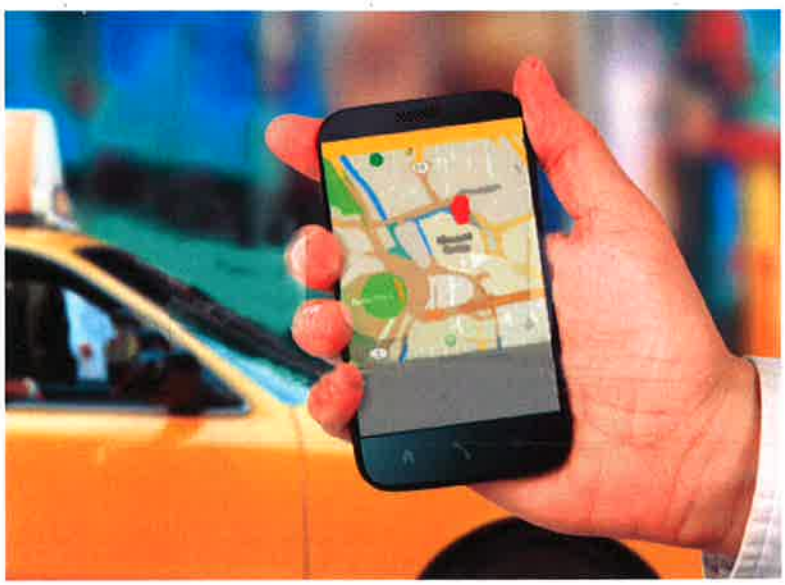
Special Report 319

# Between Public and Private Mobility

*Examining the Rise of Technology-Enabled Transportation Services*

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# Between Public and Private Mobility

## Examining the Rise of Technology-Enabled Transportation Services

Committee for Review of Innovative Urban Mobility Services

Tranportation Research Board

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SCIENCES · ENGINEERING · MEDICINE

Transportation Research Board
Washington, D.C. 20001
www.TRB.org
2015

**Transportation Research Board Special Report 319**

Subscriber Categories
Policy; economics; data and information technology; public transportation; pedestrians and bicycles; society; passengers; law

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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine. The members of the committee responsible for the report were chosen for their special competencies and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to the procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine.

This study was sponsored by the Transportation Research Board.

**Library of Congress Cataloging-in-Publication Data**
[to come]

ISBN 978-0-309-36964-0

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*Resigned from committee as of June 14, 2015.

# Preface

This report was authored by the National Research Council's (NRC) Committee for Review of Innovative Urban Mobility Services. It is the culmination of an 18-month consensus study by a committee of 12 diverse individuals appointed by the NRC to carry out the study statement of task. The committee thanks the following individuals, who attended the committee's public meetings as guest presenters, for helping to provide information necessary to address the study charge: Stephanie Box, LeighFisher; Steve Carroll, RideScout; Emily Castor, Lyft; Ashwini Chhabra, Uber; Sally Clark, Seattle City Council; Matthew Daus, International Association of Transport Regulators; Guy Fraker, get2Kno; Kevin Frederick, State Farm; Art Guzzetti, American Public Transportation Association; Sirisha Kothuri, Portland State University; Joel Laucher, California Department of Insurance; Ron Milam, Fehr & Peers; Ryan Morrison, True Mileage; Michael Pinckard, Total Transit; Walter Rosenkranz, car2go; Marco Soto, Los Angeles Yellow Cab; and Mary Lynne Tischer, Federal Highway Administration.

The project was managed by Katherine Kortum. Tim Devlin assisted with meeting arrangements and logistics for committee members. Melissa Welch-Ross and Stephen Godwin assisted in completing the report. The project was overseen by Stephen Godwin, Director of Studies and Special Programs of the Transportation Research Board. Rona Briere edited the report; Alisa Decatur provided word processing support; Jennifer J. Weeks prepared the manuscript for prepublication web posting; and Juanita Green managed the design, typesetting, and printing of the book, under the supervision of Javy Awan, Director of Publications.

A draft version of this report was reviewed by individuals chosen for their diverse perspectives and technical expertise in accordance with the procedures of the NRC's Report Review Committee (RRC). The report review was managed by Karen Febey, Senior Report Review Officer for the Transportation Research Board. The purpose of this independent review is to provide candid and critical comments that will assist the NRC in making its published report as sound as possible and to ensure that the report meets NRC institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. The committee thanks the following individuals for their review of this report: Norm Abramson, Southwest Research Institute (retired); David Chia, The Collaborative; Carson Farmer, University of Colorado-Boulder; A. Stewart Fotheringham, Arizona State University; Kevin Frederick, State Farm Insurance; Susan Handy, University of California, Davis; Ray Mundy, University of Missouri-St. Louis; Stephen Schlickman, Urban Transportation Center at the University of Illinois-Chicago; Kumares Sinha, Purdue University, Bloomington, IN; and Eric Spiegelman, Los Angeles Department of Transportation.

Although the above reviewers provided constructive comments and suggestions, they were not asked to endorse the report's conclusions and recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Susan Hanson, Clark University (emerita), and Robert F. Sproull, Oracle. Appointed by the NRC, they were responsible for making certain that an independent examination of this report was conducted in accordance with NRC institutional procedures and that all review comments received full consideration. Responsibility for the final content of this report rests entirely with the authoring committee and the NRC.

# Contents

# Summary

Information and communication technologies, combined with smartphone applications and location data from global positioning systems, are making feasible transportation services that have long been imagined but never realized on a large scale. These innovations include carsharing; bikesharing; microtransit services; and, most notably, transportation network companies (TNCs) such as Uber and Lyft.

These services are being embraced by millions of travelers who are using their smartphones to arrange for trips by car, shuttle, and public transit, as well as for short-term rental of cars and bicycles. The rapid growth in these services follows and amplifies a rebound in travel by taxis and public transit that began more than a decade ago. The new services epitomize today's sharing economy and allow an increasing number of people to enjoy the mobility benefits of an automobile without owning one, and may encourage others to leave their personal vehicle at home for the day, reduce the number of vehicles in their household, or even forgo having one at all. Notably, most of these innovations are occurring and being deployed in the private sector without public financial support, with the exception of bikesharing, which is typically publicly subsidized.

Whereas TNCs have received the lion's share of media attention to date, the other innovative mobility services are growing, evolving, and expanding mobility while also reducing personal vehicle travel, greenhouse gas emissions, and possibly automobile ownership. Although travel using innovative mobility services still represents a small share of total trips, a continued increase in customers and trips has substantial implications for the future.

To date, the most rapidly growing forms of shared mobility entail *sequential* sharing of vehicles, with each user in turn having exclusive use of a motor vehicle or bicycle. Potentially more consequential, but still in its infancy, is *concurrent* sharing of vehicles among strangers. By increasing vehicle occupancy, this form of shared services may collectively have greater effects—in terms of affordable personal mobility, vehicle use, energy consumption, traffic congestion, and environmental benefits—relative to today's most popular new sequential mobility options.

At the same time that innovative mobility services are being enthusiastically embraced by tech-savvy travelers, they do raise public policy issues. For example, those without credit accounts and smartphones cannot access many of these new services, and helmet requirements may increase safety, but can discourage bikesharing.

The most controversial new services to date are clearly TNCs, which are growing rapidly in popularity, spreading to cities around the globe, disrupting the regulated for-hire taxi industry, and posing a series of challenges to transportation and regulatory policy makers. These challenges include

- An uneven regulatory playing field affecting competition in jurisdictions that impose substantial regulations on taxis and lesser requirements on TNCs, an issue magnified by the national scale and influence of TNCs compared with mostly local taxi companies;
- Inconsistent requirements for drivers and for vehicle safety and insurance for taxis and TNCs, requirements whose efficacy, in any case, lacks systematic assessment; and

- The implications of a decline in or even the demise of taxi companies in places where low-income, disabled, and older persons rely on taxis, including wheelchair-accessible taxis, for lifeline services.

Coupled with these issues are the varying requirements for TNCs, taxis, and limousines imposed by different regulatory bodies within the same geographic area. A key challenge for policy makers at all levels of government, then, is to both encourage and facilitate innovations that meet the public's mobility needs while achieving greater public policy consistency among these new services and between them and traditional taxi and livery services.

Addressing the above challenges in such rapidly growing and evolving industries is itself challenging. Doing so will require political will; more information about the scale and nature of the services being provided; and insightful, effective public policies to guide the evolution of these innovative services so as to enhance mobility, sustainability, and public safety.

Although it is too early to draw definitive conclusions, the development of such public policies will require careful analysis of both the potential benefits and risks of evolving and expanding shared mobility services. In particular, the continued expansion of these services has potentially important implications for the location preferences of households and firms, and for their travel patterns generally and their use of public transit specifically in the years ahead. In addition, substantial growth in the concurrent sharing of vehicles could meaningfully contribute to the attainment of resource-efficient and environmentally sustainable lifestyles.

