Compensated and Real-time Rideshare

Overall Effect on California Petroleum Use		**Affects Petroleum Demand Through Intermediate Indicators:**	
Magnitude	High	**Primary**	Vehicle miles traveled
Certainty	Medium	**Secondary**	Mode choice
Applicable Level of Government	Local, State, Federal		
Relevant Laws or Cases Affecting Factor	California Public Utilities Code § 5353 and §5360, 23 USC § 101(a)(3),		
Time horizon for implementation and maturity	Rideshare will lead to immediate reductions in petroleum use, however the potential of new services to quickly induce rideshare adoption lacks empirical study		
Relevant Topics	Rideshare, taxi, e-rideshare		
Summary	Sharing the ride is the holy grail of options to reduce congestion and petroleum use. Each matched ride can take one vehicle off the road. However, sharing the ride is inherently more difficult than driving alone. Matching shared rides faces structural, communications, and incentive barriers that existing publicly-sponsored rideshare programs have addressed, but have yet to fully overcome. New private services directly address these barriers, but their potential to fully overcome them is still undetermined.		

Disclaimer: This policy brief examines the market adoption and petroleum reduction potential of compensated and real-time rideshare services rather than safety or liability of the category or individual firms.

Introduction

Recent innovations in transportation service delivery can increase the utilization of existing transportation assets, including empty seats in private vehicles. New market entrants are in part responding to a structural shift in the market for automobility–a transition from reliance on privately-owned transportation assets to increased reliance on transportation as a service retained by the traveler. New services are described in the table below:

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Types of new rideshare services

Type of Service	Description	Firms in CA or U.S.
Internet-enabled Rideshare	Regular or long-distance rideshare arranged in advance via internet with social media component, possibly with a fee or donation remitted to the driver	PickupPal, Zimride
Real-time Rideshare	Ad-hoc internet-enabled rideshare arranged immediately prior to pick-up using a mobile device, typically with a fee or donation remitted to the driver	Avego, Lyft, Sidecar, Tickengo, Uber

As with previous rideshare innovations, these new rideshare services can provide options to increase vehicle occupancy and reduce vehicle trips. Past innovations have largely failed to close the attractiveness gap between rideshare and single-occupancy vehicles. Unlike previous innovations, these innovations have been privately-sponsored and have emerged in a relatively short period of time. These new rideshare services can make rideshare more flexible and offer new incentives to drivers and passengers. Whether these new services can close the rideshare gap, and the extent to which century-old transportation service regulations will accommodate these new services remains undecided as of this writing. However, rideshare shows continued promise as a strategy to substantially reduce California's petroleum use.

Rideshare

Rideshare involves combining one or more individual trips in a single privately-operated vehicle. Rideshare faces several inherent obstacles versus single-occupant vehicle travel. In order to share a ride, two or more individuals need to be make trips with similar origins and destinations at similar times. Connecting individuals with similar trip making requirements has been a focus of past publicly-sponsored rideshare innovations. Because registering trip making requirements and communicating with matches is often a burdensome process, the past focus has been on regular rideshare, wherein two or more individuals share a ride weekly or more frequently. Slugging or casual carpool is a form of ad-hoc rideshare wherein trip origins and destinations are standardized, reducing information and communication barriers.

Even when rideshare is able to overcome information and communication barriers, a lack of driver incentives can thwart rideshare opportunities. Drivers in regular rideshare arrangements may share the costs of vehicle operations, parking, and tolls with passengers. In the long term, compensation from such arrangements can offset a significant portion of vehicle ownership and operations cost. Financial compensation from irregular, ad-hoc rideshare arrangements may be insignificant compared to annual vehicle ownership and operations costs. Slugging or casual carpool arrangements typically arise in response to some incentive, such as HOV lane access or a reduced toll.

