited upside benefits. One potential benefit, however, is that under fractional ownership, the network of vehicles expands only to the size of demand. That is, fractional ownership models avoid the risk faced by carsharing operators entering a new market, where a vehicle is placed and members come later. In fractional ownership, vehicles and members are simultaneously established. The difficulty of that coordination (which is similar to that faced by vanpools) is one of the main reasons why the fractional ownership model has been very limited. In February 2016, Ford began testing a fractional ownership pilot in Austin, Texas. Audi Unite is testing fractional ownership in Stockholm, Sweden in a model that allows up to

five people to co-own a vehicle. Finally, a startup in London is also testing this model, called Orto (Loizos, 2016).

2.4 Hybrid P2P-Roundtrip Carsharing Model

A hybrid P2P-classic carsharing model is one where the fleet includes both operator-owned and maintained vehicles, as well as private automobiles. As with all carsharing, insurance is provided by the carsharing organization during the access or reservation period. The method of access in a hybrid model depends on the vehicle that is being used. When members use a private vehicle, access has traditionally been provided through a direct key transfer from the vehicle host. When the vehicle is operator owned and maintained, access is provided through in-vehicle technology that enables unattended access. The advantage of a hybrid P2P-classic carsharing model is that it contains the structural elements of both models merged into one. The network stability and product reliability of roundtrip carsharing is embedded in the system from the conventional carsharing vehicles. But the network can be supplemented both in size and vehicle variety by the P2P vehicles entered into the system. In exchange for providing the P2P service, operators can compensate contributors in a variety of ways, including keeping a portion of the vehicle usage fee. This model could also incorporate private vehicles into a commercially managed fleet through indefinite transfer of title from a private car host to a carsharing organization. In this case, the private host received carsharing access at a reduced cost, while transferring the private vehicle ownership costs to the carsharing organization. This model was pioneered by eGo CarShare of Boulder Colorado² in 2001, and it was adopted in 2011 by Go-Op of Pittsburgh, Pennsylvania,³ during its pilot phase.

2.5 Previous Research on P2P Carsharing Impacts

There is a growing body of research on the effects of P2P carsharing, and more extensive literature on the various economic, environmental, and lifestyle impacts of roundtrip carsharing. Hampshire and Sinha (2011) conducted a simulation study of P2P carsharing using a reservation control policy within an abstract environment. They calibrate the simulation based on parameters established in previous research, and found that the control policy leads to a large increase in

² Formerly *Boulder Carshare*.

³ Now defunct.

revenue when the service is popular. Hampshire and Gaites (2011) further studied P2P carsharing to assess the market feasibility of the system. Their simulation methodology was used to generate a case study for P2P carsharing in Pittsburgh to evaluate its feasibility of establishing in that city. By applying queueing theory to estimate the number of cars needed to support demand at the census block level, we estimated that 14,460 potential members lived in viable markets within the city, and the car host penetration rate needed to support this demand ranged from 0.06% to 25%. Ballús-Armet et al. (2014) further explored the public perception and market characteristics of carsharing in the San Francisco Bay Area. We conducted an intercept survey of three hundred (N = 300) respondents in San Francisco and Oakland, splitting the respondent sample equally between each city. The survey found that 60% of respondents in San Francisco and 75% of respondents in Oakland would consider using a P2P vehicle, although fewer than 50% of residents in San Francisco and fewer than 25% of residents had heard of the term. Dill et al. (2014) presented survey data from 224 car hosts in the City of Portland who were part of a pilot P2P program. Among their findings was that the P2P carsharing model may reach a higher share of low-income households than classic carsharing. In addition, they found that there was a potential through P2P carsharing to shift driving to off-peak times.

Studies of roundtrip carsharing have been more extensive. Martin et al. (2010) found that roundtrip carsharing had a notable impact on household vehicle holdings. In its survey, users had an average of 0.47 vehicles per household before joining a carsharing organization but only 0.24 vehicles after becoming a member. Further, households in carsharing organizations were less likely to acquire new vehicles. The report also showed that the carsharing vehicles that members were using tended to be newer and more fuel efficient than the ones they shed. Other work has found that carsharing also induces travel behavior changes toward walking and bicycling and reduces overall driving (Martin and Shaheen, 2011; Martin and Shaheen, 2011a). Further research is needed on the nature of modal shift, impacts on vehicle holdings, and other key metrics to understand how P2P carsharing is impacting travel behavior in its early stages.

3. P2P CARSHARING OPERATOR SURVEY RESULTS

Our P2P carsharing survey was administered to members online. Participating P2P carsharing operators sent an email to their members containing a link to the survey URL. Across the three operators, a total of $N = 1,151$ survey responses were collected. Participating operators reviewed and contributed content to the survey instrument. The surveys had a two-tiered incentive structure. Depending on the size of the operator population, respondents were guaranteed an incentive of \$10, if they were among the first N respondents (where N was adjusted to the operator population size). Respondents that came in after the first N responses were entered into a lottery for a larger incentive of \$50 among all other respondents after the first N . Three operators participated in the survey, the former RelayRides (now Turo), Getaround, and eGo carsharing.

One of the main objectives of the survey was to evaluate travel behavior and vehicle holding changes by P2P members. The survey probed member travel patterns prior to joining the P2P network alongside existing travel patterns (i.e., before and after behavior). The survey also contained questions about vehicle ownership (including make, model, and year), as well as probed the economic returns received by vehicle contributors and the costs associated with P2P vehicle use by vehicle guests. The questionnaire finished with a collection of sociodemographic information, as well as approximations of the home and work location of respondents.

In the sections that follow, we present an overview of the survey analysis. The results explore the motivations for using P2P carsharing, as well as shifts in travel behavior, vehicle holdings, and vehicle acquisitions that respondents reported resulting from their membership with P2P carsharing. Further, we report on questions central to the experience of P2P carsharing among both guests and vehicle hosts contributing to the P2P carsharing network.

3.1 Demographics of P2P Carsharing Members

Based on the survey, we found that the demographics of P2P carsharing members reflect distributions that are very similar to those found in previous surveys of roundtrip carsharing and bikesharing systems. We compared aggregated demographic data from the surveyed P2P

carsharing services with the American Community Survey (ACS) data on the US population along the attributes of income, ethnicity, gender, age, education, and politics.

Figure 1 shows the comparative distributions of income, ethnicity, and gender among the P2P operators and the US population. The top graph of Figure 1 shows the comparative distribution of income and suggests that on-balance, P2P carsharing users have slightly higher incomes than the general US population.

The bottom half of Figure 1 shows the distributions of ethnicity and gender. Relative to the US population, Caucasian\White users were slightly overrepresented by about 5%, while Asians were overrepresented by about 15%. Underrepresentation in the sample was found in African Americans and Latinos by 9% and 14% respectively. A similar underrepresentation has been found in previous surveys of shared mobility modes. The survey sample was also gender balanced toward men at 54% relative to 44% women, whereas the broader US population is slightly gender balanced toward women.

Figure 1 Distribution of Income, Ethnicity, and Gender

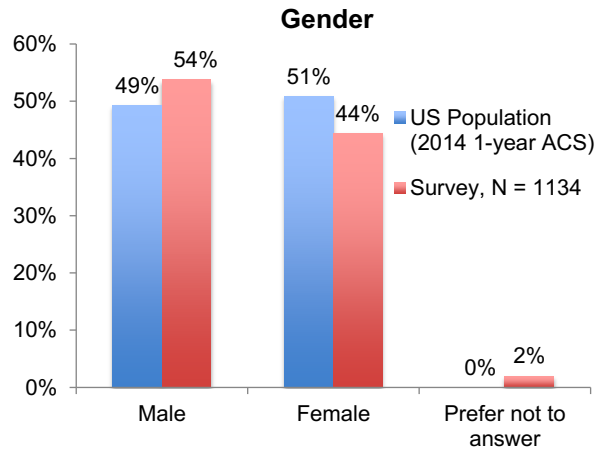
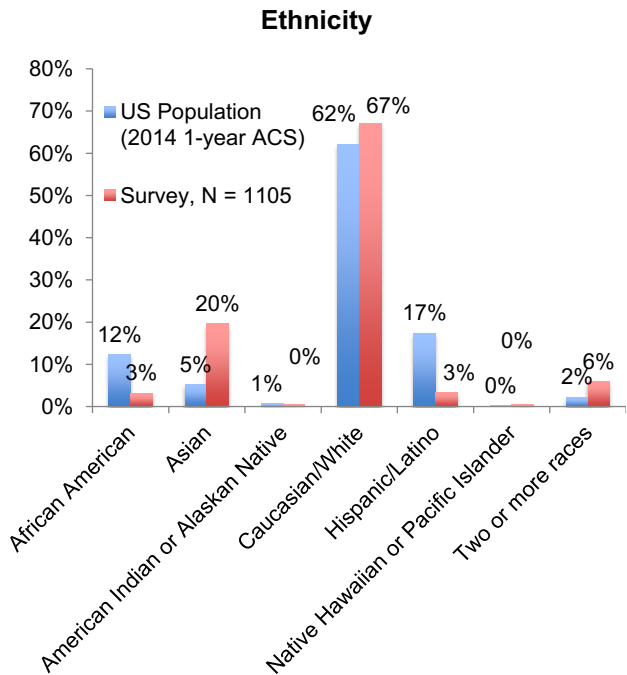
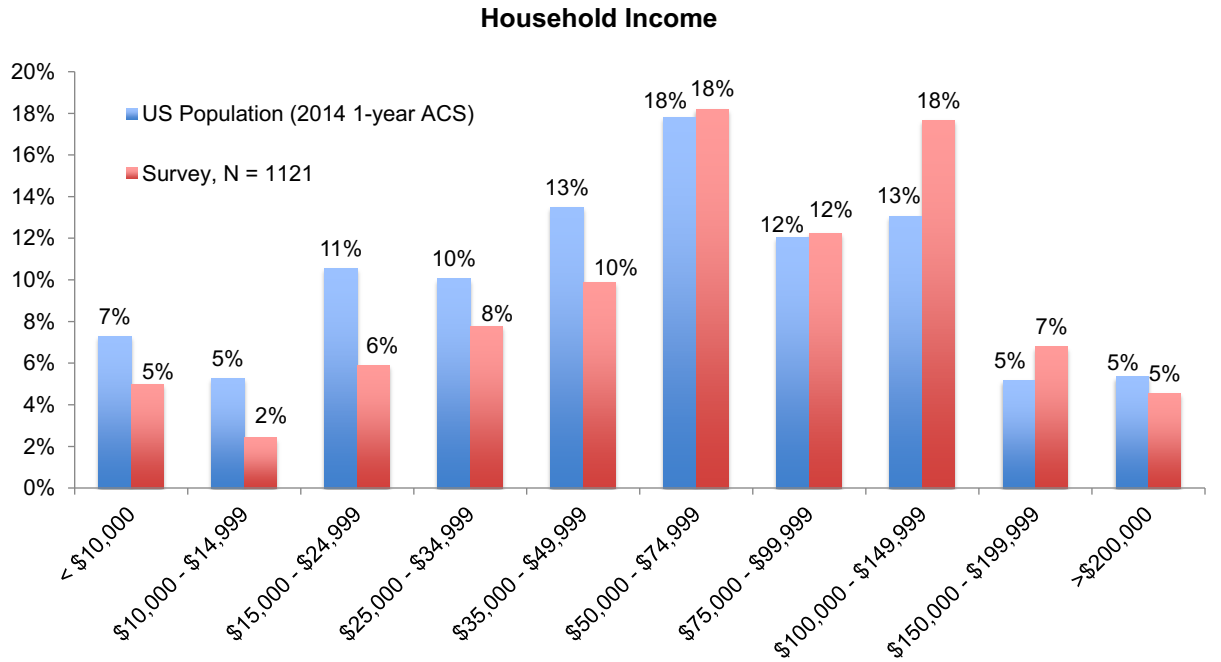
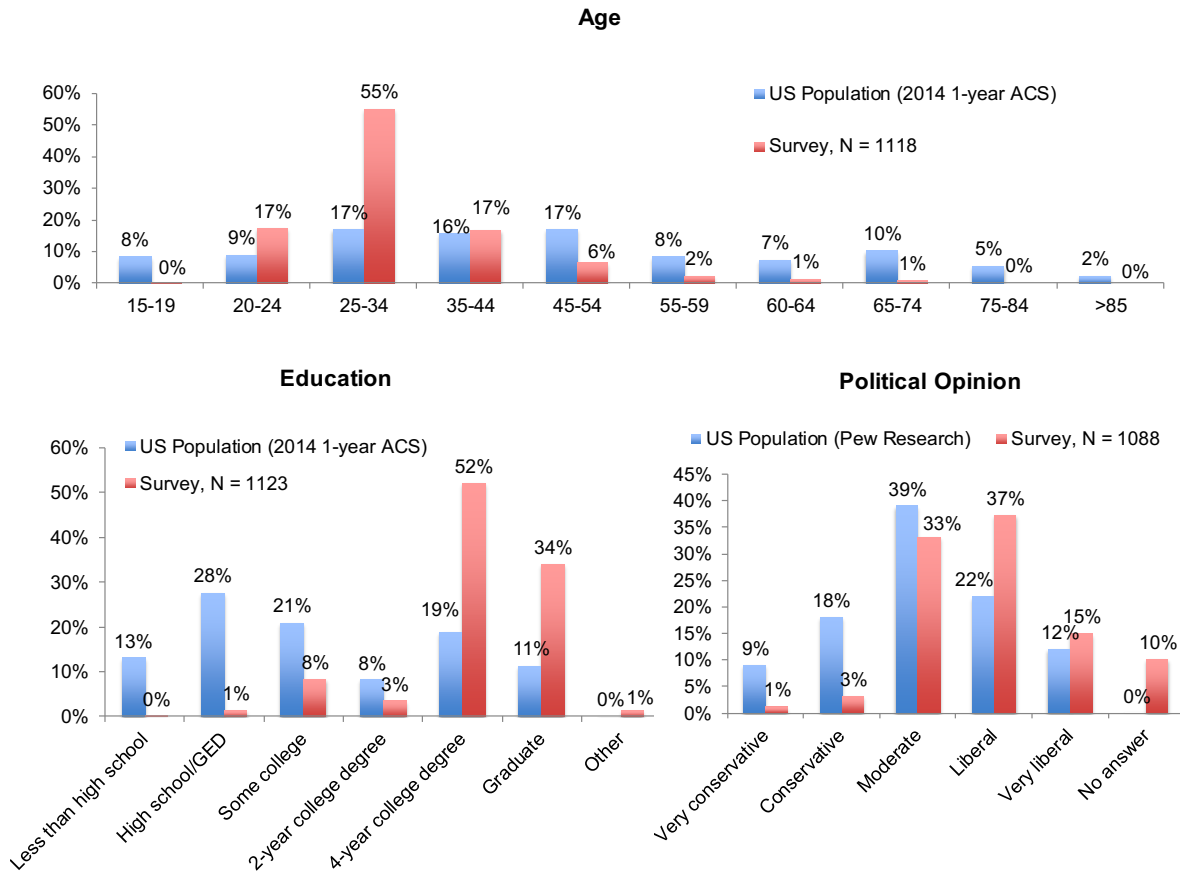


Figure 2 shows socio-demographics by age, education, and political opinion. While Figure 1 showed a relatively even distribution by income and somewhat stronger departures in race, Figure 2 shows some more significant departures along key demographic attributes. None is more significant than age, where a majority (55%) of the P2P sample is between the ages of 25 and 34, only a 17% of the US population was of this age during 2014. About a quarter of the P2P sample is above the age of 34, which is still a sizable fraction. These findings match previous studies that have found carsharing users to be younger than the population at large, but the age disparity--toward younger participants--found within the P2P sample is relatively large even compared to previous results (Shaheen et al, 2012; Martin and Shaheen, 2011). Figure 2 also shows a consistent result across many shared mobility systems, as the P2P sample is highly educated, with 86% of survey respondents holding a bachelor's degree or higher as compared to 29% in the US population. This result is remarkably consistent across previous research demographic profiles in shared mobility (Shaheen et al, 2012; Martin and Shaheen, 2011). Finally, Figure 2, shows the distribution of general political leanings among the P2P sample, and it shows that on balance respondents are more liberal than the political leanings of the US population, which was determined by the Pew Research (Pew Research Center, 2014). Thirty-seven percent and 15% of respondents self-identified as liberal and very liberal, respectively, compared to 15% and 6% sharing those views in the US at large.