The committee that conducted this study concludes that innovative mobility services can provide broad mobility benefits while serving other societal goals, but that reaping these benefits will require informed policy making. The committee favors a carefully calibrated regulatory approach for both innovative mobility services and the traditional services with which they frequently compete—an approach that accomplishes public policy goals and creates a level playing field while still allowing the full spectrum of mobility services ample opportunity to innovate and compete.

The committee's recommendations, elaborated in Chapter 9 of this report, are intended to provide guidance to policy makers and regulators in addressing the issues associated with the new mobility services.

**Recommendation 1: Policy makers and regulators should formulate public policies and regulations designed to steer the development of innovative services to improve mobility, safety, and sustainability.**

**Recommendation 1a: To the extent that technology features can accomplish the same customer service protections that previously required regulatory intervention, regulations should be adapted to embrace that opportunity. Local and state governments should reassess current taxi, limousine, and (where separately adopted) TNC regulations for market entry, geographic coverage, span of service, and the like in light of these new services and the service quality information available to both passengers and drivers.**

**Recommendation 1b: These assessments should also examine public safety requirements covering drivers and vehicles, which should be applied in**

**similar fashion across competing industry segments, ensuring consistency and a level playing field.**

**Recommendation 1c: Similarly, in consideration of both the multijurisdictional travel patterns in metropolitan areas and the large scale of business operations, state and local governments should assess how the regulations governing the various industries relate to one another, particularly when multiple jurisdictions regulate different industry segments within the same geographic area. Policy makers and regulators should consider whether traditional for-hire and shared mobility services are best monitored and regulated at the state, regional, or local level on the basis of market and service characteristics and regulatory capabilities.**

**Recommendation 1d: Policy makers and regulators at the state and federal levels should conduct systematic evaluations of safety requirements, examining the core issues of effectiveness and cost.**

**Recommendation 1e: Given the importance of accessibility for all users (which is frequently operationalized in terms of vehicles that can accommodate wheelchairs), policy makers and regulators should address the potential disparity between access for people with various disabilities and other travelers as these new services expand.**

**Recommendation 2: Policy makers, planners, and regulators should identify the information needed to set policies on, plan for, and regulate mobility services, and require this information from all regulated entities.**

**Recommendation 3: Policy makers and regulators should carefully examine and consider the pros and cons of alternative employment classifications for TNC and taxi drivers.**

**Recommendation 4: Policy makers and regulators should seek to integrate the features of TNCs and other innovative shared mobility services into existing transportation systems and services in ways that leverage the new services' strengths and features.**

Also identified in Chapter 9 are needs for research to inform policy making and regulation, along with a clearinghouse for sharing information; methodologies for integrating shared mobility services into planning initiatives; and the development of consistent definitions and information sharing requirements for service providers.

1

# Introduction

Advances in information and communication technologies, combined with smartphone applications and location data from global positioning systems, are enabling a new breed of mobility services with which to arrange for rides by private cars, vans, and buses as well as public transit, and for short-term rental of cars, scooters, and bikes. The availability of these technology-enabled shared mobility services has reinvigorated demand for ridesharing and vehicle-sharing services. While it is too early to predict how these ventures will evolve and which of them will endure, the availability of on-demand transportation services through a smartphone, easily paid for by debit or credit card, is causing many people to rethink how they go about their daily travel.

The term "shared mobility" as used in this report denotes *sequential* sharing of vehicles among users, as with taxicabs and companies such as Uber and Lyft, which provide exclusive rides to a series of passengers, and of bicycles or vehicles used serially by subscribers, as in bikesharing and carsharing.[1] The term also encompasses *concurrent* sharing, whereby passengers headed to a common general destination split the cost. Examples include traditional ridesharing or carpools and carpool-like trips offered through such services as UberPool and Lyft Line, and microtransit, which offers services in small buses or vans to groups of individuals who are willing to pay more than the cost of public transit but less than that of a taxi. More complete descriptions of these services are provided in Chapter 2.

Shared mobility certainly is not new. In the past, it represented a larger proportion of overall travel in the United States than is the case today: carpooling was more common among commuters, some people routinely hitchhiked around the community or country, and college campuses offered ride boards for students wishing to travel during breaks. Shared mobility declined for many years as single-occupant vehicles became the dominant form of ground transportation in the United States. More recently, however, it has experienced something of a renaissance, as described in Chapter 2.

Widespread use of shared mobility services has historically been impeded by the logistical challenges of finding another person (or people) going the same way at the same time, growing personal security concerns, and the ready availability of automobiles in U.S. metropolitan areas. These challenges raise questions for travelers: Can I get a ride to a desired destination when I want to travel? Who can give me this ride? How long will it take? How much will it cost? Will I be safe riding with a stranger? As described in Chapter 2, new technologies and business models are solving these problems in innovative ways and resulting in rapid growth in shared ridership. Technology advances have made it easier to arrange and pay for the use of the new services, created opportunities for service providers to manage their fleets efficiently and

[1] As of this writing, Uber offers ride services in a range of vehicle options that vary in price. The main options include UberX (midsize car), UberSUV (sport utility vehicle), Uber XL (larger sport utility vehicle for larger groups), UberBlack (luxury limousine or sedan), and UberTaxi (SUV with standard taxi-metered rates and fees and automatically added gratuities). Other services include UberFamily (a vehicle with carseats, for an added fee), UberAssist (with a driver who can help older/impaired users), UberWAV (wheelchair-accessible vehicles), and UberPool. The regular version of Lyft is supplemented with Lyft Line, which allows riders to share a trip and its cost, and Lyft Plus, which provides a six-passenger vehicle for groups traveling together.

provide near-immediate responses to service requests, and created new opportunities for concurrent use of these services, with potentially far-reaching implications for the transportation system.

As these services evolve and expand, they are likely to affect other transportation modes—public transit, private vehicles, and perhaps even cycling—along with urban development, the economy, and the environment, to degrees that are difficult to project with any accuracy. Nonetheless, many analysts have not hesitated to speculate, suggesting impacts that range from declining single-occupant trips and vehicle sales to reduced congestion and urban parking requirements. Other projections include long-term changes in travel behavior as these new services shift private vehicle travel from the high-fixed, low-variable costs of car ownership to the low-fixed, high-variable costs of car- and bikesharing and ride hailing.

The recent rapid expansion of technology-enabled mobility service companies—such as Uber and Lyft, as well as a host of others—that provide applications to link drivers and their personal vehicles with passengers has garnered headlines and raised critical questions for policy makers and regulators. These new transportation services must somehow be incorporated into long-standing regulatory frameworks built around the business models established for taxi, sedan, and limousine services (for-hire transportation). In the process, a number of policy issues arise:

- Whether the new services should be regulated, and if so, how, to what extent, and toward what public policy goals regulations should be structured;
- The employment status and compensation of workers in the for-hire (taxi and limousine) sectors, including transportation network company (TNC) drivers;
- Personal security for drivers and passengers, and safety for drivers, passengers, bikeshare users, and pedestrians;
- Insurance requirements for TNC drivers and carsharing and bikesharing users; and
- Access to app-enabled mobility services by those lacking credit cards and smartphones, as well as other equity concerns that have arisen.

Such issues are being faced in some form in urban areas around the United States where multiple local and state jurisdictions, with sometimes overlapping authorities, are attempting to oversee these services. The policy approaches developed are often diverse and sometimes conflicting. The federal government has been minimally involved because responsibilities for the oversight of these new services reside, for the most part, with other levels of government.

## STUDY SCOPE AND APPROACH

In response to the policy issues emerging from the rapid innovation and growth in technology-enabled mobility services, the Transportation Research Board (TRB) Executive Committee sought to learn more about these services and how they are used; how they relate to established transportation modes; and what implications they have for future policy development, regulation, transportation planning, and infrastructure investment. A committee of leading experts was appointed by the National Academies of Sciences, Engineering, and Medicine to conduct a consensus study and produce a report on these issues with the following charge:

> Examine the growth and diversification of technology-enabled mobility services and explore the implications these services have for consumers and existing transportation services. The study will identify policy, regulatory, and other issues and opportunities that policy makers will need to consider as they plan for and regulate these services, including the existing regulatory structure for taxi, limousine, and transit services. Priority areas of research to inform public policy decisions will also be identified.

This report includes discussion of a variety of mobility services, among them carsharing, bikesharing, taxis, and new app-based ride service companies (TNCs). However, the committee focused its efforts on the services that are generating the most controversy and posing the greatest public policy challenges for policy makers. Therefore, this report places greater emphasis on issues related to taxis and TNCs than on those related to other mobility service industries because of the current high levels of controversy and regulatory conflict associated with the former.