A third barrier to rideshare is a perceived and real loss of flexibility versus single-occupant vehicle travel. Regular rideshare schedules may not accommodate the travel requirements of potential rideshare participants. In cases where regular rideshare schedules are successful, passengers may fear the possibility of unplanned stranding in the case of a personal or family emergency. To increase the flexibility of regular rideshare services,

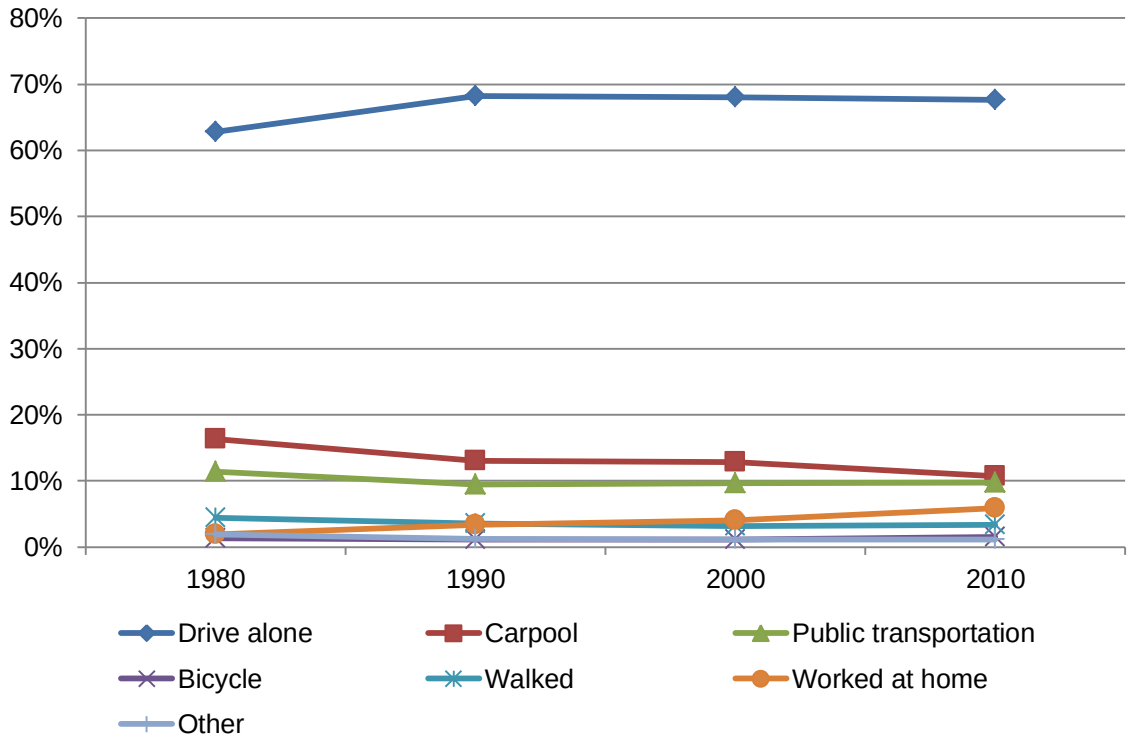
public institutions and large employers sometimes offer guaranteed ride home programs to regular ride sharers. In such a program, the stranded ride sharer is typically compensated for taxi costs incurred.

Rideshare in the Bay Area

Structural barriers make sharing the ride inherently difficult in areas with dispersed trip origins and destinations. Rideshare is typically an option only when two or more individuals are making similar trips at similar times. Looking at the number of possible daily trip combinations in the San Francisco Bay area illustrates the significant barriers to sharing the ride. The Metropolitan Transportation Commission (MTC), a regional body that forecasts travel demand among other duties, divides the 9-county Bay area into 1,454 traffic analysis zones. Zones range in size from a few blocks in urban areas with higher density of trip origins and destinations to dozens of square miles in rural areas with lower density of trip origins and destinations. With 1,454 potential areas to begin and end trips and a thirty minute window for beginning each trip segment, there are 101,477,568 possible trip segments in the Bay Area. Those who share the ride must match for at least two of these segments – one segment from the origin to the destination and another back to the origin. Matching trips is not guaranteed: of the 100+ million possible trip segments, Bay Area residents make just over 40 million trip segments per weekday.

However, these trips are not uniformly distributed across time and between zones. Far more trips occur during the morning and afternoon peak periods than in the middle of the night. Many peak period trips begin or end at work. Because these trips are spatially and temporally concentrated, they're often targeted for carpool programs. The MTC estimates over 750,000 rideshare trips to work, or about 14.7% of all work trips.