Figure 2 Demographics by Age, Education, and Political Opinion

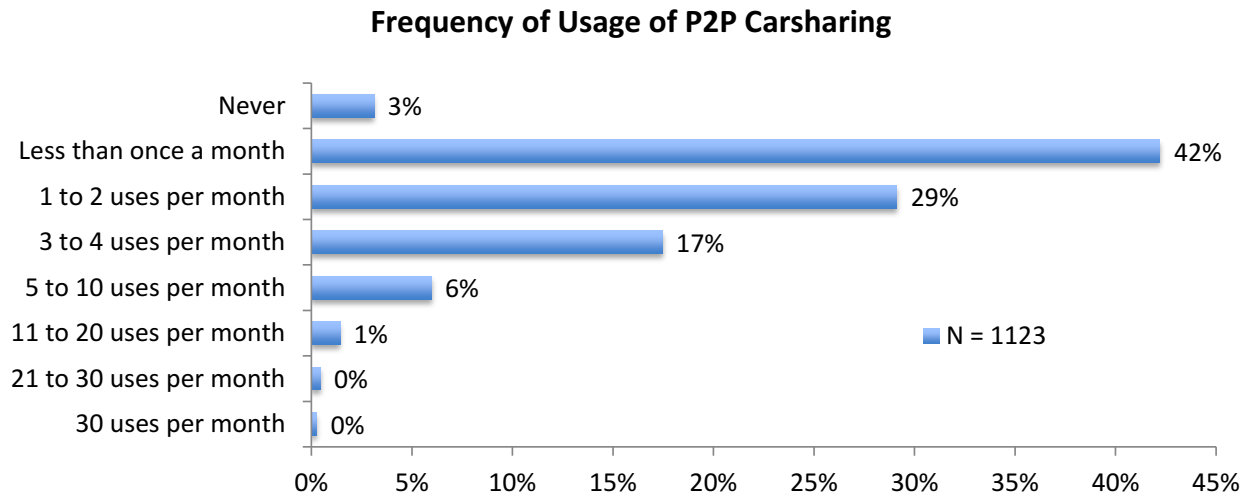


The distributions reflected in Figure 1 and Figure 2 show common findings within the demographic profiles of shared mobility systems. In large part, these results are broadly driven by the fact the P2P carsharing, like many shared mobility systems, are based on large cities, such as San Francisco, Boston, Washington DC, etc. These regions are concentrated with higher incomes, higher levels of education, and more liberal political leanings. Other attributes, such as age and race, reveal a common tendency among many shared modes to be adopted more often by Caucasian/Asian ethnic groups and by younger populations. The P2P population is distinct among shared mobility systems in that it is exceptionally young. Moreover, other attributes of this study pool also diverge from the broader US population, which align well with other shared mobility modes.

3.2 Frequency and Trip Purpose of P2P Carsharing Usage

Survey respondents were asked basic questions about their use of P2P carsharing including frequency of use and trip purpose. Figure 3 shows the distribution of usage frequency among respondents. The results demonstrate that the vast majority of respondents reported using the system less than twice a month. Within the sample of N = 1,123 respondents, 91 respondents (~8%) indicated using P2P carsharing five or more times per month, which was split rather evenly among the three surveyed operators. A total of 287 respondents (~25%) used it two or more times per month. This suggests that P2P carsharing provided occasional service for the vast majority of users (~75%) who used it one to two times per month or less.

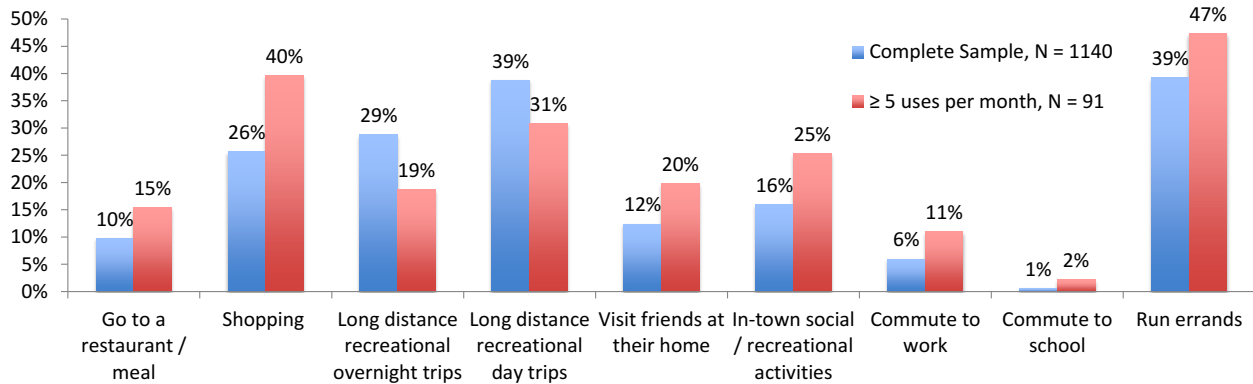
Figure 3 P2P Carsharing Usage Frequency



The basic distribution is shown in Figure 4 in which respondents were asked to indicate all of the trip purposes for which they used P2P carsharing (e.g., “check all that apply”). Figure 4 shows this distribution as a percent of the total number of respondents for the entire sample. In addition, a separate distribution is shown for the 91 respondents that used P2P carsharing five or more times per month. This distribution shows that more frequent users also tend to use P2P carsharing for more short-distance daily-needs purposes versus long-distance recreational trips that are more prominent for the broader population. This distinction between frequent users and the broader survey population carries through in the exploration of modal shift resulting from P2P carsharing, which is explored in the next section. The most frequent uses include: errands,

long-distance recreational trips, overnight trips, and shopping. Commuting to work and school ranked among the most uncommon uses.

Figure 4 Trip Purposes by P2P Carsharing
For what trip purposes do you use P2P carsharing vehicles?



Modal Shift Among P2P Carsharing Users

In the survey, we asked respondents how P2P carsharing altered their use of other transportation modes. We formulated the questions to probe the ordinal direction of the shift, as well as the potential causality of P2P in facilitating that shift. The question was structured as follows:

As a result of my membership with <P2P carsharing>, I use the bus...

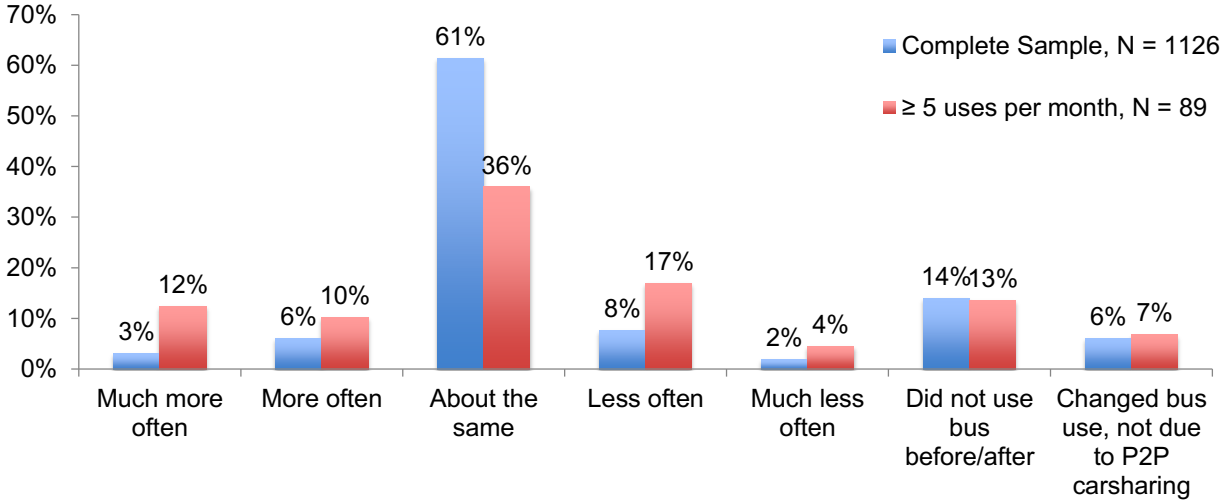
- Much more often
- More often
- About the same
- Less often
- Much less often
- I did not ride the bus before, and I do not ride the bus now.
- I have changed how I use the bus but not because of P2P carsharing.

<P2P carsharing> was a placeholder for the name of the survey operator. The distribution of responses to this and similarly structured questions offers a self-assessed measurement of how P2P systems contribute to travel behavior changes. In all of the figures that follow, the

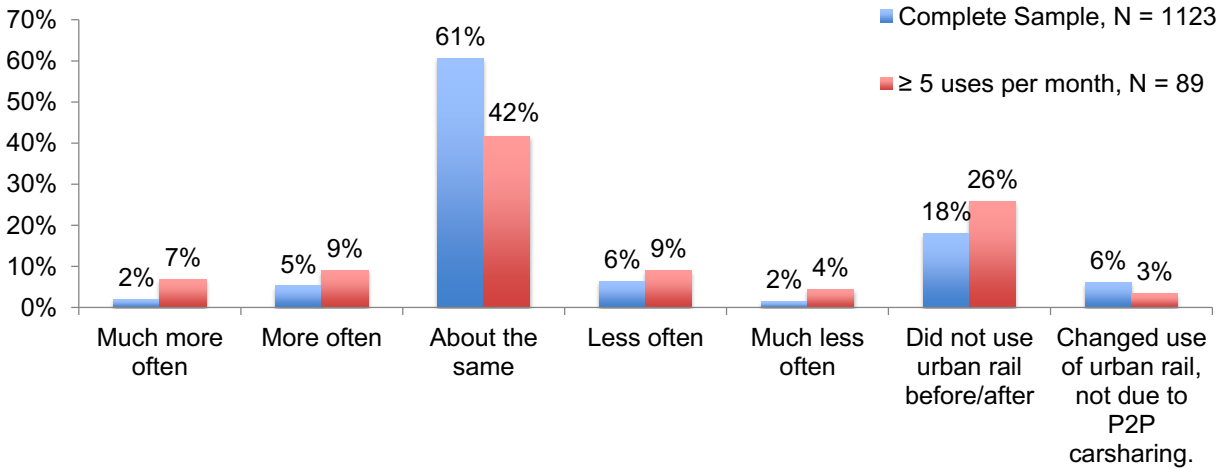
distribution of response is shown for the general survey population, as well as the population of respondents that reported using P2P carsharing five (5) or more times per month. These higher frequency users showed more intense impacts relative to the population, an expected result, given that higher frequency usage of a service is correlated with greater impacts from that service. Figure 5 shows the reported modal shift for two key public transportation modes: bus and rail. Figure 5 shows that 9% of respondents reported increasing their bus use, while 11% reported decreasing it. At the same time, 7% reported increasing rail usage, while 8% reported decreasing it. Thus, P2P carsharing is not causing large numbers of people within the sample to alter travel behavior overwhelmingly toward or away from public transportation (with net shifts between 1-2%). Rather, similar to previous analyses of other carsharing systems (such as roundtrip and one-way carsharing), there is a small net shift away from both modes (Martin and Shaheen, 2011; Martin and Shaheen 2016).

Figure 5 Modal Shift Across Key Public Transportation Modes

As a result of my membership with peer-to-peer carsharing, I use the bus:



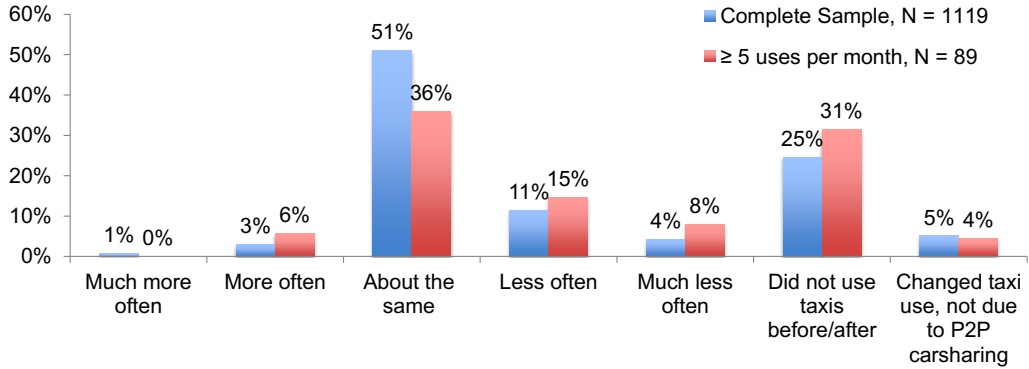
As a result of my membership with the P2P carsharing system, I use urban rail:



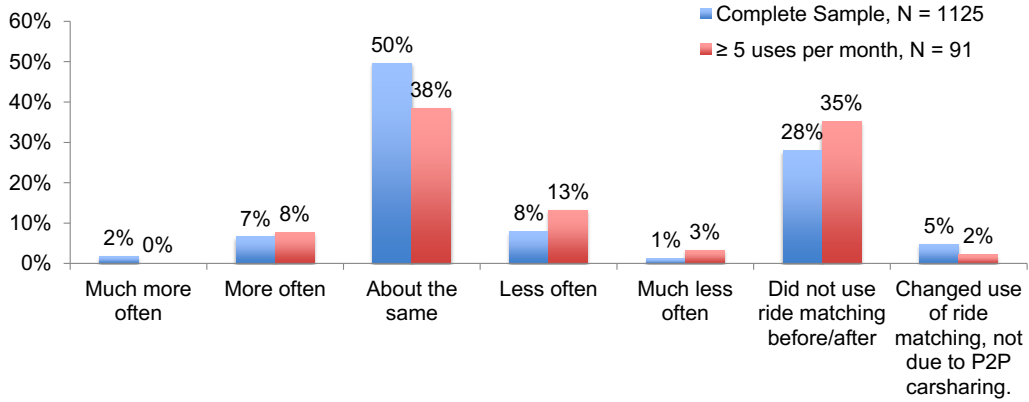
In the survey, we also asked about the impact of P2P carsharing on other modes. Figure 6 shows respondents reported modal shift for taxis, ridesourcing/TNCs (e.g., Uber, Lyft), and carpooling/ridesharing as a result of their P2P carsharing use, with different impacts among the three modes. There is a notable decline in taxi use, as 15% reported shifting away from using taxis versus only 4% reporting a shift toward using taxis more (leaving an 11% net decline).

With respect to the use of ridesourcing/TNC services, the split is even as 9% reported increasing and 9% decreasing their use due to P2P carsharing. Finally, in the case of carpooling/ridesharing, a notable increase was shown with 11% increasing carpooling/ridesharing versus 5% decreasing (leaving a 6% net increase). In short, these results indicate little to no change in public transit or ridesourcing/TNC use, a detectable decrease in taxi use, and an increase in carpooling and ridesharing.