The committee held four meetings during the course of this study to gather information and develop this report. Industry representatives and experts on urban mobility services and their ramifications were invited to the first two meetings to share information and discuss the issues from multiple perspectives in a public forum. The committee cast a broad net to gather information for the study, given that the rapid rise of technology-enabled mobility services has occurred only in the last few years. Data and research on these services, while increasing, are far less developed than is the case for other modes of transportation, in part because the rapidly growing and controversial TNCs have been sharing relatively little information with the public. Given the fast pace of new developments in this area, the committee also drew upon news articles and blogs from reputable sources for context and information, but used its judgment in interpreting what that information means for understanding the issues that face policy makers, the mobility service industries and workforce, and consumers.

## REPORT STRUCTURE

This report consists of nine chapters. Chapter 2 describes the effects of technology on transportation in general, the innovative services relevant to this report, what is known about the use of these services, and their potential impacts. Chapter 3 explains the existing regulatory structure of the taxi, sedan, and limousine industries and the challenges to that existing structure presented by the rise of TNCs. Chapter 4 presents an economic framework for addressing those challenges. Chapters 5 through 8 then review specific issues facing shared mobility services: Chapter 5 examines labor and employment issues; Chapter 6 addresses personal security for drivers and passengers and safety for the public; Chapter 7 reviews insurance issues; and Chapter 8 looks at issues of access and equity. Chapter 9 presents the overall conclusions resulting from this study and the committee's recommendations for policy makers and regulators who must consider whether and how to regulate these new services to serve public policy goals, and outlines research needs.

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# Trends and Context

For a variety of socioeconomic, demographic, technological, and environmental reasons, an increasing number of urban travelers are turning to shared mobility services to reach their desired destinations. Shared mobility services—including carsharing, bikesharing, transportation network companies (TNCs), and microtransit, as well as traditional shared services such as taxis and limousines—have been increasing rapidly in recent years in terms of both number of companies and number of trips provided. As technologies and systems are more widely deployed and become more reliable and convenient, these modes may continue to increase their modal share and possibly reduce single-occupancy motor vehicle trips. Although in the context of all travel by motor vehicle, these services provide relatively few trips, they often are essential means of travel for certain types of trips and circumstances, with particular importance for disadvantaged populations. Many of the emerging companies may fail or merge within a few years, but if the rapid growth of private innovation in transportation markets continues, it could have fundamental long-term effects on travel behavior, with significant associated mobility, economic, and environmental consequences.

This chapter provides context for the rest of the report, beginning with an overview of how technology is affecting all types of transportation. It then describes the new mobility services that rely on innovations in information and communication and other new technologies and what is known about the current use of shared mobility services. Finally, the chapter addresses the potential impacts of these new services on vehicle ownership and the environment.

## EFFECTS OF TECHNOLOGY ON TRANSPORTATION

Rapid changes now under way in transportation are due in part to the opportunities afforded to firms and individuals by new information and communication technologies. The rapid evolution of wireless communications, high-speed computing, enhanced sensors, and global positioning systems (GPS), among many other technologies, is helping to optimize logistics and freight delivery, facilitate planning for personal vehicle and public transportation trips, and simplify payments for tolls and transit fees. The new technologies, combined with new business and service models, are key elements of the next generation of transportation infrastructure and services. The sharing economy and on-demand business model are enabling a more nimble and cost-effective set of options for moving people and goods that require modest amounts of new infrastructure or capital spending. These changes in transportation also are opening up new industries and employment options, although not without negatively affecting some established interests, and potentially end-users, in the process.

Many technological innovations are affecting transportation and enabling shared mobility. In some cases, these innovations make using established modes easier, quicker, more reliable, and more predictable, attracting new customers and encouraging new types of trips by reducing uncertainty and increasing the convenience and efficiency of system use. Technological innovations also have enabled the coordination of services within larger networks and allowed system managers to optimize the use of employees and vehicles.

With the advent of open-source transit data, riders can easily know the details of transit service in real time, thereby avoiding the frequently voiced frustration of not knowing when the next transit vehicle will arrive (Brakewood et al. 2015; Ferris et al. 2010; Multisystems, Inc. 2002). Public transit also has benefited in recent years from new payment options that reduce the burden of fare collection while giving riders more choices. Traffic and GPS data can be combined in navigation systems and apps, making it easier for drivers to reroute around congestion and travel through places with which they are unfamiliar. The challenges of parking in urban areas are evolving as well with access to real-time data on parking availability; variable pricing to manage demand; and options to pay by cell phone, credit card, or online account. Collectively, highly accurate GPS data, online and application-based payment systems, remote locking and unlocking capabilities, and the ability to manage extremely large and dynamic data sets are enabling real-time rideshare matching, convenient shared-use and ownership opportunities, and bundling of multimodal travel options into packages analogous to health care or cable services. Both travelers and transportation providers can reduce costs through the new technologies. Real-time dynamic data make it possible for fleet owners and service brokers to optimize the number of vehicles needed to serve their customers, while the same data allow travelers to reduce their wait times and consider alternatives that were previously unknown or too uncertain. With more transportation options and better real-time information about them, travel by means other than personally owned vehicles is becoming a much more viable option in urban settings.

The Millennial generation that grew up with computers and mobile phones is at the forefront of the many changes described above. In the last 2 years, much has been made of the slower rate at which teens and young adults have been securing driver's licenses and the declining number of vehicle-miles they have been driving, although many questions remain about the causes of these declines and whether they represent a long-lasting trend (Blumenberg et al. 2013; Fulton 2014; Polzin et al. 2014; Schoettle and Sivak 2014). For now, it appears that many young adults depend on technology-enabled connections as much as, if not more than, those provided by personal vehicles.

## THE NEW MOBILITY SERVICES

There are many possible ways to categorize the existing set of innovative mobility services, even as newly developing options continually blur the lines demarcating one from another. The descriptions that follow, summarized in Table 2-1, provide brief overviews of the services that are the focus of this report; much more information about these and other services is available in Appendix A.

In general, *carsharing* is the short-term provision of vehicles to individuals who drive themselves and return the vehicles to set locations. It differs from traditional car rental in that most carsharing rentals are for minutes or hours instead of days or weeks, although there are some variations. By providing members with access to vehicles on demand, carsharing organizations can reduce the need for personal vehicle ownership. The most common variations include round-trip carsharing, whereby the vehicle is returned to a "home" parking space at the end of each trip, and one-way carsharing, whereby the vehicle can be parked anywhere within a relatively large service area. A newer variation is peer-to-peer carsharing, in which individuals make their vehicles available for rent in a shared fleet that is managed by a third party.

**TABLE 2-1 Selected Taxonomy of Innovative Mobility Services**

| Service | Role of Technology | Problems Technology May Solve | Factors in Success |
|---|---|---|---|
| Carsharing (examples: Zipcar, car2go) | Reservations and tracking of vehicles; billing | Convenience in making/changing reservations and in locating/dropping off vehicles; national branding encourages use while traveling | Critical mass of users to support availability of vehicles at a sufficient array of pickup/drop-off locations |
| Bikesharing (examples: Citi Bike, Divvy, Capital Bikeshare) | Reservations and tracking of bikes; billing | Convenience in finding bikeshare stations and information on bike availability; management of rebalancing | Critical mass of users to support a sufficient array of bike stations; rebalancing of bikes to ensure availability |
| Transportation network companies—sequential sharing (examples: Uber, Lyft) | Reservations and tracking of vehicles; billing; quality control via online customer feedback | Convenience of arranging ride just prior to travel; customer tracking of vehicles and wait times reduces uncertainty; national branding encourages use while traveling | Critical mass of users to support widespread vehicle availability |
| Transportation network companies—concurrent sharing (examples: UberPool, LyftLine) | Reservations and tracking of vehicles; billing; matching of riders for shared rides; quality control via online customer feedback | Convenience of arranging ride just prior to travel; customer tracking of vehicles and wait times reduces uncertainty; national branding encourages use while traveling | Critical mass of users to support widespread vehicle availability; comfort with riding with strangers; critical mass to match riders for shared rides |
| Microtransit (examples: Bridj, Chariot) | Reservations and tracking of vehicles; determining routes from public demand; billing | On-board wi-fi and efficient routing to match customer demand; customer tracking of vehicles and wait times reduces uncertainty | Critical mass of users to support a variety of routes; comfort with riding with strangers; price points that, while higher than those of standard transit, allow for regular commuting |
| Taxi apps (or e-hail) (Examples: Flywheel, Curb, myTaxi) | Easier reservations, both advance and just prior to travel | Apps may cover multiple taxi companies and estimate wait time, reducing uncertainty; national branding could encourage use while traveling | Critical mass of participating taxi companies; integration with traditional taxi operations; app use by traditional customer base |

Carsharing first appeared in Europe in the 1940s but did not become popular until the 1990s, also primarily in Europe. Carsharing developed later in North America, but it is now the largest carsharing region in the world as measured by membership (Shaheen et al. 2015). There were 45 carsharing operators in the Americas in January 2015—including for-profit, nonprofit, and cooperative business models—with approximately 1.5 million members and 22,134 vehicles (Shaheen and Cohen 2015). As of early 2015, Zipcar and car2go were the largest carsharing companies in the world (PR Newswire 2014). The public sector's role in carsharing is typically limited to encouraging its deployment and leasing street-level or other convenient parking to facilitate its use.