Rideshare to work in the San Francisco Bay Area CSA, 1980-2010



The share of carpool commutes has been declining in the Bay Area since 1980, when 16.3% of workers carpooled to work. In 2010, 10.7% of commuters carpooled.

Reducing structural, incentive, and communication barriers has been the goal of public rideshare investment. Park and ride lots concentrate trip origins, reducing structural barriers. The Bay Area has 150 free park and ride lots. High-occupancy vehicle lanes provide time savings and reduced tolls provide financial savings – creating additional incentives to share the ride. The Bay area has 340 miles of HOV lanes and plans to build another 280 miles. All Bay Area bridges provide a 50% discount for carpools and vanpools during peak hours. Computer-based services, where potential drivers and passengers state their intentions and seek matches, help overcome communication barriers. RideMatch service is the Bay Area's latest generation of publicly-sponsored rideshare matching services.

Real-time and compensated rideshare

Amey, et. al. (2010) define "real-time rideshare" as a service with stored user profiles, social network integration, and participant feedback that supports ad-hoc ride matching and automated financial transactions between users (Amey, 2010). These services can overcome common rideshare barriers arising from information, communication, transaction costs, incentives, and the need for both flexibility and reliability. However, real-time rideshare services can also displace conventional rideshare and transit trips. If such displacement is large, real-time rideshare's potential to reduce congestion and petroleum use may be muted.

Compensated and real-time rideshare service providers act as exchanges, or peer-to-peer marketplaces, connecting approved drivers and passengers for a ride. Like other peer-to-peer marketplaces, the service's value is in a buyer's ability to successfully find what they seek at a price they are willing to pay. Sellers will participate in a market with active buyers, continuing a virtuous cycle that brings liquidity to the marketplace. For real-time rideshare, liquidity means a greater volume of potential trips. Increasing rideshare volume increases the probability that two or more individuals will match an origin and destination at the specified time.

New rideshare services face barriers to virtuous adoption cycles. First, service providers must offer value to customers: quality, reliable service. Service providers use a combination of offline and online service quality controls. Services typically require that potential drivers be approved prior to their participation in the rideshare marketplace. Uber considers drivers of black car limousines and taxis, who are licensed but wish to work independently. Lyft, Sidecar, and Tickengo consider drivers who own private vehicles. Second, the services face competition from within their own market that may prevent or delay any one service from garnering a critical mass of participants. Because each provider benefits from a network effect to provide liquidity, or volume, fragmenting users between competing services can reduce market-wide adoption. Because a real-time rideshare trip's departure time is fixed, these services' success may require a greater baseline volume than compensated or internet-enabled regular rideshare. Finally, the emerging regulatory environment will have a profound effect on real-time and compensated rideshare growth.

Real-time Rideshare Regulations

Real-time rideshare is an emerging service category and most existing regulations do not directly address the practice. While real-time rideshare has been defined in U.S. Code, the

practice is not directly addressed by California law or regulations.

The 2012 transportation reauthorization bill (MAP-21) amended U.S. Code to include a definition for real-time rideshare: "projects where drivers, using an electronic transfer of funds, recover costs directly associated with the trip provided through the use of location technology to quantify those direct costs, subject to the condition that the cost recovered does not exceed the cost of the trip provided" (23 USC § 101(a)(3)). Defining real-time rideshare in U.S. Code does not formalize the practice in individual states, but rather makes real-time rideshare projects eligible for federal carpool funds. The Internal Revenue Service considers rideshare income in excess of actual trip costs or its standard mileage reimbursement rate as taxable income.

Rideshare faces two primary regulations in California. The first regulation is individual city and county taxi regulations, which differ by city, but primarily exist to support safe, accountable, and quality taxi service.

The second regulation is the California Passenger Charter-Party Carriers' Act. Compensated rideshare trips that operate on a commercial enterprise basis PUC § 5353(f) or are not between home and work PUC § 5353(h) are subject to the Act. The Act primarily regulates pre-arranged transportation services such as black cars and charter buses, as well as airport shuttle vans.