Figure 6 Modal Shift in Taxis, Ridesourcing/TNCs, and Carpooling/Ridesharing
As a result of my membership with the P2P carsharing system,
I use taxis:



As a result of my membership with P2P carsharing, I use [ridesourcing/TNC] services (e.g., Lyft, Sidecar, Uber, etc)...:



As a result of my membership with the P2P carsharing system, I carpool/rideshare:

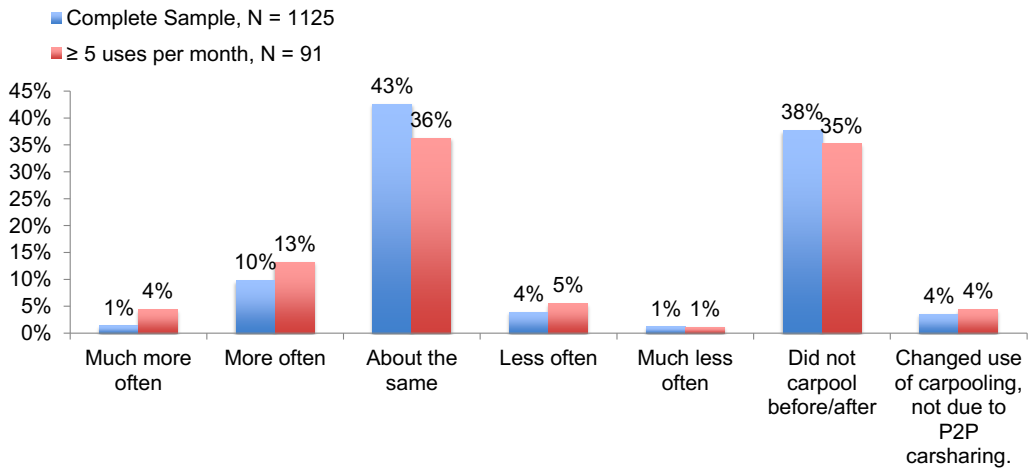
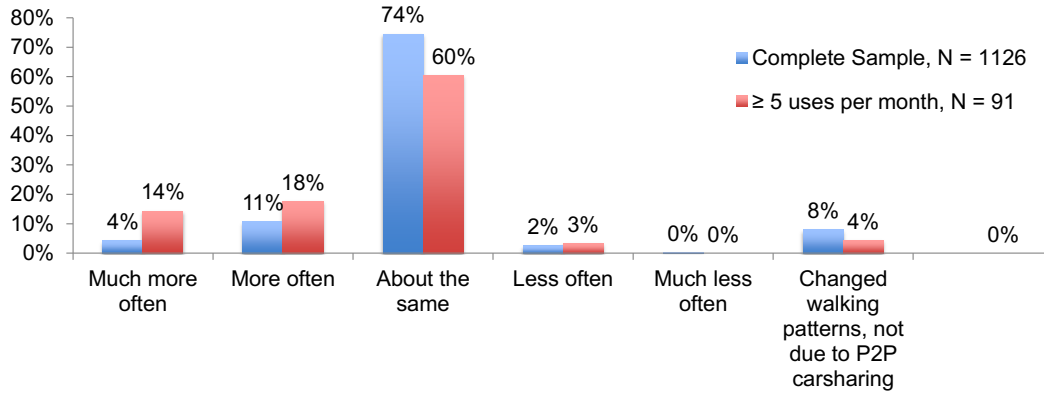


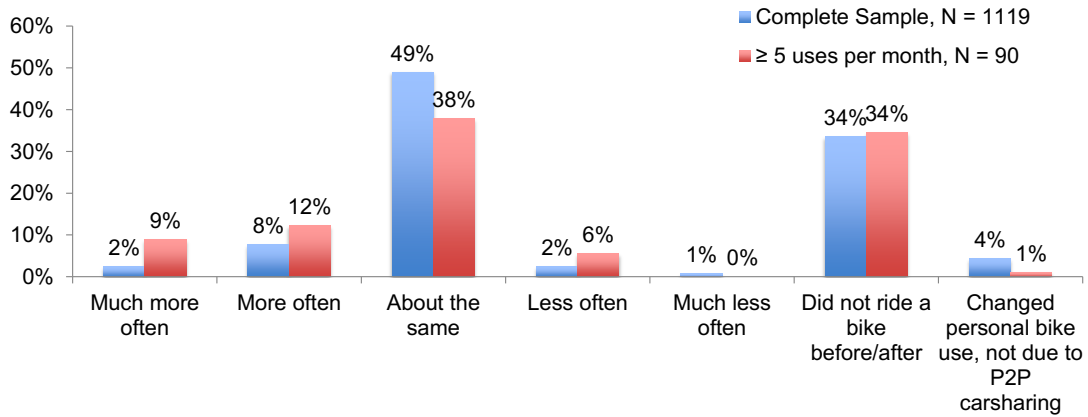
Figure 7 shows the distribution of modal shift in bicycling and walking that resulted from P2P carsharing. The results show that more respondents increased versus decreased their use of both modes. With respect to walking, 15% reported an increasing walking versus just 2% reporting a decrease in walking (net 13% increase). Personal bike use was reported to increase among 10% of respondents and decrease among 3% of respondents due to P2P carsharing (net 7% increase). In terms of public bikesharing, the shift was small and evenly split, with 3% reporting an increase and 3% reporting a decrease.

Figure 7 Modal Shift in Walking, Bicycling, and Public Bikes

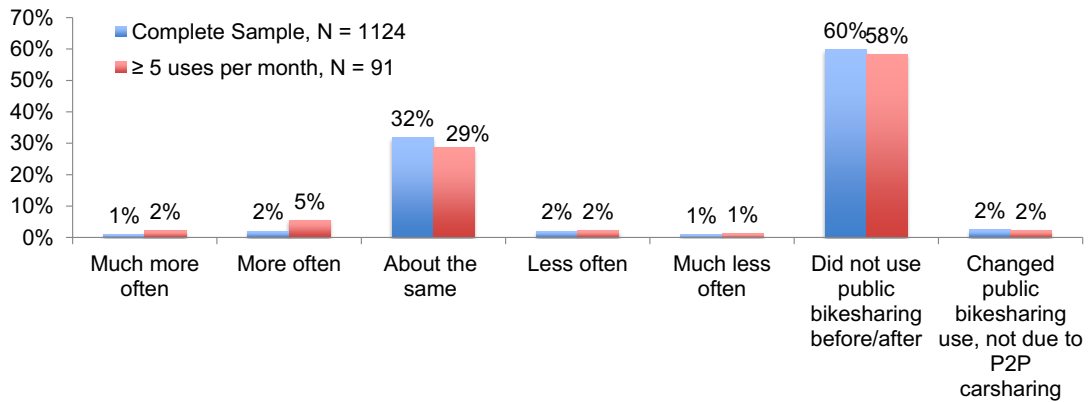
As a result of my membership with the P2P carsharing system, I walk:



As a result of my membership with the P2P carsharing system, I use a personal bicycle:

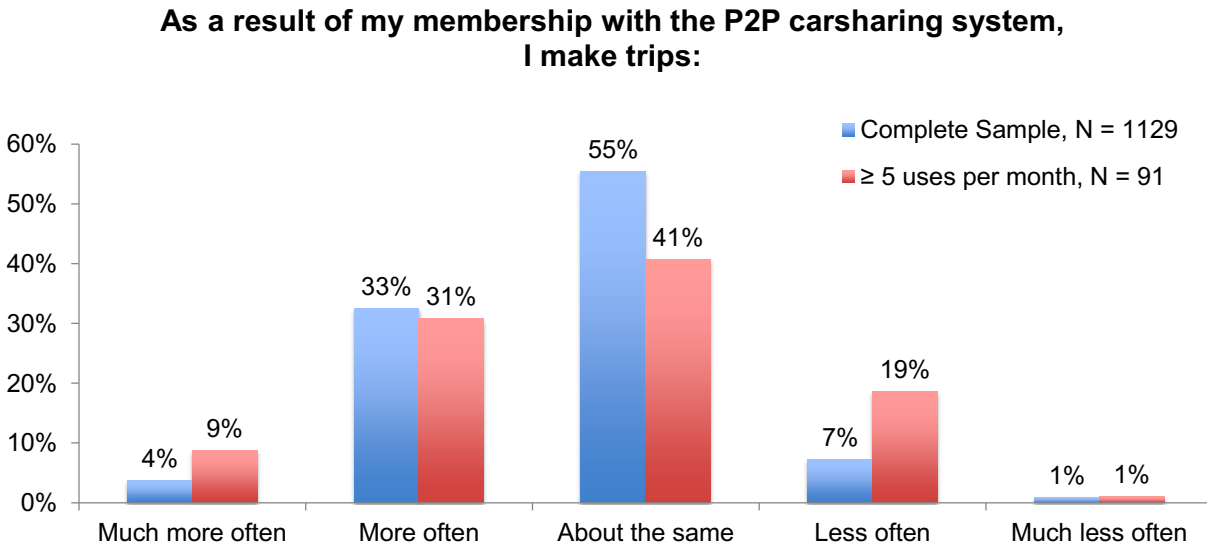


As a result of my membership with the P2P carsharing system, I use public bikes:



Finally, one of more pronounced effects of P2P carsharing appeared to be induced trip demand. Among the entire survey sample, 37% of respondents reported making trips more or much more often, while only 8% made them less or much less often (a 29% net increase).

Figure 8 Shift in Tripmaking As A Result of P2P Carsharing



While this is notable, more than half of all respondents reported making trips at about the same rate. This is in line with other results that show a sizeable portion of respondents reporting no change in their travel behavior with other modes as a result of P2P carsharing. For respondents who reported higher use of five or more times per month, a slightly different profile emerges. Among these members, there were more intense impacts in both directions; a slightly larger share of respondents took more trips (40%), while 20% reported less tripmaking due to P2P carsharing (vs. 8% for the entire sample).

3.3 Shifts in Driving as Result of P2P Carsharing

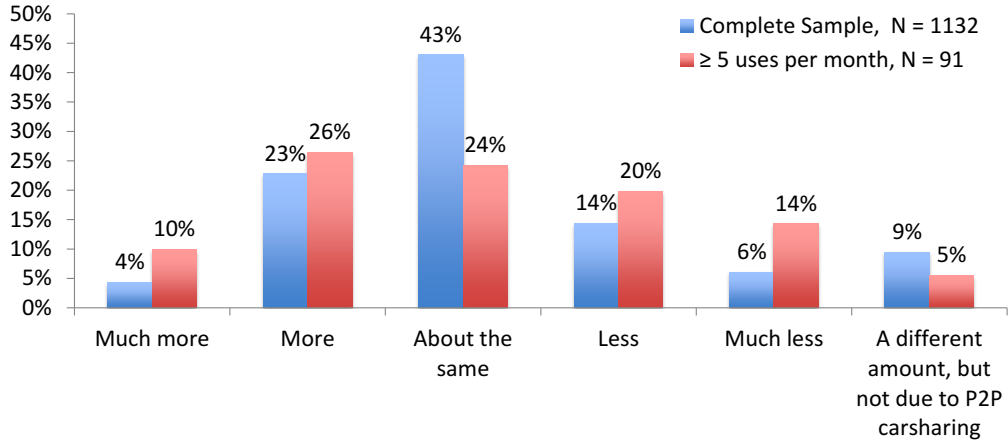
The effect of P2P carsharing on driving was found to be somewhat limited. This is partially because many users were only occasional users to begin with, even among those using the service more frequently. Figure 9 shows that among the entire member population, a slightly greater number reported *driving more* versus *driving less* as a result of using P2P carsharing

(27% versus 20%), while 43% stated that they drive about the same. Of the users that reported driving more as a result of P2P carsharing, almost half described the service as being “very important” to their driving increase. In contrast, a smaller fraction (about a third) of users that reported driving less cited P2P carsharing as a “very important” reason for their driving reduction. Overall, 20% of all survey respondents reduced driving due to P2P carsharing, and 74% of this subgroup attributed the program as a somewhat important or very important in this change.

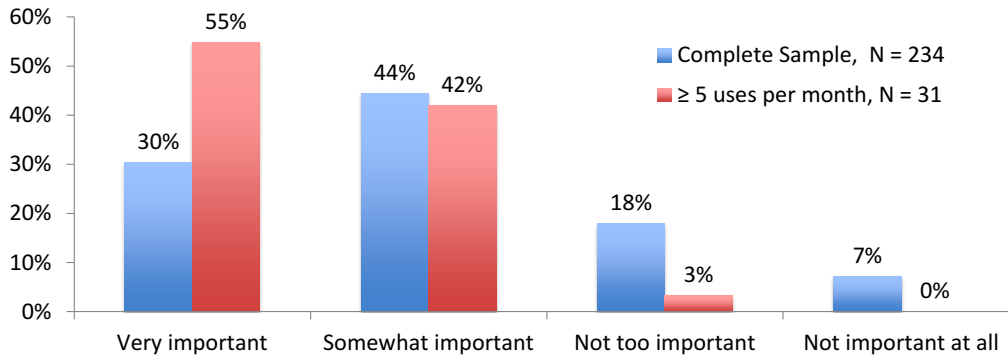
As observed with other modes, the higher frequency users showed more intense impacts in both directions. First, the share of respondents driving more increases to 36% and the share of respondents driving less also increases to 34%. Among those that shifted in one direction or another, the vast majority (at least 91%) stated that P2P carsharing was at least somewhat important in facilitating this change. In sum, there was only a 7% net increase in driving among all survey respondents and just a 2% net increase in driving among the most active users.

Figure 9 P2P Carsharing Influence on Driving

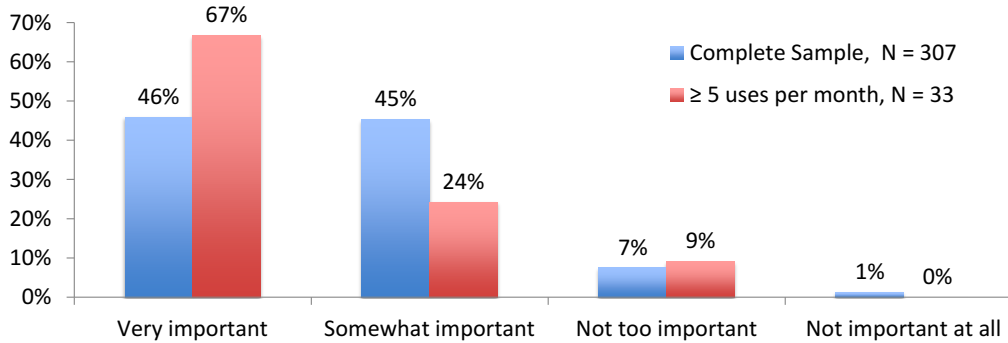
As a result of my membership with P2P carsharing, I drive overall...



How important has P2P carsharing been in contributing to your REDUCTION in driving?



How important has P2P carsharing been in contributing to your INCREASE in driving?

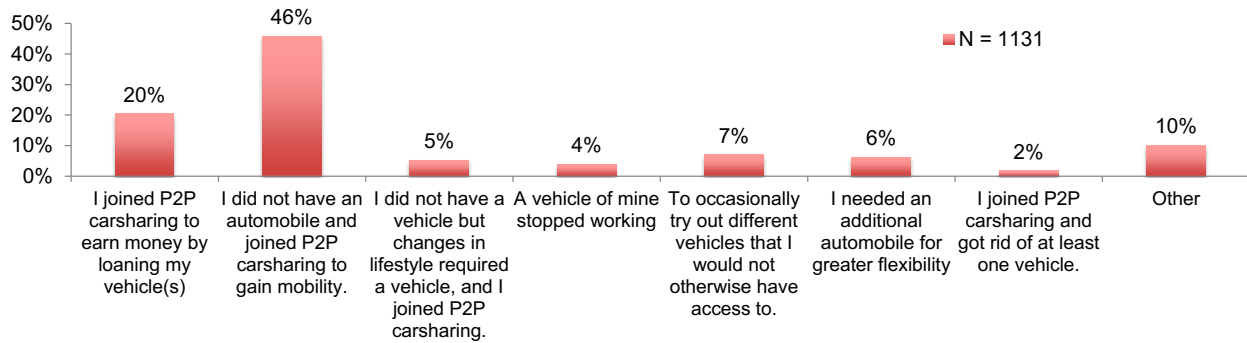


3.4 Circumstances of Joining and Impacts on Vehicle Holdings

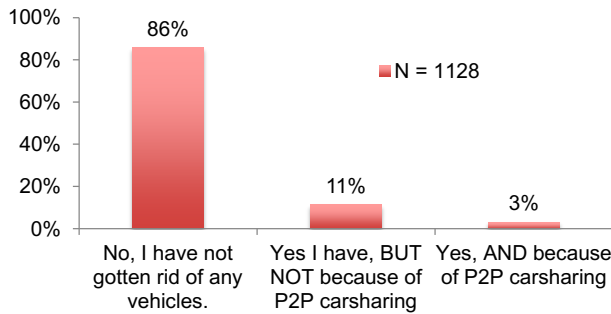
Figure 10 offers insights into why people reported joining P2P carsharing and the relationship that P2P carsharing had on reducing private vehicle holdings. Respondents were asked to state why they joined P2P carsharing, selecting the single best reason among a list of possible motivations. The top section of the graph shows that nearly half of respondents (46%) reported that they joined P2P carsharing because they did not have an automobile, and they sought additional mobility. Another (20%) joined primarily for the purpose of earning money through vehicle loans. A minority of respondents selected other categorical responses, including the need for an additional vehicle, a desire to try new vehicles, and a current vehicle ceasing to function. One infrequent response was: “I joined P2P carsharing and got rid of at least one vehicle.” This response was consistent with responses in the bottom two graphs of Figure 10 in which respondents were asked if they had gotten rid of vehicles since joining P2P carsharing. About 14% of the entire sample reported that they had, but only 3% of the sample attributed this vehicle reduction to their P2P membership. Among those (N = 35) that said their reduction was because of P2P specifically, a vast majority (92%) stated that P2P carsharing was somewhat to very important for this decision. Thus, while a segment of users shed a vehicle since joining a P2P carsharing system, very few of them recognize their membership as the influential factor.

Figure 10 Reasons for Joining P2P Carsharing and Vehicle Shedding

Please select the statement that best characterizes the circumstances under which you joined P2P carsharing



Have you gotten rid of vehicles since joining P2P carsharing?



How important was P2P carsharing in facilitating a reduction in the number of vehicles within your household?

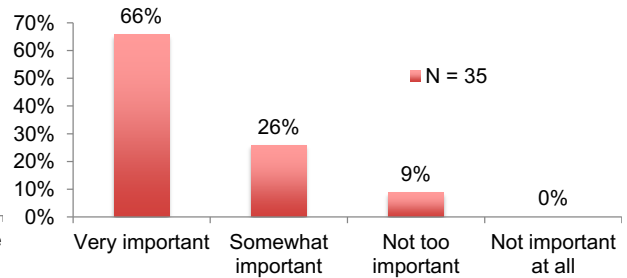


Figure 11 displays responses for the opposite question, exploring whether P2P carsharing increased vehicle purchases (as opposed to vehicle shedding). Ten percent of respondents stated that they purchased a vehicle due to P2P carsharing, with 2% of that subgroup attributing this purchase to their membership. Among the small sample (N = 20) that did purchase a vehicle due to P2P, 45% stated that it was because they wanted to loan a car in a P2P carsharing service.