*Bikesharing*, like carsharing, entails members paying daily, weekly, or annual fees for access to a fleet of bicycles for their use. Members can pick up bikes from any station and return them to that station or any other. Bikesharing, like carsharing, originated in Europe in the 1960s. After some notable failures, it gained new life in 2007 with the implementation of Paris's Vélib program, which provided more than 19,000 bikes at 1,230 stations. Since then, bikesharing has grown rapidly in Europe, and it eventually spread to North America and the rest of the world. Today, the Chinese cities of Wuhan and Hangzhou are home to the world's largest bikesharing operations, with more than 50,000 bikes each (Guilford 2014). As of May 2015, 880 cities and communities worldwide had some sort of a technology-enabled bikesharing system, providing 1 million bikes; 80 percent of bikesharing bikes were located in China. In the United States alone, 72 cities provided approximately 24,700 bikes and 2,440 stations (Shaheen 2015).

A number of public bikesharing business models have evolved in the United States. They include (1) nonprofit, (2) privately owned and operated, (3) publicly owned and operated, (4) publicly owned/contractor operated, and (5) vendor operated. These models can overlap as a result of variations in ownership, system administration, and operations (Shaheen et al. 2014). One notable exception is New York City, in which the program is publicly owned but does not take public subsidies outside of infrastructure and staff support. New York and other cities also facilitate bikesharing by providing public space for stations and bike parking.

*Transportation network companies (TNCs)* are on-demand ride services that have seen considerable growth in recent years. While some have termed the function of these firms "ridesourcing" or "ride hailing," they are increasingly known simply as TNCs. Rides are arranged through mobile apps that connect a traveler with a driver operating his or her personal vehicle. Drivers may be either licensed vehicle-for-hire drivers or private individuals without a commercial license. Fares are based on both distance and time and paid from the traveler's credit or debit card account, which is registered with the TNC. Fares are charged automatically at the end of the trip; the driver does not engage the passenger regarding payment. As of 2015, the two largest TNCs were Uber and Lyft, with Uber being by far the largest. Data on the size of these companies are difficult to obtain, but as of June 2015, Uber alone was reported to provide more than 1 million rides daily worldwide (Geier 2015). In the United States in June 2015, Lyft operated in 60 cities with more than 100,000 drivers, and Uber operated in 311 cities with more than 162,000 drivers (Shaheen 2015). Together, these figures represent approximately 80 percent of the number of taxi and limousine drivers, but Uber and other TNC drivers work mainly part-time, sometimes only a few hours a week. Additional rides and drivers are certainly being offered through other TNCs, but Uber's data were the only relatively detailed numbers publicly available at the time this report was being written. The public sector's role in TNCs has been evolving rapidly as these companies have proliferated. As described in Chapter 3, TNCs are

being regulated, but much more lightly than traditional taxi and other for-hire transportation services.

*Microtransit* encompasses flexible private transit services that use small buses (relative to traditional transit vehicles) and develop routes based on customer input and demand. Companies in this category include Bridj, Loup, and Chariot. Data on these services, including number of vehicles, routes, or riders, are not yet available. Microtransit services are aimed at those who could otherwise use the traditional public transit system but are willing to trade off a higher fare for a more convenient trip. Microtransit companies are private and unsubsidized. The degree to which they are integrated with existing transit services appears to be fairly minimal.

Some of the services described above are effectively peer-to-peer; TNCs, for example, typically rely on drivers using their own vehicles. Others, including microtransit, many taxi operations, bikesharing, and carsharing, have a centralized fleet. Bikesharing, UberX, and Lyft provide exclusive rides, while other services, including microtransit and the shared-ride TNC services (UberPool and LyftLine) provide shared rides. (Carsharing does not fit neatly into either exclusive or shared rides, but instead can consist of an individual driver or a group of individuals traveling in a vehicle that is shared among nonowner individuals.)

## CURRENT USE OF SHARED MOBILITY SERVICES

The eventual role of shared mobility services remains to be determined as these new business models are deployed more fully and mature in the marketplace. Their role may be as an adjunct to or partial replacement for traditional taxi, limousine, and transit services, or they may be part of a more profound transformation of urban mobility options if enough travelers find their performance characteristics sufficiently attractive to meaningfully alter travel preferences. For example, anecdotal data suggest that some travelers are substituting TNC services for biking, walking, and transit and personal vehicle travel, as well as for traditional taxi or limousine services. Others have speculated that broadly available and affordable TNC services could affect vehicle ownership decisions and more substantially alter household travel behavior. While acknowledging those prospects, it is nonetheless important to add perspective by understanding current travel behavior as it relates to shared mobility services.

### Carpooling

Conventional carpooling as a mode of commuting has declined substantially over the last few decades, from nearly 20 percent in 1980 to less than 10 percent today (AASHTO 2013). There are many reasons for the decline: metro areas have more spatially dispersed job centers than in the past; work schedules are more flexible, and teleworking is increasing; and driving alone is a relatively inexpensive and convenient option, particularly when commuters need not pay for parking. (It is also important to note that commute trips make up a minority of total travel: only about 16 percent of total trips and 28 percent of vehicle-miles traveled [VMT] are for work travel [AASHTO 2013].) In general, moreover, the trends in carpool commuting illustrate the popularity of single-occupant, personal-vehicle trip making, which accounts for three-quarters of work trips, a share that has been steady since 2010. About 87 percent of daily trips occur in personal automobiles (U.S. BTS 2015a).

## Taxis

Information about the scale and share of trips using conventional taxi and limousine services provides important context. Taxis and limousines represent the only private shared-used mode that is established enough for significant publicly available data on their use to be available.

In 2012, there were 7,500 establishments with employees providing taxi and limousine service in the United States, with revenues of nearly $6.6 billion and roughly 76,000 employees (see Appendix B). Taxi and limousine businesses without employees (most taxi drivers are independent contractors) account for an additional $7.5 billion in revenue, for an overall industry revenue of $14.1 billion. The U.S. census recorded more than 300,000 taxi and limousine drivers in 2006-2010, providing about 890 million trips annually. The taxi and limousine industry has grown substantially since 2000, with revenue increasing by 42 percent, the number of operators by 54 percent, and the number of drivers by 32 percent (Appendix B). (Trend data on passenger-miles traveled by taxi is not available.)

In the context of the overall ground transportation system in the United States, however, taxis and limousines account for a small proportion of trips. Taxi and limousine services represent 0.30 percent of person trips, 0.20 percent of household VMT, and 0.16 percent of person-miles traveled in the United States. These figures are higher in larger metropolitan areas and lower in smaller metro and nonmetropolitan areas. Taxi and limousine trips account for 0.39 percent of all trips in metro areas with populations of 1 million or more, compared with less than 0.1 percent in metro areas with populations of less than 500,000 (Appendix B).

Taxi use constitutes just 0.19 percent of all person trips, but these trips total about 738,000,000 annually.[2] Using another metric, there are an estimated 164,000 usual taxi commuters in the United States, representing 0.11 percent of all commuter trips.[3] Whether considered relative to all travel or only travel to work, taxis are a modestly used travel mode in terms of all person trips nationally. Given that taxi trips are generally shorter than the trips made by other travel modes, moreover, taxis almost certainly constitute an even smaller share of person-miles of travel.[4,5] Nonetheless, taxis are an important component of the overall transportation system. They may be the only option available to fill transportation needs, particularly for those without a personal vehicle, and can provide out-of-town travelers with flexible door-to-door service.

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[2] Data on taxi use are generated from the 2009 National Household Travel Survey (NHTS), arguably the most comprehensive and reliable source of national data on taxi use.

[3] Data on commuting are gathered in the American Community Survey (ACS). This annual survey, conducted by the Census Bureau continuously throughout the calendar year, queries respondents about their usual means of commuting to work in the prior week. Taxi is one response category that respondents can choose.

[4] NHTS data.