The Act defines "charter-party carrier of passengers" as "every person engaged in the transportation by person by motor vehicle for compensation, whether in common or contract carriage, over any public highway in" California, including "includes any person, corporation, or other entity engaged in the provision of a hired driver service when a rented motor vehicle is being operated by a hired driver" (PUC § 5360).

The Act establishes two types of charter services: passenger stage corporations and charter-party carriers. A passenger stage corporation operates services on an individually-arranged fixed-route scheduled service or certain flexible services. Intercity buses and airport shuttles fall within this definition. A charter-party carrier offers pre-arranged transportation for exclusive use of individuals or groups and charges based on mileage, time of use, or a combination of both. Chartered buses, contracted employer-based shuttles, and tour buses fall within this definition. In practice, real-time and compensated rideshare can exhibit elements of a passenger-stage corporation (shared rides can be priced per-seat) and a charter-party carrier (flexible routing).

Businesses wishing to operate as a charter-party carrier in California must obtain a Class P permit and:

- obtain $750,000 in liability insurance for vehicles 7 passengers or less; $1,500,000 for vehicles 8 to 15 passengers,
- if workers are employed, provide need evidence of workers' compensation insurance,
- enroll drivers in the Department of Motor Vehicles Employer Pull-Notice System, which allows an ongoing review of driver records,
- require drivers to participate in the Public Utilities Commission's drug and alcohol testing program,
- remit fees to the Commission equaling 0.25% of revenue, assessed quarterly.

On November 13, 2012, the California Public Utilities Commission fined Lyft, Sidecar, and Uber $20,000 each for four counts of violating the Charter-Party Carrier Act. On December 20, 2012, the Commissioned announced its intention to engage in rulemaking to evaluate

this service type, which the Commission refers to as "New Online-Enabled Transportation Services." In late January of 2013, the Commission entered into operating agreements with Lyft and Uber.

Case study: San Francisco & Lyft

Lyft, Sidecar, Tickengo, and Uber have concentrated their California operations in San Francisco, providing an opportunity to examine the regulatory environment facing these new services.

San Francisco's taxi regulation has three main themes: safety, accountability, and service quality (San Francisco Transportation Code, Articles 1100 et seq.). First and foremost is safety: vehicles must be properly maintained and expected regularly and individual drivers are subject to added safety requirements beyond those required of non-commercial drivers. Taxi operators and owners must be accountable: color-scheme permit holders must maintain insurance for the drivers and maintain a principal place of business staffed during regular business hours. Some of the regulations address service quality: vehicle cleanliness, service level guidelines, driver's appearance, etc.

San Francisco's taxi regulations have been somewhat tumultuous over the past decade. The San Francisco Metropolitan Transportation Agency replaced the city's Taxi Commission in 2009. The SFMTA has sought to reform the medallion transfer system, which was seen as inequitable (Lam, Leung, Lyman, Terrel, & Willson, 2006). Previously, the Taxi Commission issued medallions only to full-time drivers and transfer was prohibited, meaning that older drivers lacked a means of retiring their permit. Prior regulations limited the number of authorized medallions to 1,500. This cap artificially limited supply, allowing medallion holders to earn economic rents, or abnormal profits. As of October 2012, there were 1,416 individuals on the official waiting list, with those most recently receiving medallions having joined the list in the late 1990s (San Francisco Municipal Transportation Agency, 2012).

The taxi shortage has also impacted the quality of service, creating frustration and long waits for those seeking a taxi during times of peak demand. San Francisco's Taxi regulations prohibit color-scheme permit holders or drivers from charging different rates based on variations in demand. As a result of shortages, many consumers have sought alternatives. Some have used Charter-Party Carriers vehicles known as black cars, which must be arranged in advance, for their real-time transportation needs. Others simply used unlicensed vehicles (Baume, 2010).

It is into this environment that Uber, San Francisco's first smartphone-based real-time trip service, entered in 2010. Tickengo, Sidecar, and Lyft soon followed.

Lyft & Zimride

Lyft shares many similarities with other peer-to-peer marketplaces, like eBay. On Lyft, drivers are sellers and passengers are buyers. As with eBay, participants may rate each other after a transaction. A participant's reputation influences transactions, and individual reputation information is one of the differentiating assets: a lone female passenger riding alone at night may feel more comfortable riding with a male driver with a high reputation score than she would in a hailed taxi. Drivers and passengers with low reputation scores will likely find it difficult find counterparties for their transactions, or may be blocked from the service altogether.