Figure 11 Increases in Vehicle Holdings Due to P2P Carsharing

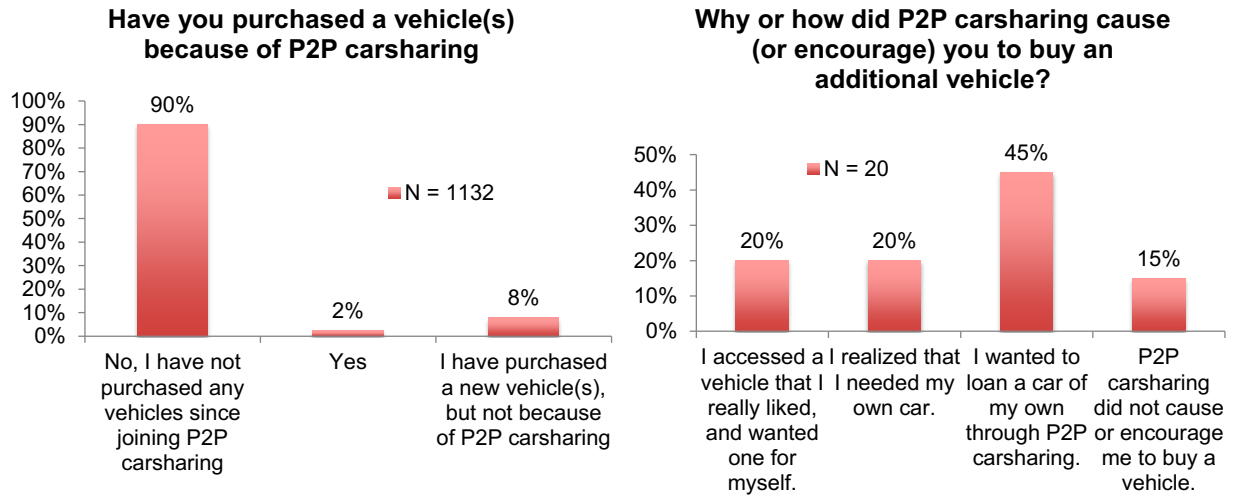


Figure 12 shows the impact that P2P carsharing has had on vehicle purchase suppression. Probing vehicle suppression effects is more challenging today than it was previously; in the past, when carsharing was limited to the roundtrip model, this involved a simple question:

If carsharing suddenly disappeared from my region, I would:

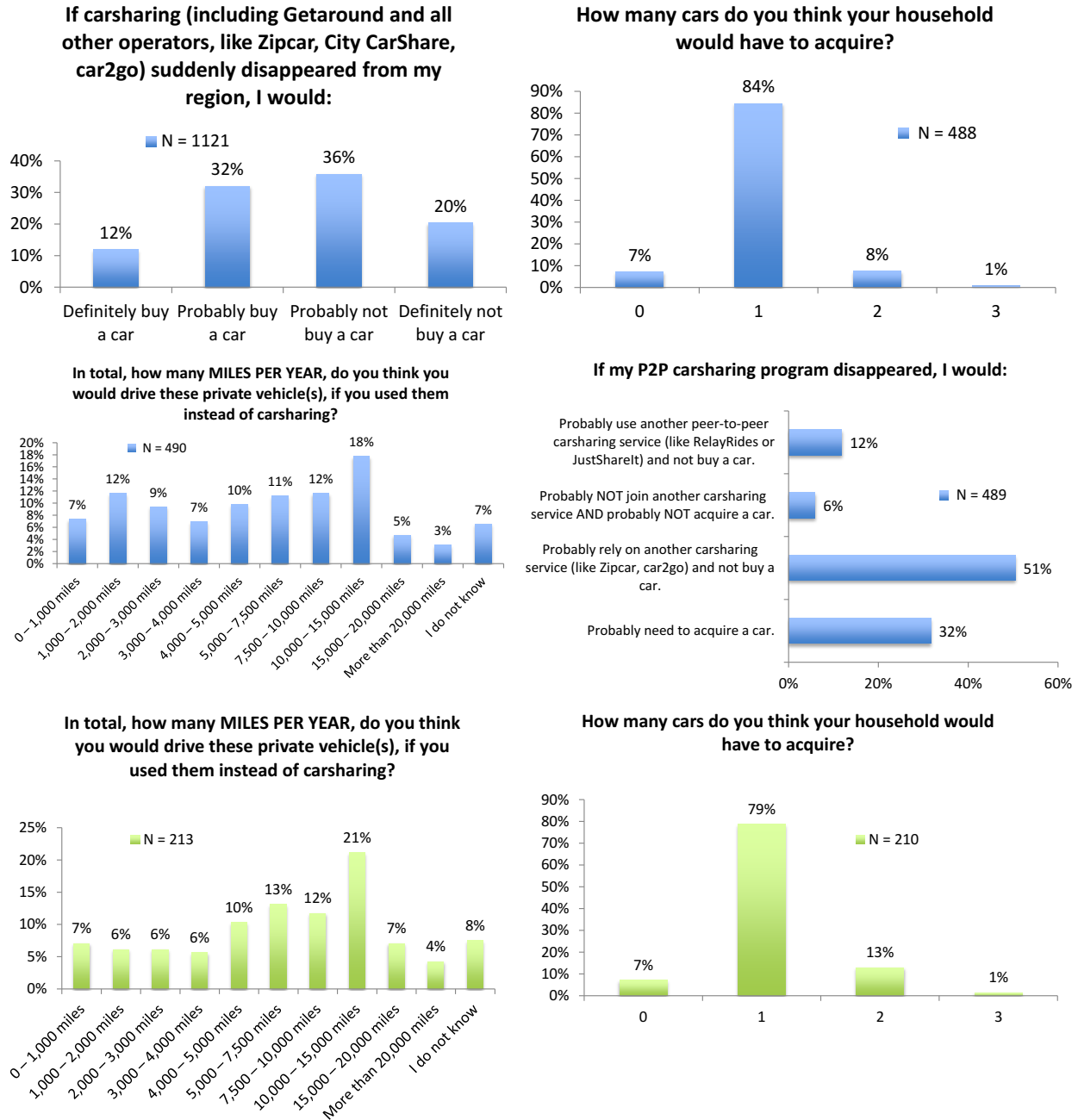
- Definitely buy a car
- Probably buy a car
- Probably not buy a car
- Definitely not buy a car.

However, with the advent of P2P carsharing, and many other shared modes, a set of questions probing the general influence of carsharing and the specific influence of P2P carsharing is needed. The results in Figure 12 show that among the survey sample both P2P carsharing and carsharing more broadly are having a pronounced effect on avoided vehicle acquisitions. Among the entire sample, 44% of respondents reported that the disappearance of carsharing (broadly defined) would result in them “probably” or “definitely” purchasing a vehicle. These respondents were asked a series of follow-up questions including: 1) How many cars do you think your household would have to acquire? 2) In total, how many miles per year, do you think you would drive these private vehicle(s), if you used them instead of carsharing? and 3) If the <P2P carsharing system> I am in disappeared, I would:

- Probably need to acquire a car.
- Probably rely on another carsharing service (like Zipcar, car2go) and not buy a car.
- Probably NOT join another carsharing service AND probably NOT acquire a car.
- Probably use another peer-to-peer carsharing service (like RelayRides or JustShareIt) and not buy a car.

This additional question is needed because more than one P2P carsharing provider might be present in the same market. The responses probe specifically whether the loss of P2P carsharing would merit the acquisition of another car. We consider the first and fourth responses to indicate a strong dependence of P2P carsharing in facilitating an avoided vehicle purchase. The bottom two of the six graphs in Figure 12 show distributions of the 210 respondents that “probably would have acquired a vehicle in the absence of P2P carsharing.” This is about 19% of the total survey sample. Notably, 93% of this subgroup (n=195), reported that they would have acquired one or more vehicles in the absence of P2P carsharing.

Figure 12 P2P Carsharing and Avoided Vehicle Purchases



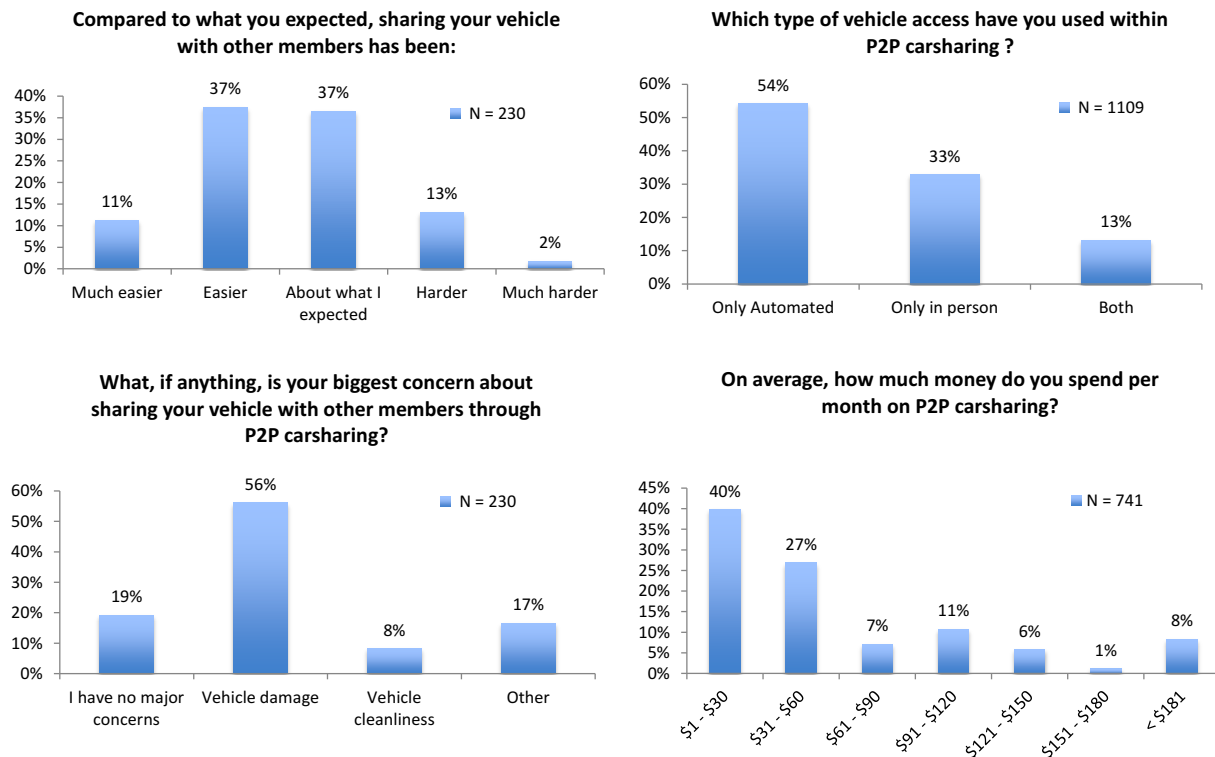
The results of Figure 10, 11, and 12 suggest that the largest effects of P2P carsharing come in the form of avoided impacts (foregoing vehicle purchases) versus observed impacts. This may be a function of the state of shared mobility at the time of P2P carsharing’s inception. Carsharing had been well established and operating for 10+ years before P2P systems came to fruition, and thus many of the direct vehicle reduction impacts may have already occurred. In addition, the wide

array of well-developed choices in shared mobility means that we should expect to see a growing influence of the avoided impact in shared mobility more broadly and a reduced influence of the observed impact.

3.5 Perceptions, Access, and Spending in P2P Carsharing Programs

We also collected data on user perceptions and spending P2P carsharing programs as shown in Figure 13. Almost half of respondents found it easier or much easier to share their vehicle than expected, while only 15% found it harder or much harder than their initial expectation. This shows that acceptance grows with system usage, and perception may be a barrier to customers joining P2P carsharing. The main fear that does remain is vehicle damage. Fifty-six percent cited this as their main concern with vehicle sharing, while 8% were concerned with vehicle cleanliness. Sixteen percent had no major concerns.

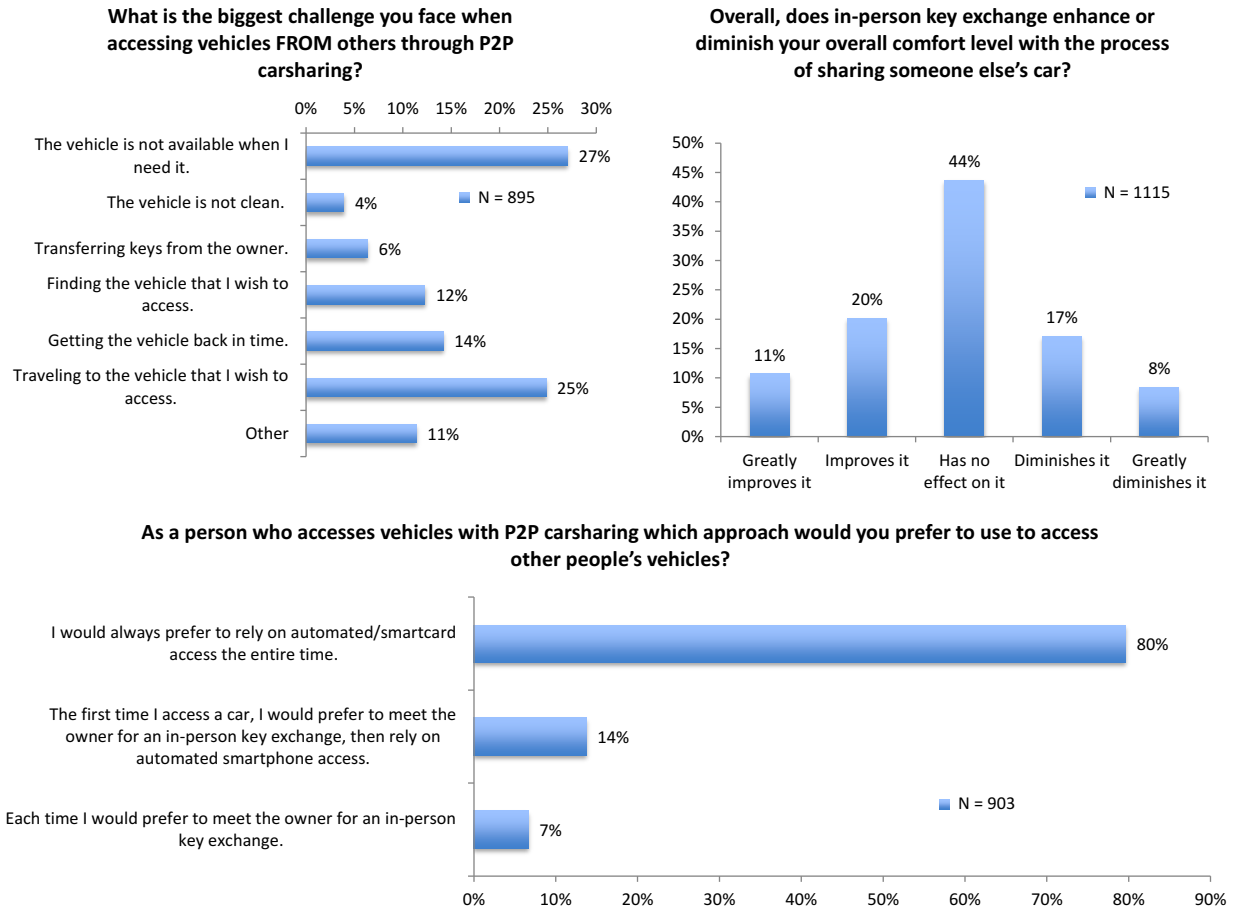
Figure 13 Perception of P2P Carsharing by Members



Regarding vehicle access type, relatively equal amounts of people had used only automated (electronic access) or only in-person (key exchange) access to P2P carsharing (45% and 39%, respectively). Only 16% had used both types of vehicle access, indicating a limited number of respondents that were able to compare and contrast the two types. Further, 40% of respondents reported spending less than \$30 each month on P2P carsharing, while two-thirds reported spending less than \$60 per month.

The two biggest challenges users faced when accessing vehicles through P2P carsharing were traveling to the reserved vehicle (25%) and vehicle availability (27%). Figure 14 shows that slightly more respondents felt that in-person key exchanges enhanced rather than diminished their comfort level in using someone else's car (31% versus 25%). However, 44% felt it had no effect on their comfort level. This validates previous studies (e.g., Dill et al., 2014; Shaheen et al., 2012) that have cited similar difficulties, such as vehicle availability and interfacing with the host in using P2P systems.

Figure 14 P2P Carsharing Vehicle Access



While 44% of users appeared to be ambivalent toward in-person exchanges with regard to their comfort levels, 80% of respondents would prefer to always rely on automated vehicle access. This indicates that while users may not mind in-person exchanges if necessary, a large majority of them would have still preferred full automation.