[5] For example, the ability to take a taxi to the airport leaves a household vehicle home for other family members to use and avoids the time and cost of airport parking, providing an attractive ground access option for travelers. Similarly, a transit commuter can use taxi services during the workday to reach a business meeting or lunch appointment, thereby making it easier to commute by means other than driving, including public transit. Taxi service is particularly important in large metro areas and enables their critically important urban cores to function (Rode and Floater 2014; Rodrigue 2013). In addition, as revealed in the data, taxis are a critical lifeline for many individuals without access to personal vehicles who make trips, including medical trips, not well served by fixed-route public transit. Taxi services also frequently are relied upon by social service agencies as a mobility option for transporting their clients, often through the use of vouchers, as described in greater detail in Chapter 8.

### Public Transit

The scale and organization of public transportation generally are much better understood than is the case for the taxi industry, and therefore are described in less detail here. Notably, transit use, in passenger-miles, has increased by 25 percent since 2000 (U.S. BTS 2015b), and transit trips have increased by 16 percent (National Transit Data Publications 2009 and 2011).[6] Transit, like taxis, is critical to the functioning of major urban areas, particularly for work trips. Transit's share of commuting in metropolitan areas with greater than 5 million population is almost 13 percent, and its share of work trips in metropolitan areas with populations between 2.5 and 5 million is almost 6 percent (U.S. BTS 2015b, p. 28). Even so, its share of total national person-miles is modest—roughly 1.5 percent—and its share of total person trips is about 2 percent. For some people, transit (as with taxis) may be their only option for some or most of their travel. In particular, public transit systems provide services to people with disabilities, who often use on-demand, door-to-door service.

### Car- and Bikesharing

Some forms of shared mobility are more robustly understood than others. There are notable bodies of research on the scale and use of car- and bikesharing, while other forms, such as TNCs, microtransit, and employer shuttles, are less well understood. The section below on impacts provides results of research on car- and bikesharing in selected urban areas, including estimates of their impacts on single-occupant vehicle travel, vehicle ownership, and use of other modes.

### Transportation Network Companies

The growth of TNCs has been rapid, even meteoric, but surprisingly little is known about the scale and performance of these private firms, which are subject to limited public regulation. Among TNCs, Uber and Lyft have emerged as the largest to date, as described in Chapter 3 in greater detail. As of March 2015, the number of Uber vehicles in New York had overtaken the number of medallion cabs (Licea et al. 2015); the company had been in operation for 4 years at that point. The number of TNC vehicles overall had overtaken the number of cabs prior to March 2015, as other companies, including Lyft, also operate in the city. However, the New York Taxi and Limousine Commission reported that yellow cabs still make 10 times the number of trips made by Uber cars (Licea et al. 2015), reflecting the part-time nature of much TNC car use. By mid-2015, Uber reportedly had 2 million customers in the New York City area (Badger 2015).

As of January 2015, the taxi market in San Francisco was about $140 million per year, while Uber's gross revenues in that city in 2014 were reportedly approximately $500 million and growing at a rate of 200 percent per year (Blodget 2015). Uber's CEO reported that trips in San Francisco were increasing three-fold year by year and that trips in New York were increasing four-fold (Blodget 2015). Some of this growth may be attributable to service quality: Rayle and colleagues (2015) found that in San Francisco, 90 percent of TNC rides occurred within 10 minutes of the request at all times of day, compared with only 35 percent of taxi rides during the day and 16 percent at night and on weekends.

[6] See National Transit Summary and Trends reports for 2009 and 2011 for unlinked passenger trips trend data (http://www.ntdprogram.gov/ntdprogram/pubs.htm#dt).

The Rayle et al. (2015) study of 380 TNC users in San Francisco found that they were generally younger and more highly educated than city residents as a whole (84 percent of riders had a bachelor's degree or higher as compared with 52 percent of city residents [U.S. Census 2014]). UberX provided the majority of trips (53 percent), while other Uber services (UberBlack, UberSUV) represented another 8 percent. Lyft provided 30 percent of trips, and other services the remainder. The survey conducted for the study also asked respondents for key trip data, including trip purpose, origin/destination, and wait time. Responses revealed that 67 percent of all trips were social/leisure trips (bar, restaurant, concert, visit friends/family), and only 16 percent were work related. Forty-seven percent of trips began somewhere other than home or work (e.g., restaurant, bar, gym), while 40 percent originated at home. Thirty-nine percent of respondents said that if TNCs had not been available, they would have taken a taxi, while 24 percent would have traveled by bus. Four percent cited a public transit station as their origin or destination, suggesting that TNCs occasionally provide first-/last-mile service to and from public transit. Forty percent of TNC users reported that they had reduced their driving because of the service. TNC trips within San Francisco averaged 3.1 miles in length, whereas taxi trips averaged 3.7 miles. This study was exploratory in nature and did not include "ridesplitting" services, such as Lyft Line and UberPool.

This study also did not examine e-hail taxi services, as they were not widely deployed at the time of the survey. Since then, there has been a dramatic increase in use of e-hail taxi services. As of October 2014, for example, 80 percent of San Francisco taxis (1,450 taxis) were reportedly using the e-hail app Flywheel, which has brought taxi wait times closely in line with those of ridesourcing (Sachin Kansal, unpublished data).

Business travelers appear to be using TNCs in particularly large numbers. Concur, a travel expense management company, reported a nine-fold increase in client use of Uber between 2013 and 2014 (White 2015). The travel expense management company Certify reported that among business travelers, use of Uber (55 percent) surpassed that of taxis (43 percent) in the second quarter of 2015, a near reversal of the shares observed (Uber 43 percent, taxis 53 percent) in the first quarter of that year (Certify 2015). Lyft accounted for only 1 percent of business trips in the second quarter of 2015, but its market share grew by 153 percent between the first and second quarters of the year (Certify 2015). Average fares may be the reason that TNCs are gaining market share: Certify results show average fares for Lyft to be $22.51, for Uber $30.03, and for taxis $34.48 (Certify 2015).[7]

The rapid expansion of TNCs, as partially described in Box 2-1, has also led to changing beliefs about the total potential size of the market for shared rides. The global taxi and car service market saw relatively minor changes for decades, although it has grown substantially in recent years. The changes that TNCs have brought to the car-for-hire market appear to have accelerated this growth, although it is as yet difficult to know how many rides may merely shift from single vehicles, taxis, or transit to TNCs. Given the rapid growth in TNC drivers and revenues, some of the rides are apparently new to for-hire transportation, resulting in an increased overall market size for TNCs and potentially shrinking the share of other modes, from private vehicle to transit.

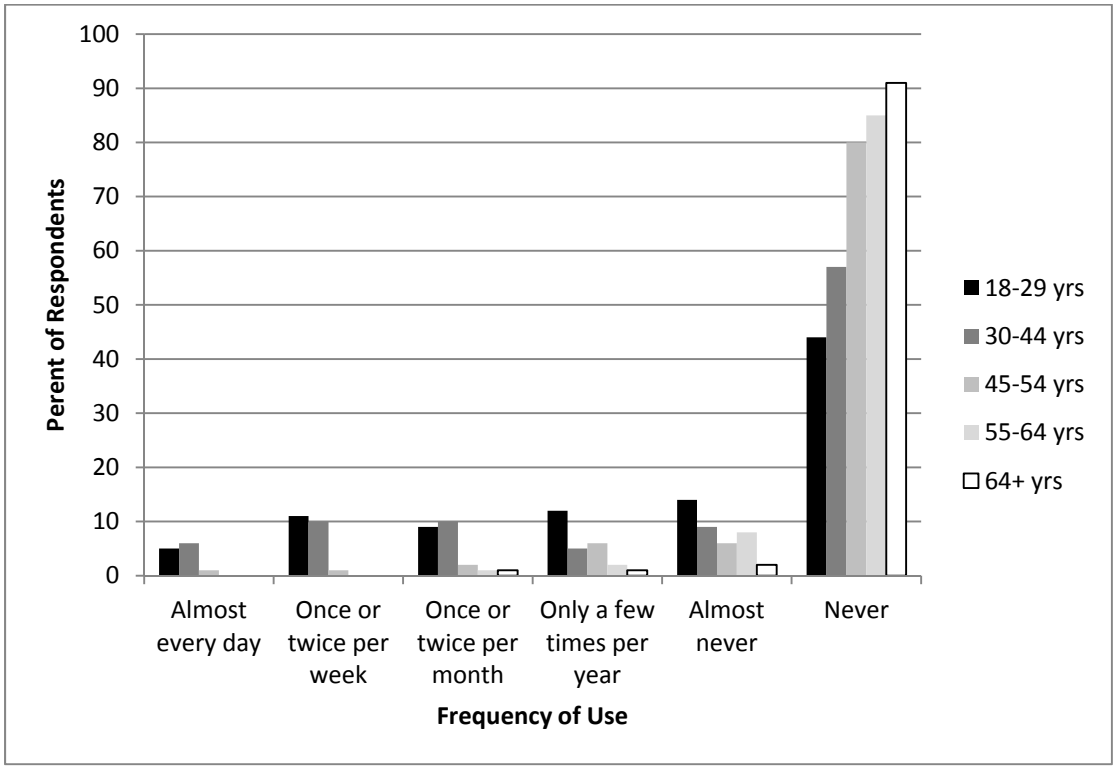
[7] These data, derived from business trip expense reports compiled by Certify, enable direct comparison of TNC and taxi fares in the same cities for the types and lengths of trips taken by business travelers (e.g., between airports and hotels and between hotels and meeting places).