In addition to reputation information, buyers have some assurance that service quality is commensurate with costs: while Lyft will automatically deduct and transfer a suggested

donation between the passenger and driver, the passenger can change or eliminate the donation within 24 hours after the trip (Lyft, 2012). The transaction is cashless and processed electronically.

As of this writing, Lyft suggests a fixed, per-mile donation rate. The total donation amount varies based on trip distance, but not on other factors like the time of day, day of week, and revenue potential of the backhaul trip. The company may move to a demand-based dynamic pricing scheme in the future (Green, 2012). Dynamic pricing would allow price premiums during times of peak demand and offer steep discounts for trips the Lyft driver would make anyway, such as backhauls.

Lyft is a product of Zimride, Inc., a national provider of internet-enabled social rideshare services. Zimride facilitates regular rideshare for commute trips and occasional pre-arranged rideshare for longer distance trips. Zimride can limit participation to defined communities, such as universities or employers. Zimride trips can be compensated or uncompensated, with payments handled between participants. Zimride integrates with social networks in order to match participants with friends or friends of friends, or to enable users to learn information about other participants prior to entering the vehicle.

Logan Green, CEO of both Zimride and Lyft, described the primary difference of the two services as the lead-time for the trip: Zimride rides are pre-arranged, but rides arranged at the last minute, as is the case with Lyft, command a price premium (Green, 2012). The two services can be complements: those who rely on regular pre-arranged rideshare may occasionally need an emergency ride home or elsewhere. Driving alone in a privately-owned vehicle preserves this flexibility, but real-time rideshare can provide additional flexibility for regular rideshare passengers.

Evaluating effects of new rideshare services

Because real-time and compensated rideshare services are currently in an early market phase, they have yet to display their full potential to reduce petroleum use and traffic congestion. Existing services operate as technology startups and are largely focused on developing a scalable and administratively efficient service as they build a customer base. Because the services have entered the California market through San Francisco, a high-income city with a tech-savvy population and existing peak-period shortage of taxis, initial prices are high.

Because compensated real-time rideshare and pre-arranged regular rideshare are complimentary services, their petroleum reduction potential should be evaluated jointly. Compensated real-time rideshare and regular rideshare's potential to reduce California congestion and petroleum use depends on the long tail: the mass market adoption of rideshare trips at much lower per-mile prices. At high prices, it's likely that many passengers will shift to using real-time rideshare services in-lieu of taxis. It's also likely that many drivers will seek passenger-serving trips for which they have no purpose at the destination, leading to overall increases in VMT. At lower prices, the probability that passengers will shift from driving alone increases, as does the probability of attracting former conventional ride sharers and transit users. A high price for the service, whether brought about by regulations or profit motive, could shorten the long tail and dampen potential reductions in statewide petroleum use.

The long tail of users also enhances the value of the service to all users—through a network effect that provides liquidity into the marketplace—increasing the probability that a passenger match with a driver's premeditated trip. Such drivers will likely be willing to offer

the trip at a lower price, as the compensation is ancillary to their primary trip purpose of providing for their own mobility. Consistent ride matching rides requires a large threshold of users and transaction activity. Trips arranged in near-real time reduce flexibility in departure times, necessitating even larger transaction to provide reliable matching. Compensation serves to attract additional drivers to participate in the market.

Estimating the potential of new rideshare services to reduce petroleum use in California depends on the total possible market size and new rideshare's ability to convert single-occupant vehicle trips to multi-occupant vehicle trips. This estimation involves a key assumption, that the low-hanging fruit – existing rideshare potential not enabled by new services – has stabilized. Those that would like to share a ride using pre-existing services or arrangements have already done so. New, privately-enabled technology-based rideshare services and compensation arrangements will facilitate new rideshare trips

Estimating excess seat capacity in California's privately occupancy vehicles is possible using 2009 National Household Travel Survey data (U.S. Federal Highway Administration, 2011). The table below presents an estimate of excess seat-mile capacity for personal travel in private vehicles by California households in 2009.