In Figure 15, we examine the host and guest breakdown of the P2P carsharing members. It shows that about 21% of users were providing vehicles for the rest of the network. While the majority of those accessing vehicles were paying less than \$50 to \$100 a month, there was a more varied breakdown of earning amounts among those loaning vehicles. Overall, it appears that those providing vehicles were earning more per month than guests are spending.

Figure 15 P2P Carsharing Role and Costs/Revenues

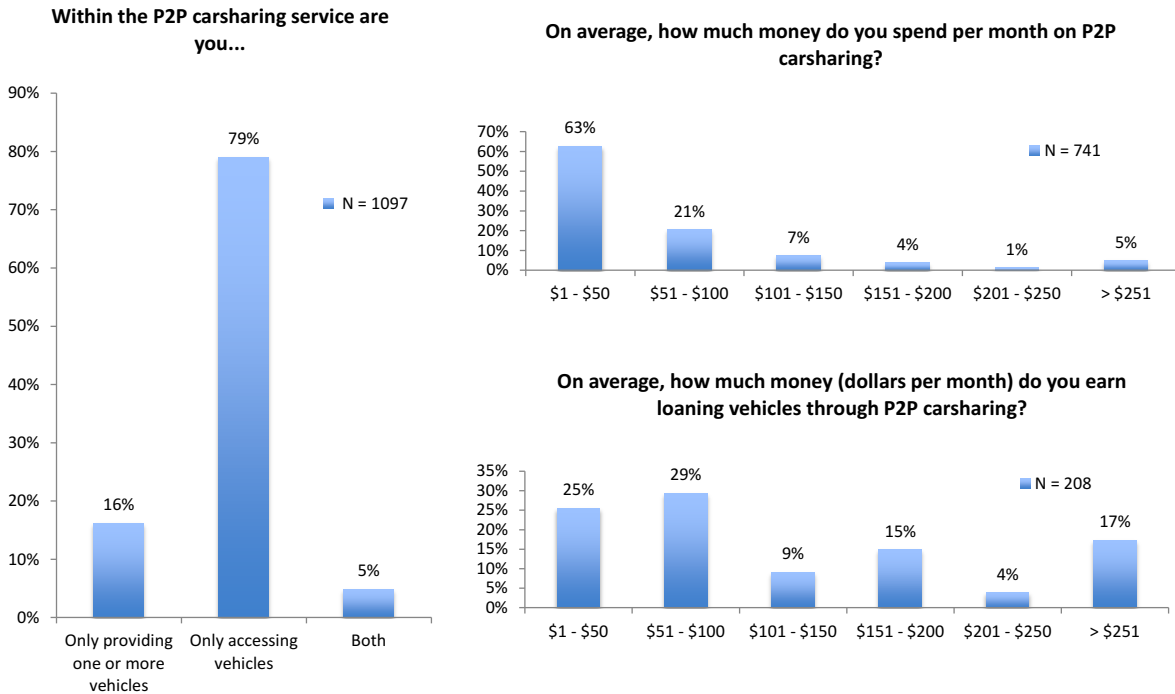
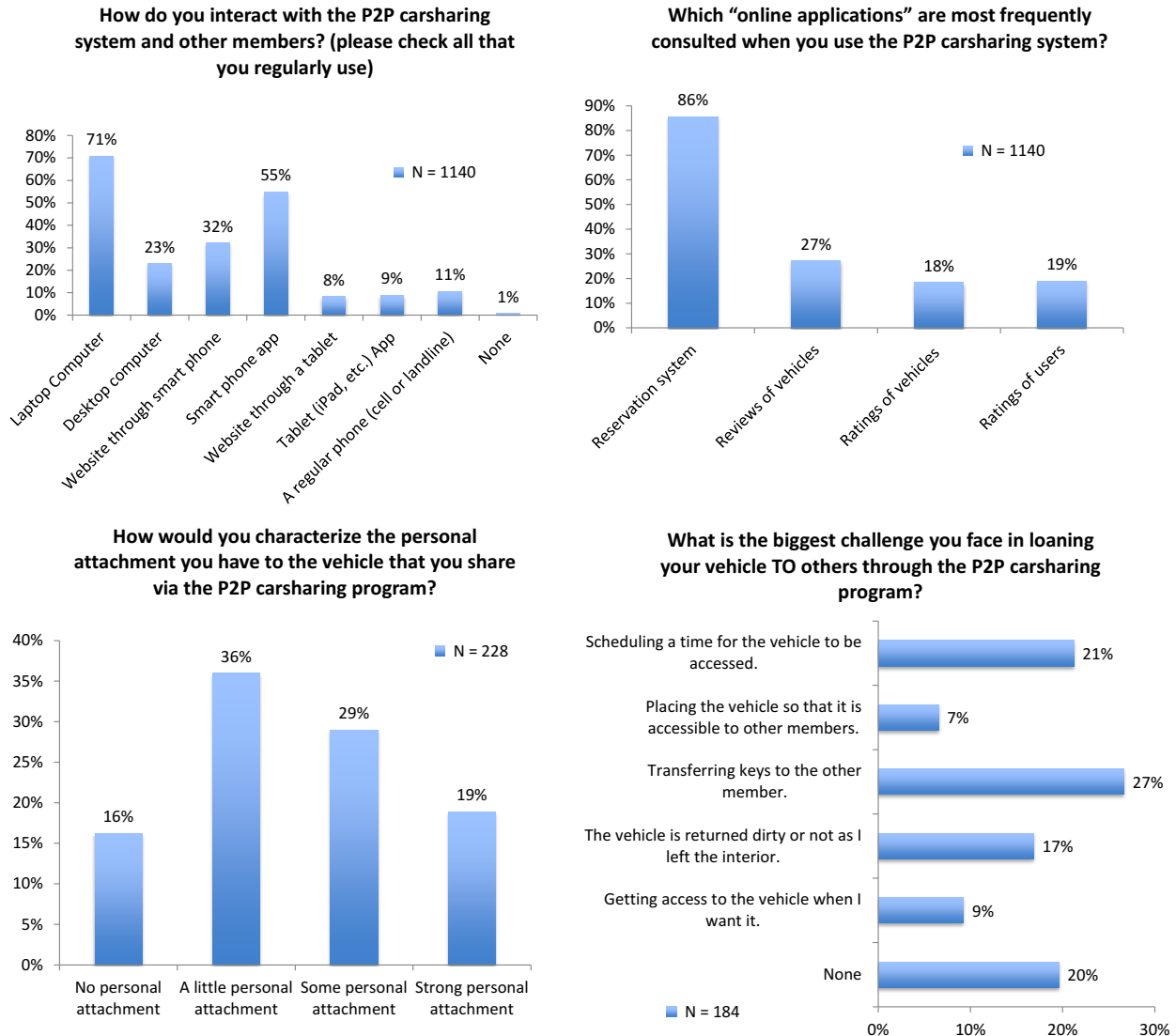


Figure 16 shows how respondents communicated and interacted with the system, which was primarily through laptop computers and smartphone applications (70% and 54%, respectively). Respondents were asked which online applications they consult before using the system (in check all that apply). The reservation system was also the main online application consulted (85%) before using P2P carsharing services. Interestingly, only about 19% of respondents stated that they checked user ratings before reserving or loaning a vehicle. Twenty-seven percent check vehicle reviews, and 18% consult vehicle ratings.

Figure 16 Use of Online P2P Carsharing Applications and Vehicles

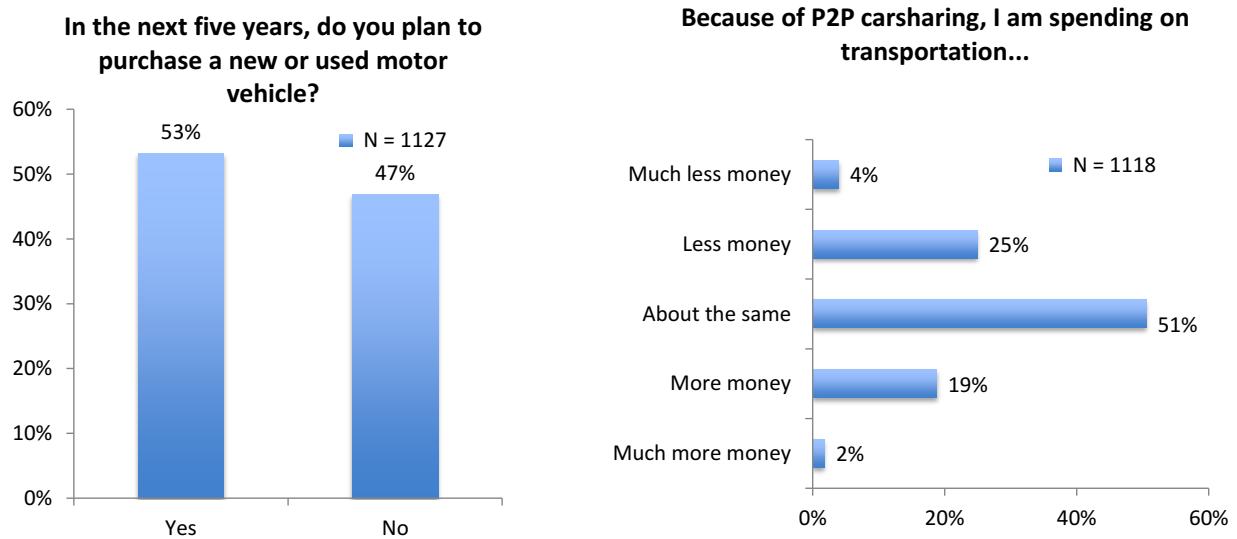


Users that loan vehicles were roughly split evenly between having little to no personal attachment (52%) and having some to strong personal attachment to their shared vehicle (48%). Those contributing vehicles to P2P systems cited logistical issues, such as arranging a time to meet the user (21%) and transferring car keys (27%), as the two top challenges in using P2P carsharing. This validates the earlier finding that guests also dislike the process of setting a time to meet the host, as well as returning the physical keys.

Slightly more users plan to purchase a new vehicle in the next five years than those who plan not to, although the split is fairly even (53% versus 47% not planning on buying). Figure 17 shows

that the two most cited reasons for P2P carsharing trips are errands and long-distance recreational day trips (about 39% and 38%, respectively). Long-distance recreational overnight trips and shopping are the next two most cited trip purposes (28% and 25%, respectively). These numbers likely support the two spikes seen earlier that show proportionally more users driving either under 50 miles or more than 300 miles a month.

Figure 17 Vehicle Ownership, Trip Purpose, and Travel Costs



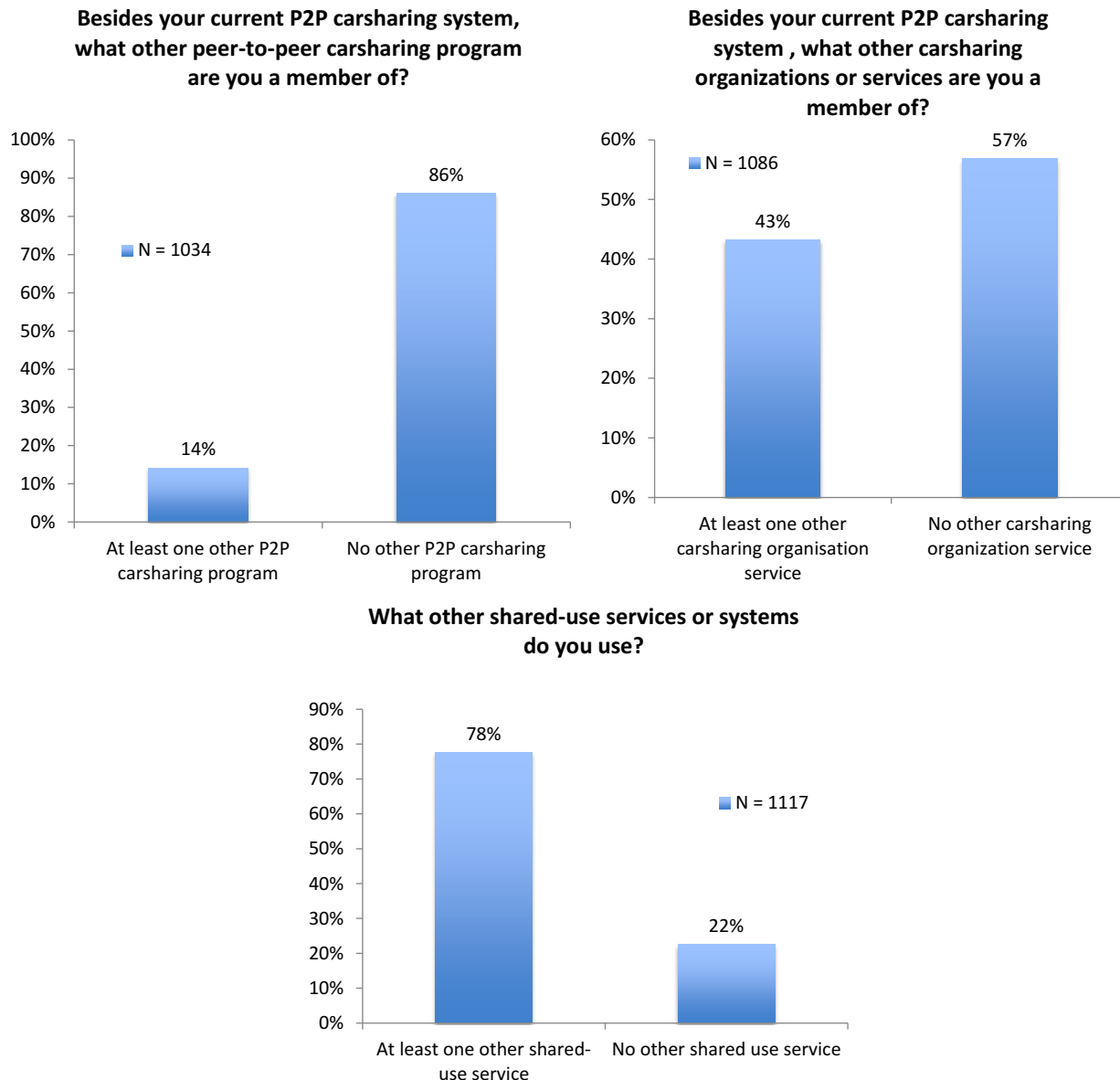
P2P carsharing has a split cost saving impact, with about half of respondents reporting some change in spending—either as an increase or decrease due to P2P carsharing. About 29% reported spending less, whereas 21% reported spending more. The other half, 51% of respondents, reported spending about the same amount of money on transportation due to P2P carsharing.

3.6 Membership and Use with Other Shared Mobility Services

While the majority of P2P carsharing respondents were not members of other P2P programs (86%), 43% did report being a part of other general carsharing organizations, as shown in **Figure 18**. This means that rather than one type of carsharing system replacing another, P2P carsharing and other shared mobility services likely complement each other and provide a variety of

mobility options that meet the needs of specific circumstances. Further, indicative of the integrated nature of the sharing economy, three-fourths of respondents reported being a part of at least one other shared service including systems, such as Airbnb, Zipcar, and ridesourcing/TNCs.