Box 2-1

## Frequency of Use of Ridesharing Applications: Results from a National Tracking Poll of Registered Voters

A national tracking poll conducted online during June 29-31, 2015, by Morning Consult asked a national sample of 2,173 registered voters, "How often do you use ridesharing applications on your smartphone such as Uber or Lyft?" About 3 percent of registered voters reported almost daily use of ridesharing applications, about 5 percent reported using them once or twice per week or once or twice per month, and 72 percent said they had never used them.

As shown in the figure below, frequency of use varies with age. About 10 percent of respondents aged 18-44 reported using ridesharing applications once or twice per week or month, and about 6 percent reported using them almost daily. Fewer than 1 percent of those older than 45 reported using ridesharing applications as much as once or twice per week or month. About 50 percent of respondents aged 18-44 said they never had used ridesharing applications, compared with about 85 percent of those older than 45. Only 1 percent of student registered voters said they used ridesharing applications almost every day, but 7 percent used them once or twice per week or month.




About 11 percent of Hispanics reported using ridesharing applications once or twice per week or month, compared with 4 percent of whites and 7 percent of African Americans. Six percent of Hispanics said they used the applications almost every day, compared with 3

(*continued*)

Box 2-1 (*continued*)

percent of African Americans and 2 percent of whites. Seventy-five percent of white respondents but only 51 percent of Hispanics and 59 percent of African Americans reported never having used ridesharing applications.

A greater percentage of those living in urban areas (about 8 percent) than of those living in suburban (4 percent) or rural (3 percent) areas reported frequent use of ridesharing applications. Seventy-nine percent of those living in rural areas and 75 percent of those living in suburban areas reported never using ridesharing applications, compared with 59 percent of urban residents. Four percent of residents polled from the South and Midwest said they used ridesharing applications once or twice per week or month, compared with about 6 percent from the West and Northeast. Fewer respondents from the Midwest reported almost daily use (1 percent) compared with those from the South and West (3 percent) and Northeast (4 percent).

Females and males reported comparable levels of use: about 2 percent of females and 3 percent of males said they used ridesharing applications almost daily; about 4 percent of females and 6 percent of males said they used them once or twice per week or month; and 74 percent of females and 69 percent of males said they had never used them.

About 8 percent of those polled with a bachelor's or postgraduate degree reported using ridesharing services once or twice per week or month, compared with 4 percent who had less than a bachelor's degree. Three percent of respondents earning up to $50,000 annually said they used the applications once or twice per week or month, compared with 6 percent of those with annual incomes over $50,000. The percentage reporting almost daily use ranged from 2 to 3 percent across all income categories.

The same poll asked registered voters, "How often do you use traditional taxi services?" Three percent of the registered voters polled said they used taxi services almost every day, and about 5 percent said they used them once or twice per week or month—the same percentages as for ridesharing applications. About 10 percent of respondents aged 18-44 (and 9 percent aged 18-29) said they used taxis once or twice per week or month—the same as for ridesharing applications. About 5 percent of those aged 19-44 reported using taxis almost every day—again, similar to ridesharing (6 percent). Thirty-five percent of 18- to 44-year-olds reported never using taxis (versus 50 percent who had never used ridesharing applications). Fifty percent of those older than 45 said they never used taxis, compared with 85 percent who had never used ridesharing applications. Four percent of student registered voters said they used taxi services almost every day (versus 1 percent who reported almost daily use of ridesharing applications). Five percent of students said they used taxi services once or twice per week or month, compared with 7 percent who used ridesharing applications that often.

Four percent of respondents earning up to $50,000 annually said they used taxis once or twice per week or month (compared with 3 percent for ridesharing). Among those with annual incomes greater than $50,000, about 6 percent said they used taxi services once or twice per week or month—the same percentage that reported this frequency of use for ridesharing. Almost daily use of taxis ranged from 2 to 3 percent across the reported income levels—the same as for ridesharing.

Nine percent of urban respondents said they used taxis once or twice per week or month, and a similar 8 percent said they used ridesharing applications that often. Five percent of urban residents reported using taxis almost daily—the same percentage that reported almost daily use of ridesharing applications.

Source: Morning Consult 2015.

While Millennials living in urban areas are the predominant users of TNCs, what happens in the years ahead will depend on such factors as how life-cycle and cohort effects begin to shape TNC use. For example, it is not known whether Millennials who are faithful TNC users will continue to use and demand TNCs if they move to lower-density suburbs when they have children. Also unknown is whether new and older urban residents such as retirees, the cohort with the least use of TNCs, will increase their TNC use when settling into urban areas.

### Summary of Current Use

The preceding sections draw on fragmentary and disparate data sources in an attempt to place the scale and growth of TNCs and other urban mobility services in context. In the broadest context, the private automobile remains the dominant mode of travel nationwide, accounting for 87 percent of daily trips. Carpooling, a conventional form of shared-use travel, has been declining steadily for decades, dropping from almost 20 percent of work trips in 1980 to less than 10 percent today. However, other forms of conventional shared-use travel—taxi and transit—have been growing. Trend data on taxi trips and passenger-miles are not available, but industry revenues, operators, and drivers have increased by 42, 54, and 32 percent, respectively, since 2000. Taxis are estimated to represent 0.2 percent of person trips, a figure that appears small at the national level but nonetheless represents 738 million trips annually. Transit passenger trips and miles have also been growing—up 16 and 25 percent, respectively, since 2000—and transit accounts for about 2 percent of person trips.

The current scale and growth of TNCs, bikesharing, carsharing, and microtransit can only be approximated based on a variety of different sources. A recent national poll (Morning Consult 2015) suggests that TNC use today is roughly comparable to use of taxis (3 percent of respondents reporting “almost daily” use of both modes), but use of TNCs appears to be growing rapidly. Uber reports an annual tripling of trips in San Francisco and a quadrupling of trips in New York City, a doubling of gross revenues, and enrolled drivers increasing by tens of thousands annually. In 2013 and 2014, enrolled drivers at Uber doubled every 6 months, with 40,000 new drivers gained in December 2014 alone (Hall and Krueger 2015). Survey data on business travelers’ use of TNCs indicate that such travelers are selecting TNCs more frequently than taxis, perhaps because of lower average fares. As fragmentary as these indicators of scale and growth may be, they exceed what is known about the use of other TNCs.

Information about the use of carsharing and bikesharing is also limited, but as reported in the previous section, as of the beginning of 2015 there were 45 operators offering carsharing to 1.5 million members, and bikesharing had spread to 72 cities offering almost 25,000 bicycles. Whereas these services remain quite small at the national level, in combination their impacts could be greater if they continue to grow, as described next.

## IMPACTS OF THE NEW SERVICES

The features of the new shared-use modes and business models influence travel behavior by affecting important considerations in travel decisions such as cost, convenience, and security. This influence, in turn, potentially affects trip-making rates, mode choices, and perhaps trip destinations or paths. Ultimately, these changes in travel behavior can influence the role of transportation in society and the economy—specifically affecting personal mobility, the safety

and capacity of the transportation system, and the environmental and economic impacts of transportation.

Respondents to surveys of carsharing and bikesharing members report substantial effects on mode use, vehicle ownership, and travel behavior. In a survey of members of four different bikesharing programs in North America, 50 percent of respondents reported reducing their automobile use as result of bikesharing (Shaheen et al. 2014). Other studies suggest that bikeshare survey respondents may reduce their driving by 25 to 52 percent (Houle 2011; DeMaio 2009). These results, however, should be interpreted with caution because of low response rates and possible response bias toward the most enthusiastic supporters of the programs. Shaheen and colleagues (2012) also found that 39 percent of bikesharing survey respondents reduced their use of public transit. Of interest, bus use decreased among bikesharing respondents in larger cities but increased among those in smaller cities—this increase being attributed to the fact that bikesharing improves access to bus lines. Rail usage increased among respondents in smaller cities but decreased among those in larger cities because of the faster travel speeds and cost savings associated with bikesharing (Martin and Shaheen 2014). Buck and colleagues (2013) corroborate this shift away from public transportation, reporting that among survey respondents, 35 percent of casual users and 45 percent of annual members of Capital Bikeshare in Washington, DC, replaced a public transit trip with bikesharing.