Estimating excess seat-mile capacity for California household private vehicle travel (2009)

Vehicle Type	Household Person Miles Traveled by Vehicle Type *(NHTS 2009)*	Assumed Average Passenger Capacity for Vehicle *(authors)*	Estimated Excess Seat-mile Capacity *(authors)*	Household Vehicle Miles Traveled by Vehicle Type *(NHTS 2009)*
Car	182,328,000,000	3	384,353,000,000	129,829,000,000
Van	32,439,000,000	5	88,661,000,000	17,269,000,000
SUV	68,033,000,000	4	171,133,000,000	42,830,000,000
Pickup Truck	46,559,000,000	2	52,757,000,000	35,163,000,000
Total ***(above modes only)***	**329,359,000,000**		**696,904,000,000**	**225,091,000,000**

Estimated excess seat-mile capacity is calculated based on trip-level data on respondent's mode and the number of people traveling with the respondent on the trip.

Filling excess seat-miles with new rideshare services

Rideshare's potential to fill excess seat-miles depends on two factors – the share of excess seat miles that new rideshare services can fill and the conversion rate of single-occupancy vehicle drivers to rideshare.

Sharing the ride is nothing new in California. About 57.3% of household passenger miles traveled and 55.9% of trips in cars, vans, SUVs, and pickup trucks occurred in a vehicle with more than one occupant (U.S. Federal Highway Administration, 2011). For 46% of these trips, at least one of the additional occupants was a household member. At assumed average vehicle occupancies, approximately 31% of available seat miles are already filled. However, by filling excess seat-miles, California can make significant strides toward reducing statewide consumption of motor vehicle fuels.

The table below estimates reductions in petroleum use at various market saturation intervals and conversion rates. The conversion rate – the ratio of reduced single-occupant vehicle trips to rideshare miles – accounts for rideshare trips that shift from other modes (e.g. taxi and transit). Because little empirical study exists on new rideshare services, the authors assume this rate conservatively. Additionally, because the new rideshare services involve driver compensation, the estimates account for a rebound effect – an increase in VMT due to some exclusively-passenger-serving rideshare trips – chauffeuring. The long-tail phenomenon is expressed through increased conversion rates at higher levels of saturation.

Estimates of fuel savings from rideshare

Additional Ride-share Market Share	Con-version Rate	Ride-share PMT (Millions)	Estimated Induced Passenger- Serving VMT (Millions)	Estimated Reduction (Increase) in VMT (Millions)	Reduction (Increase) in Fuel Use (millions of gallons)	Reduction (Increase) in Motor Vehicle Fuel Use (percent)	Fuel savings (millions of dollars at $3.14 dollars/gallon)
0.10%	20%	96	278	(139)	(7)	(0.04)%	($23.9)
0.50%	33%	3,484	1,161	0	0	0.00%	0
1%	50%	6,969	1,742	1,742	95	0.54%	$299.4
2%	67%	13,938	2,323	6,969	380	2.16%	$1,197.5
3%	75%	20,907	2,613	13,066	713	4.05%	$2,245.4
5%	83%	34,845	3,048	25,698	1,402	7.96%	$4,415.8
10%	90%	69,690	3,484	59,236	3,233	18.35%	$10,178.9

Data is authors' calculations based on 2009 National Household Travel Survey and 2010 Highway Statistics 2010 data. Effects in reducing auto-ownership are excluded from the analysis. Fuel price is 2010 annual average, which is lower than more recent annual averages.

New rideshare services may increase petroleum use in the short run. This is primarily because limited supply results in market skimming and high prices – creating an incentive for chauffeuring trips. If the market attracts a sufficient number of participants to create liquidity in ride-matching, the price will drop, increasing the conversion rate of rideshare trips from single-occupant vehicle trips.

Whether or not emerging or future rideshare services can achieve sufficient participation to create a virtuous cycle of adoption requires analysis that is beyond the scope of this policy brief. This offers an opportunity for future research that introduces a compensated and real-time rideshare mode into a travel demand model to understand how price may affect rideshare for matched routes and departure times.

However, if real-time and compensated rideshare can succeed in expanding ride share by 1% or more, these services' effect on petroleum use will be substantial.

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