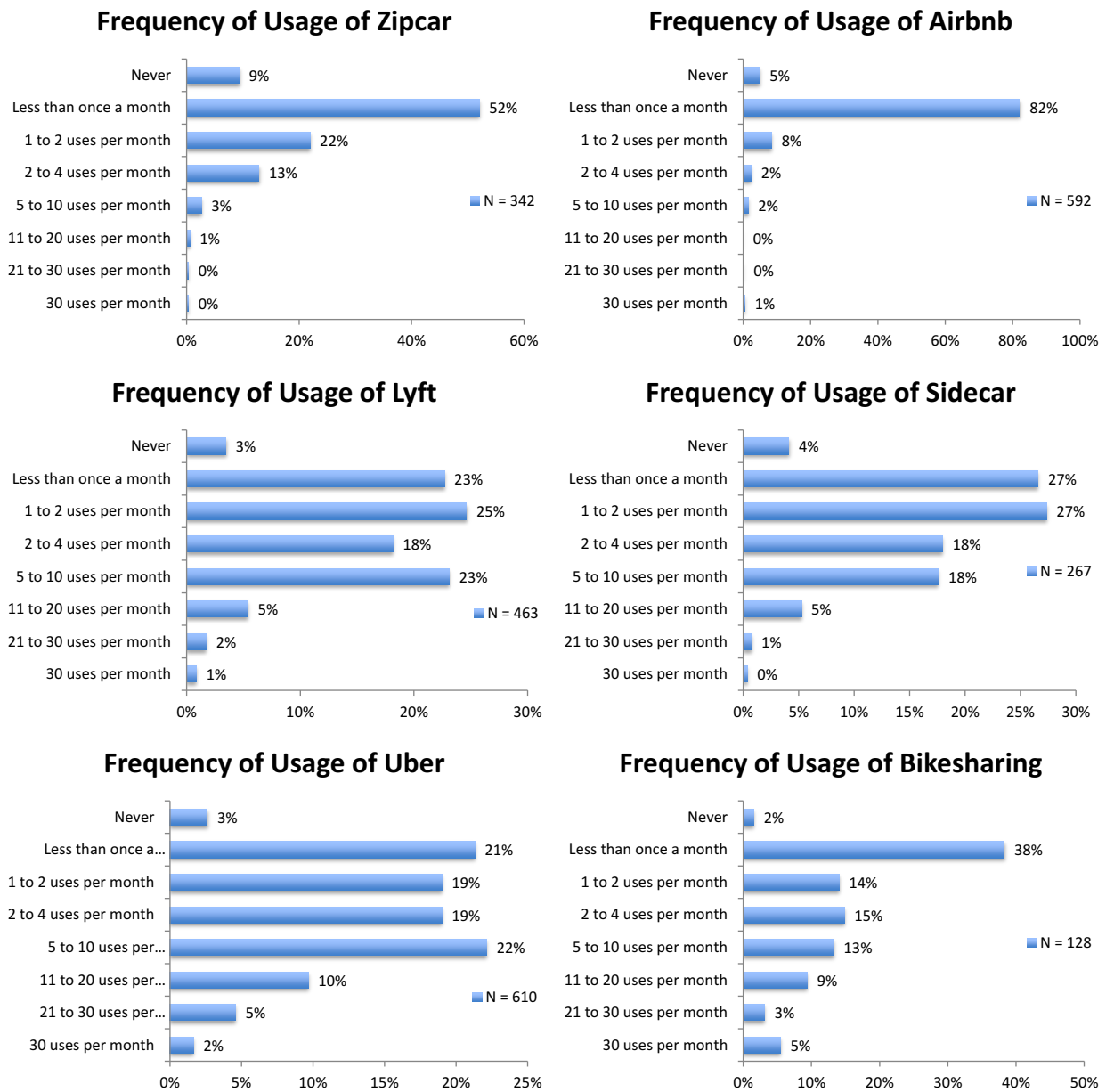
Figure 18 Other Shared Mobility Memberships



Indeed, almost 40% of the P2P carsharing survey respondents reported using Zipcar more than once a month, demonstrating a considerable overlap in members that use both P2P and roundtrip carsharing. In Figure 19, the frequency of use for a variety of shared services are summarized. Of

the respondents that also use ridesourcing services, roughly three-fourths use them more than once a month across the three providers at the time of the survey (i.e., Lyft, Sidecar,⁴ and Uber). A third of respondents use Lyft and Uber, in particular, more than five times a month.

Figure 19 Frequency of Use of Other Shared Mobility Services



⁴ Now defunct.

Overall, the survey showed that users of P2P carsharing were generally active participants in a variety of shared mobility modes. It further provided a quantification of changes in travel behavior and vehicle ownership that resulted from access to the P2P carsharing network. Additionally, the survey clarified perceptions, monetary aspects, and access considerations associated with P2P carsharing use and vehicle contribution. All of these effects are in the form of a distribution that highlights which benefits and behaviors increased for some and decreased for others. These and other qualities and experiences of P2P carsharing are explored more qualitatively in the sections that follow, which feature operator interviews, and focus groups with P2P carsharing hosts and guests.

4. OPERATOR INTERVIEW RESULTS

4.1 Background

To gain a more in-depth perspective of P2P carsharing operations and services, we interviewed six experts from within P2P carsharing companies, the majority of which were in the United States. These interviews were conducted from mid-2013 to early-2014. Interviewees were given the same set of questions but were invited to speak freely on related topics. We discuss key takeaways from the interviews that covered: 1) rural markets, 2) P2P as it compares to roundtrip carsharing, 3) environmental benefits, 4) social benefits, 5) demographics, 6) fee structures, 7) insurance, and 8) barriers.

4.2 P2P Carsharing In Contrast To Roundtrip Carsharing

Many experts agreed that the most practical benefit of P2P carsharing is its reduction in the costs of automobile use. The P2P carsharing model allows some companies to gain access to vehicles that they would otherwise not be able to afford or typically not be included in B2C carsharing fleets. That is, P2P carsharing fleets are far more diverse in nature versus those of other carsharing services, which are known for fleet standardization. Among P2P systems, guests can choose from budget cars to high-end luxury vehicles (including Teslas) to pick-up trucks. For hosts, P2P carsharing allows them to recoup expenses and make money from a car that is

depreciating and sitting idle approximately 95% of the time, on average. This is particularly the case in high-end vehicle ownership, which in some cases can be more manageable by monetizing the idle time of the vehicle.

A few experts view roundtrip carsharing as a direct competitor to P2P carsharing due to the similarities between roundtrip and P2P carsharing from the user's perspective. However, many experts viewed roundtrip carsharing as complementary, with one expert noting that the former enabled the rise of the latter by introducing the public to the idea of carsharing. Experts seem to agree that roundtrip carsharing has a stronger hold on the short-term rental market, while P2P carsharing was making gains in the long-term, recreational rental market. Many experts see vehicle manufacturing companies as the real "competitor," as P2P carsharing operators considered reducing the number of cars on the road as part of their mission.

4.3 Environmental Benefits

While the survey shows a mixed impact on modal shift to and from public transit, the experts noted that P2P carsharing, like roundtrip carsharing, can encourage greater use of alternative transportation modes. Experts were optimistic that P2P carsharing reduced vehicle miles and greenhouse gas emissions, but they do not have research to support these claims. One expert believed that P2P carsharing took vehicles off the road, but another expert thought this was unlikely and instead thought that P2P carsharing was more likely to reduce the number of new cars being manufactured. While fewer cars may be being manufactured, one expert cautioned that P2P carsharing could also keep older cars on the road longer, as they convert to the secondary use of making money for the host.

4.4 Social Benefits

The greater geographic diversity of P2P carsharing vehicles offers a shorter walk for guests, and it also permits lower income or geographically isolated households to enjoy the benefits of carsharing. Some P2P carsharing companies facilitate in-person key exchanges. Many guests and hosts value the personal exchange, as putting a face to a name helps alleviate concerns that

people might have about using other people's personal vehicles. One expert suggested that P2P carsharing supports a broader shift away from an economy of ownership to an economy of sharing assets. Another expert stated that the sharing economy allows for human connection, which many consumers prefer.

4.5 Fee Structures

Nearly all the experts interviewed noted that hosts could set their own prices, but their companies provided recommendations on appropriate prices based on market rates. Anywhere from 70 to 100% of the total system revenue came from usage fees, depending on the company. Other revenue came from booking fees or in some cases the sale of in-vehicle technology. Many companies charged membership fees for hosts and guests. For several companies, around 20% of member fees go toward insurance, making it the largest cost.

4.6 Insurance

One of the highest costs (and barriers) of P2P carsharing was reported to be insurance coverage for operators. One company relied on the host and guest to provide coverage and did not offer any additional insurance coverage. This company's liability only extends to individuals they allow into the system and verification that hosts and guests have sufficient insurance coverage. Most companies, however, provide some sort of mandatory insurance structured per reservation, per month, or per year. Insurance fees are typically bundled with reservation fees. All of the experts mentioned that the lack of precedence for P2P carsharing and high premiums made securing insurance especially challenging and, for some, the most difficult step in launching their company. A few experts mentioned their appreciation of California and Oregon legislation that prohibited carriers from dropping individuals because they shared/rented their personal vehicles or spiking their premiums. Since the time of this study, Washington State has also enacted similar legislation. In addition, P2P carsharing operators have developed strategies for providing insurance that cover vehicles while they are in use by guests in nearly all other states,⁵ which do

⁵ At present, New York is the only state that does not allow P2P carsharing.

not jeopardize the existing insurance policies held by vehicle hosts. Thus, a single vehicle in a P2P carsharing network, such as Turo, is covered by two different insurance policies: one that insures the vehicle's use by the host and the other (provided by the operator – called “group insurance”) that covers all driving by guests.

4.7 Barriers

The lack of standardization among P2P carsharing models was reported to be both an attraction and deterrent for guests. P2P vehicles varied significantly in terms of age, interior quality, maintenance, and driving feel. While such diversity allows the guest to have an unprecedented range of choice, this also was reported to reduce the reliability and predictability of the service—or at least the perceived reliability and predictability—of P2P vehicles. With B2C carsharing operations, vehicles are more standardized, so reliability and predictability of the experience is higher. For example, one expert suggested that guests may trust a roundtrip carsharing company more because of this. On the other hand, another expert suggested that the personal connection that P2P carsharing attempts to foster may increase trust in this carsharing model. It was suggested that guests may even take better care of vehicles, if they know that an individual, rather than a company, owns it. To build trust in P2P carsharing, many experts cite media coverage, increased exposure via social media, and word-of-mouth referrals as crucial. Some companies have experimented with the use of an online user-rating system as a way for hosts to develop a good reputation. A few companies refrain from connecting hosts and guests. In these models, the host and guest do not interact or even know who the other is. In fact, some guests may not even know they are driving a P2P carsharing vehicle. This hybrid version of P2P carsharing is akin to roundtrip carsharing conducted with P2P vehicles. It is not uncommon to find roundtrip carsharing operators to provide a combination of P2P vehicles and a dedicated fleet (e.g., Getaround).

One expert suggested that parking will become a major barrier and opportunity in the future of P2P carsharing. Parking is a finite supply, but the car-centric nature of America has led to the development of extensive parking infrastructure. More broadly, America's streets are geared toward privately owned automobiles as opposed to public transit or carsharing. This expert

argued that parking should be expensive enough to deter personal vehicle ownership and be provided for free to carsharing operators. Such measures would force individuals to reevaluate the necessity of car ownership and entertain the idea of P2P carsharing or other transportation modes.

4.8 Rural Markets

One of the more promising dynamics of P2P carsharing is its potential to introduce carsharing to rural markets. Unlike roundtrip and one-way carsharing, P2P carsharing's use of existing, underused vehicles does not require significant capital to establish a network vehicle in remote areas. Even though implementing P2P carsharing is generally cheaper than roundtrip or one-way carsharing, setting up P2P carsharing in suburban and rural areas is more expensive and inconvenient than in urban areas. One expert noted that rural markets are still underserved because there is a limited supply (hosts willing to share their cars), demand (guests), or both. Therefore, while the concept was enticing, the reported reality is that it takes longer to establish P2P carsharing in rural areas than in urban areas, and companies tend to target the most promising markets first.

4.9 Conclusion

The expert interviews discussed the promise of P2P carsharing, while also identifying its challenges. The lower capital costs of P2P carsharing allow it to potentially reach more diverse markets than roundtrip and one-way carsharing. Moreover, the diversity of P2P carsharing vehicles offers guests more choice. It is hypothesized that the environmental benefits of P2P carsharing are largely similar to those of roundtrip carsharing, although there is some concern that P2P vehicles are older than traditional carsharing vehicles and therefore less fuel efficient. The social benefits of P2P carsharing align with the benefits of the sharing economy: increased use of existing resources and more human connection. Guests and hosts of P2P carsharing tend to be young, educated, and upwardly mobile. The barriers of P2P carsharing were identified to be generally parallel to those of roundtrip carsharing, but the diversity of P2P vehicles also raised

some concerns over reliability (even if this was just perception). In P2P carsharing, insurance and trust issues were identified as manageable challenges.

5. SUMMARY AND CONCLUSIONS

P2P carsharing represents another evolution in the sharing economy in which shared mobility has transitioned from the sharing of a commercial vehicle fleet to the sharing of personal vehicles. This transition is a critical point in the development of the sharing economy in that it opens mindsets and policy to P2P economy. This evolution brought about new questions in the areas of policy, insurance, and social interaction among neighbors. It further paved the way for additional models of sharing, mostly notable those of Lyft and Uber, which quickly followed the path of providing shared mobility with personal vehicles established by P2P carsharing and its predecessors.

This study sought to shed light on the impacts of P2P carsharing from a number of different angles and methodological approaches. The implementation of a survey of P2P carsharing members provided a quantification of behavioral impacts among guests and hosts, while the operator interviews and focus groups surfaced nuanced qualitative opinions. Key findings from the survey, expert interviews, and focus groups follow below.

Socio-Demographics

The results of the survey show that P2P carsharing had an impact on how members traveled and their vehicle ownership. It also helped them spend less money on transportation. Users of P2P carsharing were generally of a slightly higher income relative to the US population. However, this could be in part due to the fact that P2P carsharing is predominantly operated in urban areas. However, other visible departures are less associated with the urban focus of shared mobility. For example, the P2P survey respondents were found to be more Caucasian than the general population and more gender balanced toward men. P2P survey respondents were young, with 55% of respondents between the ages of 25 to 34. In addition, they were on average, highly educated, with 86% having a graduate degree or higher. Respondents rated themselves as

politically more liberal than the general population, although this too is reflective of urban populations.

Frequency of Use and Trip Purpose

P2P carsharing was reported to be used with moderate frequency by respondents. In total, about 55% of respondents were active with their membership, using the system once per month or more. It is likely that the sample represented a more active share of the sample population than the overall sample population of members. At the most frequent activity levels, 8% used the system five or more times per month. The most common reasons for P2P carsharing use were serving basic needs, including running errands. Long distance recreational trips were the second most common reason. Among high frequency users (five or more trips per month), usage was more tilted toward practical applications, such as errands and shopping.

Impacts on Public Transportation

As with many shared mobility modes, P2P carsharing had mixed impacts on public transit use. The vast majority of respondents reported no substantive change in public transit use as a result of P2P carsharing. Moreover, those that increased public transit usage were balanced by those that decreased it to nearly the same extent. High frequency users had more prominent effects in both directions, and this subgroup had slightly more respondents reporting an increase versus decrease of bus (22% vs. 21%) and rail (16% vs. 13%). Overall, there were not large changes in public transit usage among P2P carsharing members.

Impacts on Taxi, Ridesourcing/TNCs, and Carpooling Use

While taxi use showed a net decline among all respondents, there was no net change in the use of ridesourcing/TNCs. In addition, respondents indicated a net increase in carpooling, suggesting that P2P users were likely taking trips with multiple occupants more often than their regular travel. Furthermore, members reported making more overall trips as a result of P2P carsharing.

Driving Impacts

Overall, more respondents in the sample indicated that they drive more (27%) due to P2P carsharing than less (20%), but the net difference is less among those that are frequent users

(36% to 34%). Whether it was an increase or a decrease in driving, most respondents considered P2P carsharing to be playing a role that was at least somewhat important. In addition, a plurality of respondents (43%) indicated no change in their driving amount.

Vehicle Ownership Impacts

The circumstances of joining P2P carsharing are illustrative of the scale of vehicle ownership impacts among members. Most respondents joined P2P carsharing for purposes other than replacing a personal vehicle. For example, 46% of respondents did not have a vehicle and joined to gain additional mobility, and 20% joined to earn money sharing their own vehicle. About 15% of respondents joined for circumstances related to foregoing a vehicle purchase, while another 2% reported joining to sell a vehicle. These percentages were rather consistent; about 3% of respondents stated that they got rid of a personal vehicle since joining P2P carsharing and that they sold it because of P2P carsharing. Furthermore, about 14% of the entire sample stated that they would probably need to acquire a car, if their P2P carsharing service disappeared. Since these shares represent what is likely a more active segment of the population, the shares of similar activity among the entire population would most likely have been lower.

Vehicle Access Concerns and Recommendations

Respondents reported common challenges with access to vehicles and sharing them. About 15% felt that sharing vehicles was harder than expected, while about 48% felt that it was easier than expected. Among the biggest challenges reported by guests included vehicle availability as well as traveling to access them. Most respondents (80%) preferred automated access to the vehicle if that was available. In terms of spending, slightly more respondents reported spending less on transportation due to P2P carsharing as opposed to more, but the split was rather even within the sample.

Sharing Economy Engagement

Finally, P2P carsharing was found to be used in conjunction with other shared mobility services as 14% were members of at least one other P2P system; 43% were members of at least one other carsharing organization; and 78% had used at least one other shared-use service. P2P carsharing

users were also relatively frequent users of Uber and Lyft, indicating that members used a portfolio of shared mobility modes to meet their transportation needs.