Respondents to surveys of carsharing members report similarly substantial shifts in travel behavior. For example, Martin and Shaheen (2011) found that carsharing survey respondents, on average, decreased their household vehicle-miles traveled (VMT) by 27 percent and reduced their greenhouse gas (GHG) emissions by 0.58 metric tons over 1 year (corresponding to a 34 percent reduction in GHGs). As part of the same study, Martin and colleagues (2010) found that for every carsharing vehicle, 9 to 13 personal vehicles were shed, and that carsharing vehicles had a 10 mpg greater average fuel economy relative to the vehicles shed by survey respondents. These results, however, may not be representative because of the low response rate (10 percent of potential respondents). Mishra and colleagues (2015) found that vehicle holdings among urban carsharing residents were lower by 10-40 percent, while transit, biking, and walking trips were all higher. These results corroborate the work of earlier studies. Cervero and colleagues (2007) examined the final results of a before-and-after study of City Carshare in San Francisco and found that VMT among carsharing members had fallen far more than the VMT of a control group; in addition, each carsharing vehicle replaced up to six personal vehicles. Lane (2005) similarly found that carsharing members reported reducing their VMT by several hundred miles per month and that each carsharing vehicle removed more than ten personal vehicles from the road. Whether the effects noted above would be as large for subsequent bikeshare and carshare users is uncertain, since many of the studies cited rely on nonrandom surveys with low response rates that may be biased by responses from the programs' most enthusiastic users. Even if representative of the first generation of users, early adopters may have different preferences about personal mobility relative to the general population.

Comparable data on TNC services and microtransit are not yet available, although at least one study has shown that TNCs may be substituting for both transit and driving trips (Rayle et al. 2015). Transit agencies are watching the evolution of these services carefully to understand how they may interact with and affect transit services.[8]

[8] In mid-2015, the Transportation Research Board's Transit Cooperative Research Program (TCRP) began a study entitled "TCRP J-11: The Impact of New Technology-Enabled Mobility Services on Public Transportation." The study report is expected to be completed by the beginning of 2016.

Ultimately, travelers and transportation policy makers are interested in understanding the consequences of TNCs and related technology-enabled transportation services and business models for travelers and for the economy and the environment. In some cases, the interrelationships and consequences are subtle and can vary depending on the behavioral response. For example, a direct impact of TNCs may be to reduce personal vehicle trips, but the TNC pickup/drop-off mileage may result in more total travel. On the other hand, if TNCs enable or encourage higher vehicle occupancies or skew overall travel behavior away from single-occupant vehicle travel by reducing personal vehicle ownership, they may have positive impacts in terms of minimizing VMT.

Many of the new mobility services have the potential to increase average vehicle occupancies as shared rides become more common. Increased vehicle occupancies would lead to significantly smaller carbon footprints per passenger. In addition, the ability to aggregate trips and increase vehicle occupancy would improve energy efficiency and enable the capacity of transportation systems to increase and accommodate growing needs without adding to congestion or requiring proportional increases in infrastructure.

Not only might existing services continue to promote shared rides, but they and other new services could provide first- and last-mile service to fixed-route buses and rail lines. Other microtransit services might proliferate. If it becomes easier for individuals to travel without owning a private vehicle, car ownership may be reduced, much as has been seen with carsharing services but on a far greater scale.

Reduced vehicle ownership creates a positive feedback loop in which even larger VMT reductions result. This phenomenon occurs when car owners sense very low marginal costs in deciding whether to take a trip, since they perceive the marginal costs to be limited mainly to the cost of gasoline and parking (and tolls). Evidence is overwhelming that car owners do not consider the full cost of trips in making their travel choices. If consumers own fewer vehicles and use other mobility services, they may become more accustomed to considering the marginal cost of each trip, possibly thereby making fewer discretionary trips.

Reduced private vehicle ownership needs may also result in reduced parking requirements as residents reconsider their options for traveling easily without a private vehicle. Reduced parking needs may allow for increased densification, depending on zoning codes and community support for the conversion of parking space to other uses, which in turn can make transit and active transportation modes (particularly walking and bicycling) more realistic options. The combination of more rational trip making and the proliferation of multirider services creates the potential for dramatic reductions in VMT—and therefore in pollution, GHGs, road infrastructure needs, and parking facilities.

It is also possible, however, that these new services will have the opposite effects. Convenient and inexpensive shared rides in TNC and other vehicles may attract transit riders who currently travel in much more space- and energy-efficient buses and trains. Moreover, the lower cost and reduced driving associated with shared vehicles may induce additional trip making or longer trips, again contributing to increases in VMT, congestion, and GHG emissions.

## CONCLUSION

Technology advances have fostered a broad array of innovations in passenger transportation in recent years. Carsharing, bikesharing, and more recently TNCs and microtransit have emerged as

important and growing components of urban passenger transportation. For several decades, policies designed to increase transit use so as to reduce reliance on the private automobile and its associated contributions to congestion and emissions have met with marginal success. In contrast, private companies offering shared vehicles and rides—particularly TNCs but carsharing and bikesharing as well—have recently emerged and appear to be experiencing rapid expansion and success.

Whereas the number of trips made using these services is large and growing, it is still small in the broader context of total national trips. Taxis and limousines, the main existing services against which TNCs compete, account for fewer than half a percent of trips in metropolitan areas of 1 million or more population. In one national poll of registered voters, about 3 percent of respondents reported "almost daily" use of a TNC (the same percentage that reported "almost daily" use of taxis) (Morning Consult 2015). Uber alone reportedly had 2 million customers in the New York City area in mid-2015.

TNCs aside, taxi and transit trips have been increasing in number and share in recent years, perhaps because of the attraction, particularly among Millennials, of urban lifestyles less dependent upon personal automobiles (Blumenberg et al. 2015). At the same time this trend is occurring, however, reliance on personal vehicles for single-occupant commute trips has been growing, while conventional carpooling has declined. Whether urban mobility services, and TNCs in particular, will affect the broad and enduring trend of single-occupant vehicle trips is of considerable interest and importance in planning for infrastructure capacity and managing vehicle emissions.

Carsharing and bikesharing, which have a longer history than TNCs and microtransit, are reducing automobile ownership and VMT in personal vehicles—as well as drawing travelers away from transit—among the small share of early-adopting urbanites that currently use these services. Among North American bikesharing users, survey respondents have reported declines in automobile use of up to 50 percent, along with similar declines in transit use. Respondents to surveys of carsharing member households have reported reductions in VMT of 20 to 40 percent and in automobile ownership of 10 to 50 percent. While these results may not be altogether scalable to the general population, they nonetheless are encouraging and dramatic. TNCs are garnering the most attention in the media at present, but their broader effects on travel choices are not yet known. By all accounts, they are meeting growing demand with better service and fare options relative to taxis, but also may be increasing total travel, congestion, and emissions in the near term by replacing walking and transit trips, or as a result of the extra travel entailed in picking up passengers. Over the longer term, TNC carpooling options and other mobility services may facilitate more higher-occupancy trips and support the trend toward urban living and its broader environmental benefits.

What form the new mobility services will take as they evolve and whether and how they will affect travel behavior and demand, the use of all other modes (including taxis and limousines), private vehicle ownership, and residential and commercial location preferences remain to be seen as these options grow and serve different market segments and geographic areas. Studying and documenting these developments will be important to inform public policy debates. However, the lack of information about the scale, growth, and operations of these new services constrains the ability to understand their impacts and, as described in succeeding chapters, to plan intelligently for them and determine whether or to what extent they should be regulated.

## REFERENCES

### Abbreviations

AASHTO American Association of State Highway and Transportation Officials
U.S. BTS United States Bureau of Transportation Statistics

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3

# Taxis, Regulation, and the Rise of Transportation Network Companies

Most of the regulatory and policy challenges facing the officials who oversee innovative mobility services center on transportation network companies (TNCs) and their place in the transportation system relative to for-hire sedans, limousines, and taxicabs. TNCs have certainly been the greatest source of controversy, both for their aggressive models of market entry and as the established, regulated for-hire transport industry has attempted to push back against them. Accordingly, this chapter provides an overview of taxi regulations, the development and expansion of TNCs, and the often varied regulations applied to the two industries—issues analyzed in greater detail in subsequent chapters.

## TAXI REGULATION[9]

Taxicab owners, fleets, and drivers are sometimes governed by extensive regulations that cover nearly every aspect of taxi service, particularly in large American cities. Smaller and midsized cities tend to apply a lighter regulatory approach, more akin to restaurant or building industry health-and-safety regulation and with little coverage of service quality issues. Where regulations are far-reaching, their breadth and specificity have increased over decades as regulators have sought to address documented problems and abuses in the industry. The regulations have thus been born of practical experience and problem solving as opposed to economic or regulatory theory, and often vary among jurisdictions, reflecting particular local circumstances and experiences. In large metropolitan areas, where taxis commonly are regulated by local governments and sometimes airport authorities as well, there are often multiple taxi-regulating bodies, each of which promulgates its own set of rules and regulations.