Expert Interviews

The expert interviews with operators explored issues, barriers, and opportunities related to P2P carsharing from the perspective of those most directly involved with navigating industry challenges and expansion. Operators reported that P2P carsharing exhibited great growth potential, while at the same time servicing mobility needs of the urban and suburban public. They recognized the intriguing potential of P2P carsharing in scaling carsharing to more rural environments, but they noted that it is quite difficult and expensive to reach low-density regions for a number of reasons. One of the most prominent reasons is lack of awareness, as well as a lack of willingness or interest among people living in these markets. Personal vehicles are distantly spaced, and they are needed by the hosts to meet virtually all travel needs. Thus, P2P carsharing has predominantly focused on urban markets. At the same time, operators view P2P carsharing as complementary to roundtrip carsharing. Operators also noted barriers to P2P carsharing, including finding ways to provide predictability and reliability of experience within a fleet of vehicles that was diverse in the forms of age, interior quality, maintenance, and driving feel. Another challenge reported is insurance. These issues have been mitigated in recent years, as operators have found solutions (sometimes imperfect) within industry frameworks, with most states allowing vehicles to be covered by multiple policies depending on if they are being used by hosts or guests. Nevertheless, the efficient and effective provisions of insurance remain an evolving dynamic within the shared mobility industry.

Focus Groups

The focus groups sought to identify qualitative insights from both vehicle guests and hosts participating in P2P systems and highlight some of the idiosyncratic issues faced. For example, the key concerns before joining included trust, vehicle cleanliness, and access logistics (meeting the host/guest, etc.). However, focus group participants had all overcome these initial concerns. Vehicle hosts generally felt that they were getting value from sharing their vehicles. At the same time, they also acknowledged that their participation in P2P carsharing had some upfront costs

(e.g., car kit installation) and generally made them pay more attention to vehicle maintenance expenses.

Focus group participants noted a number of advantages for P2P carsharing. Vehicle hosts acknowledged the extra income, as well as the perceived value of participating in the broader sharing economy, a concept they supported. They also appreciated 1) helping with vehicle access, 2) sharing luxury vehicles with others, and 3) contributing to a better environment. In addition, guests considered the flexibility of P2P carsharing pricing policies to be an advantage as it enabled them to take longer-distance trips than roundtrip carsharing normally would. Vehicle guests viewed P2P carsharing as both cost efficient and convenient, as it removed their need to worry about vehicle theft, parking, street cleaning, or other concerns associated with personal vehicle ownership. Furthermore, guests noted that they had access to a wider variety of vehicles than other shared mobility options. For the complete synopsis of the focus groups, please see Appendix A.

Focus group participants also noted a few disadvantages from P2P carsharing. Among hosts, there was an occasional lack of access to their own vehicle while it was being used, leading them to use public transit more or other active modes (e.g., walking, cycling). Hosts expressed some concern over vehicle damage, although none of the participants had experienced significant damage to their vehicle. Most of the challenges reported by the vehicle guests related to coordinating vehicle access; over half of the participants had reported inquiring about a vehicle and not receiving a reply. Others noted some inconvenience with needing to schedule and coordinate with the vehicle host for a physical key transfer.

Looking Forward

The research we have undertaken as part of this report has shed light on P2P carsharing as it exists under current conditions. However, it is clear from the amount of financial and intellectual capital being invested in automated vehicles (AVs) that self-driving cars will become a significant part of the future of mobility. While still largely in testing mode (there are a handful of self-driving pilots with passengers in the U.S. and Europe), AVs have been projected to function in a shared fashion, broadly termed Shared Automated Vehicles (SAVs) (Stocker,

2018). Of the business models in which SAVs may function, two specifically involve P2P carsharing:

1. P2P with Third-Party Operator

Similar to how P2P carsharing exists today, this version would entail individually owned AVs to be made available for use on a short term, on-demand basis. Private operators would, as they do currently, host platforms to arrange usage periods and manage financial transactions.

2. P2P with Decentralized Operations

Although largely similar to the first option, this scenario entails AV hosts and guests arranging and paying for usage periods via a public, and open-source ledger, such as those that employ blockchain technology.

In February 2018, Waymo (an automated vehicle company owned by Google’s parent company, Alphabet) received its first permit to operate a ridesourcing/transportation network company service in Arizona—joining General Motors/Lyft and Uber in testing AVs in a shared mobility service in the U.S. While mainstream deployment is still likely years away, P2P carsharing models can help to inform the transition to P2P SAV services, as well as public familiarity with privately owned shared vehicles. The findings presented in this report can shed light on P2P carsharing and provide early insights into opportunities and obstacles for shared privately automated vehicles in the future.

Summary

By leveraging the existence of privately owned vehicles, P2P carsharing systems were among the first to integrate shared mobility systems with personally owned assets. The study results offer insight into P2P carsharing impacts on travel behavior of both vehicle guests and hosts. P2P carsharing uniquely fits a specific demand within the shared mobility ecosystem. No other shared mobility mode provides access to such a diverse array of vehicles across a broader geographic environment. While extensively expanding this model outside the urban core can present an operational challenge, growth into suburbs and rural areas has potential to extend the reach of

shared mobility, as well to reduce the costs of automobility for many. This study demonstrates that P2P carsharing access has enabled some households to reduce vehicle ownership, and more prominently, avoid a vehicle purchase. Further, it provides access to vehicles that are unique and entertaining to drive and otherwise inaccessible through traditional car-rental arrangements. It also offers an alternative means to access vehicles for long distance travel and enables hosts to reduce their vehicle-ownership costs and monetize idle assets.

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APPENDIX A - FOCUS GROUP SUMMARIES

TSRC researchers conducted two focus groups with P2P carsharing vehicle hosts and vehicle guests (five per group) to gain perspective on usage and its impacts upon their travel patterns. One focus group was comprised of vehicle hosts, and the other was with vehicle guests. Focus group participants were selected from two P2P carsharing organizations in the Bay Area. P2P operators participating in the study had the opportunity to contribute to the design of the focus group protocol. Prospective participants were screened based on the length of their membership, frequency of P2P use, and the distance they resided from P2P vehicles. A \$75 incentive was provided as compensation for the time participants spent in the focus group. The focus groups were helpful in clarifying personal experiences and perspectives on P2P carsharing. Researchers also probed perceptions of the cost savings and environmental impacts of their travel choices. The qualitative data obtained from the focus groups helped inform the design of the online P2P carsharing member survey.

6.1 Sociodemographics

Participants of both focus groups received a survey at the beginning of each meeting for the purpose of collecting background demographic information and data on their use of P2P carsharing organizations. Both groups met in a public library in San Francisco and were comprised of five people, basic summary statistics of the host focus groups are shown in Table 1 below.

Table 1 Summary Statistics of Host Focus Group

Owners Focus Group			
Education	Participant Count	Income	Participant Count
Some College	1	Below \$15K	2
Bachelor's Degree	1	\$25K to \$35K	1
Graduate School	3	\$150 to \$200K	1
		More than \$200K	1
Marital Status	Participant Count	Gender	Participant Count
Married	2	Male	3
Single	3	Female	2

In addition, their ages ranged from 21 to 33. All but one of the participants in the vehicle host focus group resided in a two-person household in which both members of the household had a driver's license. The other participant lived in a five-person household in which three of the household members had a driver's license. Three of the focus group participants were strictly car hosts (hosts) in P2P carsharing. One indicated that she was both a car host and guest; while the fifth participant chose not to indicate their status. The vehicle-guest focus group was comprised of a slightly different demographic profile. Table 2 below presents similar summary statistics for the vehicle guest focus group. All five members of the vehicle-guest group were P2P carsharing users who used vehicles from other members. Their ages ranged from 29 to 46.

Table 2 Summary Statistics of Guest Focus Group

Renter Focus Group			
Education	Participant Count	Income	Participant Count
Some College	2	\$15K to \$25K	1
Bachelor's Degree	1	\$25K to \$35K	2
Graduate School	2	\$50K to \$75K	1
Marital Status	Participant Count	Gender	Participant Count
Married	0	Male	4
Single	5	Female	1

6.2 Pre-Focus Group Questionnaire Results

Researchers distributed a pre-focus group questionnaire to the participants of both focus groups prior to the discussion. The questionnaire was designed to gauge participant involvement with P2P carsharing and determine their travel patterns before and after joining.

All members of the vehicle-host group owned vehicles and granted access to them through P2P carsharing. Four participants shared their vehicles in urban areas, while one shared their vehicle in a suburban setting. Three of five of the vehicle hosts had been involved in P2P carsharing for about a year, while the other two had been involved for more than a year. Two of the participants primarily granted access to their vehicles over the weekends, one did so only on weekdays, another all week, and one had yet to share their vehicle. Each participant shared only one vehicle through a P2P carsharing service. In the event that they owned more than one vehicle, the oldest model was always the one that was shared. In this focus group, all vehicles belonging to the host focus group participants were older than 2006 (2003, 2002, 2001, 1997). The host of the oldest car (1997) indicated he was considering purchasing a new vehicle as it may “be more profitable,” but none of the participants were planning to sell a vehicle in the near future as a result of their participation in P2P carsharing.

The pre-focus group questionnaire also polled vehicle hosts on their vehicle use in addition to their involvement with P2P carsharing. All participants of the host group indicated that they use their vehicle for errands when it is not being shared, four out of five indicated they use it to shop within city limits, and two indicated they use it for longer trips (e.g., vacation). Only two of the five hosts use their vehicles to commute to work. Four out of five participants were able to grant access their vehicles as often as they made them available. Three shared their vehicle less than 20 hours a week (2/5), while another shared a vehicle out between 21 and 50 hours a week. The last participant had not yet to made her vehicle available for use through a P2P carsharing service. Three of the five participants had not changed their amount driven since they started sharing their car, and another was unsure if granting access to their car through a P2P service had had an impact upon their travel patterns. Finally, the last participant noted he was driving less as a result of sharing his car (less than 20 hours a week) and was instead walking and using public transit to a greater extent.

Four out of five participants indicated they usually use public transit at least once a week. Among those four, two use public transit for shopping within city limits, one uses public transit for running errands, one uses public transit for leisure activities (1/4), and two use it for their daily commute. The last participant reported never taking public transit.

Similarly, the pre-focus group questionnaire polled vehicle guests on their vehicle use both within and outside of their P2P carsharing involvement. Out of the five participants, two indicated they use a car once a week, one indicated twice a month, another once a month, and the last participant noted they use a vehicle less than once a month. The relatively low frequency in system usage is explained by the vehicle guests' high use of public transportation, which they employ for a variety of trip purposes between three and 14 times per week. The bus, ferry, BART, and Muni enable participants to conduct daily commutes (3/5), run shopping trips within (5/5) and outside of the city (2/5), complete additional errands and social activities (4/5). Four out of five participants claimed to use vehicles through P2P carsharing for short shopping trips. In addition, one participant mentioned using P2P carsharing to transport equipment, while another two stated they tended to use P2P carsharing vehicles for longer shopping trips (i.e., outside of the city limits), one of whom included running errands and meeting people as

additional trip purposes. Two people indicated that long trips and vacation travel were additional reasons for which they use cars through personal vehicle sharing services. Two of the participants stated they drive as much as they did prior to joining a P2P carsharing organization, and the other three increased their car usage frequency as a result of their P2P carsharing membership.

Only one of the vehicle guest focus group participants owned a vehicle (a 1958 Ford), and had no intention of selling it. Another participant had recently sold their personal vehicle, as it had become an economic burden and had concerns related to parking enforcement and theft. Only one vehicle guest expressed interest in purchasing a (subcompact) car, a decision that stemmed from using a similar car through a P2P carsharing service.

The members of the car guest focus group ranked: 1) price, 2) proximity, 3) the type of vehicle in relation to their trip purpose, and 4) the “greenness” of the car in order of descending importance. This particular group considered familiarity with the lender, entertainment features, and the ability to use a “premium” vehicle to be of less concern. The main reasons stated for joining the P2P carsharing program ranged from convenience and cost efficiency to increased transportation options. Only one mentioned environmental concerns specifically. At the same time, most participants (4/5) considered air quality effects as a key criterion for a vehicle purchase.

All participants in the vehicle host focus group indicated monetary reasons for sharing their vehicle, and three suggested that there were environmental benefits of this action. Of those three, two added that they did not use their car often and liked the idea of sharing resources. Although no participants noted environmental benefits as their main reason for sharing a vehicle, they all agreed that changes in travel behavior should account for a larger reduction in energy consumption than technological improvements in transportation.

Four of the five guests were also members of a roundtrip carsharing service, although one of the four belonged to two roundtrip carsharing organizations. In contrast, only two of the five individuals in the vehicle host focus group belonged to roundtrip carsharing organizations in

addition to P2P carsharing. Regarding questions about involvement in other shared mobility organizations, one vehicle guest indicated he/she always participates in the sharing economy (e.g., Lyft, Uber, AirBnB), two indicated that they sometimes do, and one said these were services they rarely used. All participants in the host group used other shared services, with AirBnB and Uber ranking as the most popular (4/5), followed by Lyft, Sidecar (now defunct) and TaskRabbit (2/5). Two of the guests had never heard of the terms “shared-use economy” or “collaborative consumption,” whereas as one vehicle host had not heard the term “shared-use economy.” All had heard of the term “collaborative consumption.”

6.3 P2P User Experience

Both P2P carsharing hosts and guests were asked to comment on their experience as individuals engaged with personal vehicle sharing services. The ways in which the participants of the two focus groups responded to these questions are detailed below.

The Start of the Program

All vehicle-host participants joined P2P carsharing for the extra income. However, two also had other, more important reasons. One was referred by a friend, while another felt that such programs were valuable to people who do not own cars.

Key Concerns Before Joining

Participants of the host focus group were asked to list their top three concerns about lending their vehicles. They ranked trust, operation of their vehicles, and vehicle cleanliness as primary concerns, as well as convenience/logistics in sharing their vehicles, insurance, and driving behavior of guests as secondary concerns. Participant suggestions for mitigating concerns include: 1) promoting the convenience of P2P carsharing, 2) providing greater background information on users and their trip purposes, and 3) providing more information on tax payments. Two participants noted that their concerns were resolved after they joined their respective programs and talked to existing users.

Guest focus group participants had concerns about P2P carsharing prior to joining their respective organizations. A participant who did not own a car was initially unsure if the vehicle host's automobile insurance would cover her during her usage period. One participant was concerned about penalties for late returns, and another was worried about gaining car access from strangers. An additional participant complained about excessively complicated access processes adopted by hosts who had not installed the automatic-access car kits.

Vehicle Priority Among Hosts

Four out of five participants shared their primary household vehicle for P2P carsharing, while one participant shared his secondary vehicle.

Managing P2P Carsharing Usage Periods

The amount of time hosts spent on managing P2P carsharing ranged from 10 minutes to two hours per week, depending on how actively involved they were in sharing their vehicle. One participant spent very little time doing so because she rarely shared her car, while another spent more than two hours doing so as a result of his high-demand vehicle and his special instructions for guests. The hosts who shared their vehicles less than once a week all spent less than half an hour managing the process.

Promoting P2P Carsharing to Others

Members of both focus groups learned about P2P carsharing in different ways. Participants in the guest focus group listed side-panel advertisements on news and social media websites, word of mouth, public transit advocacy websites, bus stop posters, and billboards as examples. In the host focus group, four participants learned of P2P carsharing from news articles or Internet advertisements, while one was referred to it by a friend. All participants in the guest group felt that P2P carsharing was not commonly known in general or in the Bay Area. Two members of the host focus group felt that P2P carsharing was well known but qualified their answer by stating that this perception may be a geographic phenomenon.

Participants in the guest focus group had many suggestions for promoting P2P carsharing including: 1) providing rewards for existing members who introduce others to P2P carsharing, 2)

advertising at BART stations where people are thinking about commute-related issues, and 3) partnering with environmentally friendly organizations, such as bicycle coalitions or walking clubs. Two recommended likening P2P carsharing to Zipcar, which defined the concept of “shared mobility” to them. Others suggested emphasizing the concrete benefits of membership, such as safety and insurance, in addition to sharing economy ideological factors. Three participants recommended a small driving credit for new members to encourage individuals to test this innovative concept and possibly garner higher revenues in the future. Indeed, one participant joined a P2P carsharing organization after purchasing a Groupon deal, and one tried it because the free driving credit provided after sign-up. Participants in the host focus group had several ideas for promoting P2P carsharing. They predominantly (4/5) gravitated toward providing monetary incentives to initial members to increase the desirability of participating in P2P carsharing. Other suggestions from the host focus group included finding “early adopters” to use P2P carsharing on a trial basis, referral bonuses and/or special events, endorsing other non-income incentives of sharing a car, and advertising on college campuses. Three participants suggested publicizing the insurance policy provided to all P2P carsharing hosts to increase uptake.

Income Versus Hidden Cost

Although all participants of the host focus group were interested in extra income derived from sharing through a P2P carsharing program, their responses varied. Two participants felt they were getting their money’s worth for the time spent on vehicle maintenance. One stated that they initially put a lot of effort into maintenance, but she later reduced this effort and raised her prices on weekends. One claimed that despite the higher startup cost (e.g., installation of a car kit), costs fell with time.

Pricing: A Host’s Perspective

All participants of the host focus group had suggestions for pricing mechanisms. Four stated they would like P2P carsharing companies to provide a “suggested price” in pricing the car but ultimately leave the final pricing decision to the host (currently companies will provide market rates for vehicles but allow hosts to manually set them as well). However, one participant preferred that P2P carsharing companies set the prices for all vehicles, citing convenience and

better information as the factors behind their opinion. Two participants would like to be able to schedule price changes based on different seasons and special weekends/holidays. Finally, one participant commented that he felt negatively about guests bidding on vehicles and preferred a fixed price.

Supply and Demand

Of the five participants in the host focus group, two believed demand for P2P carsharing was higher than supply and felt that P2P carsharing companies were eager to attract more hosts. Another participant felt the “current imbalance” in supply and demand was largely a seasonal phenomenon because there were other rental services that satisfied the demand for cars in urban areas. A fourth participant felt that demand was less than supply as most suburban residents already owned a car. Four out of five vehicle hosts liked the amount of time their vehicles were shared and felt they got more requests than needed, which consequently enabled them to choose the most favorable guests.

All participants in the vehicle guest focus group felt there was an adequate supply of vehicles available through P2P carsharing websites, as long as one remained reasonably flexible on walking distance or price. However, most stated they had experienced difficulties in acquiring a vehicle at one point or another. Three out of five participants had attempted to contact an host to seek access to a car but never received a response. These members suggested that a time limit should exist by which an host must provide a response (even if it is a refusal).

Participants praised instant-reservation systems (also known then as car kits, currently named “Connect”) for their role in improving ease of access to P2P vehicles. One described such technologies as “[bringing] the convenience of [roundtrip carsharing] to P2P.” One participant only borrowed cars with instant reservation systems, and another predicted that people would become more willing to lend out their cars, if such features made sharing more convenient.

Car Kit

The majority of participants in the host focus group (4/5) did not have a car kit that allowed for keyless vehicle access. The one participant who did have keyless access set up within the vehicle

valued its convenience, as he did not personally have to interact with guests. Two participants in the host focus group were interested in car kits. One could not get one due to the design of the car, while the other believed it could be helpful but was still undecided on acquiring one.

Advantages

All participants in the host focus group agreed that one of the biggest advantages of sharing their vehicles was the income derived from doing so. Two liked contributing to the sharing economy, as did two respondents from the guest focus group. Other advantages discussed in the host focus group included helping someone in need of car access, sharing a luxury vehicle with someone else, and contributing to a better environment.

Three participants from the guest focus group considered the flexible nature of P2P carsharing mileage/pricing policies to be an advantage, as it enabled them to take longer-distance trips than roundtrip carsharing. Two participants viewed P2P carsharing as cost efficient and convenient and placed particular emphasis on its convenience, as participating in P2P carsharing removed their need to worry about vehicle theft, parking, street cleaning, or other concerns associated with personal vehicle ownership. Two participants believed that P2P carsharing offered users a wider variety of vehicles than roundtrip carsharing. Another believed it helped to reduce vehicle ownership.

One guest noted that P2P carsharing required less parking, beyond current personal vehicles, and land lost to parking results in higher opportunity costs to society. Two participants noted that P2P carsharing had a wider variety of vehicles, so it suited different trip types. One found P2P carsharing to be cheaper than roundtrip carsharing during the day, while the remaining two felt P2P carsharing offered a more personal experience.

Disadvantages

Participants in both focus groups also discussed a number of disadvantages to P2P carsharing. Two participants in the host group said that they had to increase their use of public transportation or walking while their cars were being used, and they considered this to be a negative side effect. Two other hosts were also concerned about users accidentally damaging their older vehicles, as

they associated their personal vehicles with utility and sentimental value. The fifth participant noted vehicle damage concerns, although these related more to additional wear and tear of the vehicle than accidental damage.

Most of the participant challenges reported by the guest group related to hosts having different access procedures. Almost all had contacted hosts who never replied to inquiries, which complicated the process of trip planning, and two guests experienced hosts who canceled advanced reservations. Two found borrowing cars without an instant-access kit to be a frustrating experience, as doing so required them to meet vehicle hosts in person. One participant, who deemed himself “less particular about vehicle types” did not have such experiences.

Usage Period Length and Car Model

One participant wondered about the length of the usage period, as well as how the make and model of the vehicle affected its popularity with users; he personally preferred shorter usage periods. Another participant said users chose her car for its brand, while another participant stated that it did not make any difference as many of the listed cars were of the same brand. One participant who owned a fuel-efficient car found it to be a popular feature among guests as well, as the vehicle was more environmentally friendly with lower gas costs.

Vehicle Choice

With regard to the motives that influence vehicle choice, two guests go out of their way to borrow the same car from the same host, while the remaining participants emphasize cost, distance, or availability. Guests added that the vehicle type they borrow depends on their trip destination (e.g., furniture stores versus weekend getaways).

Participants were also asked about car features that were most important to them, such as “green” (hybrid/EV), infotainment, and automated driving. Three were concerned about gas mileage, while the remaining two cared more about price and vehicle type. In addition, two participants commented on the availability of amenities, such as Bluetooth connectivity, a sunroof, or other attributes that contribute to driving experience.

6.4 Insurance/ Liability Issues

Insurance Concerns

No members of the host group had any concerns regarding insurance before or after joining a P2P carsharing organization. Two had spoken with a representative of their P2P carsharing organization and felt their concerns were adequately addressed. One said the program came highly recommended from a friend, and one noted that P2P companies were eager to settle minor damages. All five participants acknowledged that their insurance companies did not know that their car was being shared through a P2P carsharing program, and none of their vehicles had been involved in an accident while being operated by a P2P guest. One believed the P2P carsharing company would pay for repairs at a body shop in the event of an accident. Another participant said her personal vehicle insurance would not cover the damages from P2P carsharing because the vehicle was used to generate income. All participants considered it fair for the P2P companies to be responsible for damages incurred during usage periods. One participant found some minor scratches after a guest had used it, but he was more concerned about users returning vehicles with the correct amount of gas.

While all members of the vehicle guest group were aware that insurance was provided by their P2P carsharing organization, four out of five did not know any details about deductibles or the extent of their coverage. Of these participants, one guest was concerned about liability in the event that a previous user damaged the car without reporting the incident. Another participant had read the details before joining and felt the coverage was sufficient.

6.5 User Interactions

Interaction with New Users and Repeat Users

Three participants of the host focus group had shared their vehicle to many first-time P2P users. Another thought many of the guests were existing roundtrip carsharing users trying out new services. All members of the host focus group had repeat users.

License Checks

None of the participants in the host focus group checked guest driver's licenses at the point of an exchange. One had attempted to do so but felt it was more of a hassle than it was worth, as he encountered a guest using his wife's account to use the car and had to call the P2P carsharing operator to clarify the situation. These experiences aligned with those of the individuals in the vehicle guest focus group, who commented that while P2P carsharing organizations' terms and conditions state hosts will check users' IDs prior to usage periods, no host had ever requested to see their driver's licenses or verified their identity before handing them the keys. They theorized this was because their P2P carsharing accounts were linked to their Facebook profiles, which enabled hosts to view their profile pictures beforehand. The hosts noted that they trusted their P2P carsharing organizations to perform guest screening.

Considerations in Selecting Guests

Most (4/5) participants in the host group possessed the same considerations in selecting guests. These factors included: guests' ratings (if any), trip destination and length, and convenience. For one participant, the pick-up time overrides all other factors, especially since his guests can drop off the key in the car.

Reviews of Guests and Their Relevance to Vehicle Hosts

All participants in the vehicle host focus group were able to view the reviews of previous hosts for guests and considered them to be an important but not crucial aspect of selecting guests. Two hosts stated that while reviews were important, the purpose and destination of the trip were more important. One participant noted that many guests were first time users without any reviews. All were willing to share their cars with new users who did not possess any previous reviews.

With respect to negative reviews, all hosts agreed that the contents of the reviews were notable. One host avoided users with three or four bad reviews, which they believed demonstrated consistently poor behavior. Another judged guests based on the content of the review: trash problems were acceptable, but accidents were not.

Purpose of Reviews for Both Hosts and Guests

Participants of both focus groups discussed the importance and purpose of reviews in addition to the ways in which reviews inform their P2P carsharing use. All participants in the host focus group said vehicle guests were able to review them. Three felt their vehicles became more popular after they gained more reviews, while one remained neutral on the subject. One commented that while reviews were helpful, the effect leveled off after three or four positive reviews. In turn, all participants in the vehicle guest focus group were reviewed by vehicle hosts, but most did not view this feature positively. Two respondents reported miscommunication with hosts that resulted in poor reviews. In one of these cases, the host was unable to amend or delete the negative review, and the respondent stopped using that particular P2P carsharing service. Three hosts did not use social media to review or provide feedback. None of the hosts were able to respond to the reviews that they received at the time but stated that they would have liked to have the option. Although one felt it would be an unnecessary (albeit positive) feature, another stated they would like to be able to respond to negative reviews and explain the situations detailed within them.

Participants of the host group were asked about methods to determine user reliability in deciding with whom to share their car. One suggested a ‘shared economic score’ to indicate how well people perform in shared mobility services. Another participant acknowledged the previous idea but felt there were caveats: a person who did well with one service would not necessarily do well with another. A third participant said they focused on trip purpose and existing reviews, while a fourth stated they would like to have a more in-depth profile of the guests including information such as place of work.

A few guests commented on the difficulty of communicating directly with hosts after a usage period without involving the P2P carsharing company. Many would have liked a mechanism to respond to negative reviews. Most participants favored a mandatory two-day period for dialogue prior to the public display of a negative review. They believed this would avoid back-and-forth arguments and also strengthen the “collaborative consumption” focus of the P2P framework, as the dialogue would occur between two individuals rather than with a company representative.

All participants in the guest focus group were able to view reviews of vehicle hosts submitted by previous guests. One said this was a very important feature; one used it as a tiebreaker when deciding between two otherwise similar cars; and two stated they did not consider it to be important. Four out of five vehicle guests were willing to borrow from a new lender without any previous reviews, while the participant who considered the review function to be “very important” stated they would not borrow from such users, if at all possible. Most participants were willing to consider borrowing from lenders with poor reviews, although their willingness was contingent on price, the number of bad reviews, wanting to give lenders a chance, and the specific reason behind the poor reviews. For example, one respondent was not concerned about vehicle messiness, which was sometimes used to justify poor reviews. Some guests also questioned the credibility of reviews on the basis that some reviewers are “just angry” and purposely give low reviews. One respondent gave reviews out of courtesy, if he received a good review he would write a positive one back.

Attachment to Vehicle After P2P Carsharing

Four out of the five participants in the host focus group felt that they had a higher sensitivity to their vehicle after joining P2P carsharing as a result of checking it before and after each usage period. Similarly, one became more familiar with her vehicle as a result of cleaning it more frequently, and another vouched for the necessity of knowing all details in the event of damages. A third participant was concerned about the additional mileage incurred as a result of participating in P2P carsharing, as he took good care of his car prior to sharing it. The final participant commented that while P2P carsharing did not make him feel more or less attached to his vehicle, it did force him to perform repairs more promptly to retain its usable condition.

6.6 Comparison to Roundtrip Carsharing

All participants of both focus groups (10/10) were familiar with roundtrip carsharing companies, such as Zipcar. All members of the guest focus group possessed experience with traditional carsharing companies, and four were current members. Participants in the host group stated that conventional carsharing was present in the locations where they shared their vehicle.

Members of the vehicle guest group reported using roundtrip and P2P carsharing vehicles for different types of trips. Most of the respondents stated they use roundtrip carsharing for shorter, one- or two-hour trips, due to the convenience and availability, despite the fact that four out of five claimed they used P2P carsharing for short shopping trips in the pre-focus group questionnaire. Participants tended to use P2P carsharing for longer, full-day trips, citing cheaper prices as the reason.

6.7 Environmental and Social Impacts

Alteration of Travel Patterns Among Hosts

Four out of five participants in the vehicle host focus group altered their travel patterns after joining a P2P carsharing program. One participant lost some flexibility in her travel patterns as a result of sharing her primary vehicle and took buses or borrowed cars from friends to compensate. Another participant had once sought access a car from another organization when she needed to make a trip, while her personal vehicle was occupied by a P2P carsharing user. A third participant commented that the lack of a vehicle prevented him from running errands on the days he chose to share his. All vehicle hosts said there were trips they would like to take but were unable to due to guests' usage of their personal vehicle.

Trip Choice Among Guests

Four out of the five participants in the guest focus group had intentionally avoided some types of trips in their P2P vehicle. Of the four, one was concerned with mileage limitations, two were intentionally more cautious because they were operating a personal vehicle (rather than a corporate-owned vehicle), and one was concerned about losing out on granting access, if the hosts learned of his desire to travel to forest trails.

Buying Additional Car for Carsharing Purposes

No participants in the host group purchased another car as a back-up for sharing purposes. However, one had read an article that discussed the rising popularity of P2P carsharing as an alternative form of income and the tendency of some members to purchase new cars exclusively

for P2P sharing purposes. Another participant of the focus group had considered this option, but he did not pursue it due the perceived high risks involved.

Personal Freedom of Guests

Participants in the vehicle guest focus group were asked, if they felt their “personal freedom” levels had changed as a result of carsharing. They were instructed to use their own interpretations for this term. All but one felt their levels of personal freedom had increased, as they felt P2P carsharing offered a greater variety in vehicle choice and in two cases improved their time management skills. One participant experienced no change in their “personal freedom.”

Environmental Benefits and Harms

Participants of the host focus group were conflicted about the environmental benefits of P2P carsharing. Three felt that it was less “green,” as a result of their vehicle being driven more frequently. One host had increased their walking after joining P2P carsharing, but another considered this an “exchange” of carbon footprints. According to this participant, while hosts (such as himself) may be walking or taking public transit more often, guests may in turn be replacing public transit or walking trips with car trips. Thus, he was unsure of the overall extent to which car footprints were reduced, if at all.

Three participants thought the availability of P2P carsharing encouraged people to hold on to their old cars and share it rather than replace it with a new car. For two of these participants, using existing cars was more environmentally friendly due to the environmental cost of manufacturing a new vehicle. Since roundtrip carsharing companies exclusively use newly purchased vehicles, they considered P2P carsharing to be better for the environment. However, one participant wanted to see more economic analysis to determine, if P2P carsharing really reduces car ownership.

Social Benefits and Harms

Participants of the host focus group possessed a wide range of views on the social benefits and harms of P2P carsharing. One felt that the social benefits included an increase in social interaction, as his guests were often traveling with multiple individuals. Similarly, another host

was able to meet more people and establish connections with some frequent guests. Several participants agreed that P2P carsharing had increased their trust in society, as it enabled them to share a personal good with a complete stranger. With respect to social harms, one participant voiced concern about the potential tensions that could arise from poor reviews.

6.8 Collaborative Consumption

All participants of both focus groups (10/10) engaged in other collaborative consumption services. Within the host group, two used only one other service, one used two other services, and the remaining two used three other services each. These services included AirBnB (4 participants), TaskRabbit (2 participants), Lyft (1 participant), Sidecar (now defunct ridesourcing/TNC, 1 participant), and Couchsurfing (1 participant). Of the guest group, two had used carpooling services, such as Zimride and Craigslist Rideshare; one used both ridesharing services and AirBnB; one hosted Couchsurfing visitors; and one participated in informal neighborhood-based sharing. Among the guests, four believed they used collaborative consumption services more often than their peers, while one considered his peers to engage in about the same level involvement as him. All members of the host focus group felt that they used collaborative consumption services more frequently than their peers, and two stated that most of their friends were unaware of the sharing economy, and the topic did not come up in their regular conversations. Three engaged in collaborative consumption because they felt sharing “was a part of their personality” and because of the “local culture of sharing,” while one valued cost savings.

6.9 Program Improvements

Participants of both focus groups had a number of suggestions for improving the P2P carsharing user experience. Participants in both groups discussed implementing a more convenient mechanism for car exchanges (1 host, 3 guests). Two members of the host group and one member of the guest group discussed pricing mechanisms: the individuals in the host group were interested in changing the pricing mechanism used to determine the rates at which cars are shared, while the individual in the guest group was interested in the potential for one-way carsharing and flexible pricing depending on the time of day. Two members of the guest group

stated they would like improved customer service. Another stated he would like to have more in-person customer service with the P2P carsharing provider. Three participants of the guest group wanted to improve the ease of vehicle reservations and access. They felt hosts should be required to respond to user inquiries within a fixed period of time to reduce the uncertainty associated with waiting and would like more instant-access vehicles with car kits or lock boxes to remove some of the uncertainty and inconvenience associated with P2P carsharing. One participant was interested in the potential of one-way sharing or having flexible prices depending on the time of the day. Another suggested offering parking incentives for P2P vehicles, although this could raise equity concerns.