Taxis are regulated at the county level in some states, including Florida, Maryland, and Virginia. In Colorado and Nevada, the latter a state that relies heavily on tourism, they are regulated by one or more state agencies. Sedan services also are regulated predominantly by municipal or county agencies, with notable exceptions in California, Pennsylvania, and Colorado, where state agencies regulate sedans as passenger carriers.

With all these different jurisdictions regulating the taxi industry from their own vantage points, it should come as no surprise that the nature and extent of regulation vary considerably nationwide. Some regulatory issues—particularly safety but also fare metering—are approached similarly, whereas control over market entry, pricing, geographic coverage, and access for disadvantaged riders show distinct differences. The phenomenon of multiple regulatory bodies enforcing widely varying rules and regulations is neither unique nor necessarily problematic (building and safety codes, after all, are normally enforced by local governments), but what is perhaps unique about the taxi industry is that a single cab ride from an airport to the downtown of a large metropolitan area may pass through a half a dozen taxi-regulating jurisdictions, each

[9] This section relies heavily on a paper prepared by committee member Bruce Schaller, which is provided in full in Appendix B.

with its own rules governing (or prohibiting) the ability of that cab to pick up other passengers after discharging the airport passenger.

### Public Safety

Some aspects of regulation are quite straightforward and applied in similar fashion across the country. Most obvious in this category are provisions for background checks of drivers and fleet or vehicle owners and vehicle insurance requirements and safety inspections. Even at the height of their influence in the 1970s and early 1980s, advocates of taxi deregulation focused on entry and economic regulation and never proposed privatizing responsibility for public safety (Frankena and Pautler 1984; PriceWaterhouse 1993). In a post-9/11 world, the breadth and influence of public safety concerns have deepened as taxi regulators have worked with antiterrorism personnel mindful of the potential use of taxis as part of terrorist plots. These concerns are particularly acute at airports. To address public safety concerns, regulations generally focus on background checks of drivers, vehicle inspections, and minimum standards for vehicle liability insurance—topics treated in greater depth in subsequent chapters of this report.

### Fares

In nearly all cities, taxi fares are set by regulation. Fare regulation is designed to ensure predictability in the amount customers will be charged, to eliminate price gouging,[10] and to ensure a reasonable return for owners and drivers. The regulations most commonly set a fixed fare rate that applies uniformly across all companies.

Following federal standards for taximeter devices, fares are calculated on the basis of an initial charge (the "drop"), along with mileage and time charges. When a cab is stuck in traffic, the time charge applies; otherwise, the mileage charge applies. A variety of surcharges may also be applied, most commonly for additional passengers and luggage and based on time of day. Cities increasingly have adopted flat-rate fares for trips between regional airports and the central city to make the fares predictable and guard against overcharging. Aside from a few peak-time surcharges, taxi fare rates are rarely set to vary in response to changing levels of demand for service.

Rate-making processes are varied. Existing rates may be reviewed periodically or at the request of the industry. Whether to even conduct a review can become a politically charged issue. The need for rate increases can be evaluated against standardized measures such as the consumer price index or price indexes specially calculated to reflect taxi industry costs. Fares may be increased for the purpose of increasing driver earnings, and sometimes in conjunction with caps on the lease fees that fleets can charge the drivers. Regulators often conduct surveys of peer cities to assess where their city falls relative to others, with a particular view to how business and leisure travelers will perceive its taxi fares.

[10] There is not one economic or regulatory definition of "price gouging." The committee uses the term to refer to unreasonable charges for the circumstance. In the case of taxi fares, which are strictly regulated, charging anything more than specified in regulations could reasonably be considered "price gouging." For TNCs, whose prices are not regulated, there may be an economic rationale for surge pricing, as discussed in Chapter 4.

## Market Entry

Two of the most controversial aspects of taxi regulation are entry and economic regulations, both of which extend beyond the realm of public safety and price setting. These types of regulations first became commonplace in the 1920s and were particularly common during the Great Depression, when market entry restrictions were adopted in New York City, Chicago, Boston, Baltimore, Toronto, Montreal, Quebec City, Winnipeg, and Vancouver. With jobs in short supply and wages falling, unemployed workers flocked to the taxi industry. The result was an oversupply of drivers, particularly at cab stands, and problems ranging from lack of insurance to overcharging to curbside fistfights among drivers competing for fares (Davis 1998; Gilbert and Samuels 1982). In response, cities placed moratoriums on the issuance of new licenses, seeking to let attrition bring supply back in line with demand for service. These codes often included provisions for issuance of additional licenses should a regulatory finding of public convenience and necessity reveal the need to do so.

After World War II, entry controls remained in place, and the first controversies arose over whether cities should issue additional licenses. Taxi fleets and drivers in large cities generally resisted, fearing a loss of income. New York, Boston, Chicago, and some smaller cities as well went decades without issuing additional taxi licenses. Licenses could be transferred between owners and grew in value, thus establishing "medallion" systems that enriched fleet owners and owner-drivers who held a vehicle license (see Box 3-1 for descriptions of different regulatory systems).

While big cities became renowned for medallion systems, the situation developed much differently in smaller cities with predominantly dispatch (as opposed to street-hail) trips. These cities tended to have one or more fleets and few if any independent owner-drivers. Regulators built regulatory structures that relied on fleet owners to provide training and oversight of drivers and respond to public complaints. Regulators sometimes focused simply on administering public safety requirements and little else.

Entry controls in fleet-oriented systems vary widely. Some cities let the owners of fleet-based companies adjust the size of their fleets either without government oversight or with relatively pro forma reviews, and let new companies enter the industry provided they meet minimum qualifications (e.g., background checks, licensing, and vehicle standards). Other regulatory systems limit the number of taxis each company can operate and control the entry of new companies. Las Vegas, for example, regularly reviews trip volumes and fleet sizes before adding any medallions, which are spread across authorized companies. In other places, the process may involve a company application; public hearings; petitions from user groups; and various calculations, such as the ratio of cabs to population.

The most vexing regulatory issue in fleet-oriented systems concerns the entry of new companies. Cities with taxi regulatory structures based on companies being awarded franchises to provide service (see Box 3-1) address the entry of new companies through the competitive franchising process, which is open to both incumbent fleets and newcomers. Where franchises are not awarded, regulatory systems that focus on fleet-level regulation take the form of certificate systems (see Box 3-1).

In certificate and other restricted-entry systems, incumbent fleets may resist the entry of new companies so as to protect their business interests. This resistance can lead to shortfalls in service in two ways. First, controversy over how much to expand the size of the industry and how to distribute additional operating authority can cause a stalemate in expansion efforts.

Box 3-1

## Types of Taxi Regulatory Systems

**Permit/medallion system:** Operating authority takes the form of taxicab vehicle permits. The number of permits (often called "medallions" after the metal ornament that is affixed to the exterior of the car) is set through law or regulation. Permits/medallion licenses are generally transferable and have value. Examples of this system include New York City, Chicago, Boston, Miami-Dade, San Diego, Seattle and King County, Minneapolis, and San Francisco (permits in San Francisco are nontransferable).

**Certificate system:** Authority to operate taxicabs is issued to companies, usually with a specified number of vehicles being allowed to operate under the certificate. Companies can generally apply for a change in the number of authorized vehicles, and a decision is made according to specified criteria. Certificates cannot be transferred between taxi companies. Examples of this system include Fairfax and Arlington Counties and Alexandria, Virginia; Kansas City, Missouri; Austin, Texas; Denver, Colorado; and Pittsburgh, Pennsylvania.

**Franchise system:** Franchises are issued through a competitive process. After a set term of years (possibly with extensions/renewals), the franchise is rebid. A franchise specifies the number of cabs each company may operate. Examples of this system include Los Angeles and Anaheim, California, and Dulles Airport.

**Open entry:** There is no limit on the number of cabs. New companies and possibly individual drivers can obtain authority based on showing qualifications. Examples of this system include Phoenix and Orange County, Florida; Orange County, California (outside Anaheim); Washington, DC; and livery sectors in New York City and Newark, New Jersey.

Source: Schaller 2007.

Without sufficient numbers of cabs in service, dispatch response times can suffer. Second, fleets that are protected from competition through franchises sometimes lose the incentive to offer quality service. Both the regulatory system and the industry can thus became calcified and reactive. This can occur whether the taxicab market is growing or shrinking.

### Service

Taxi regulators often are drawn into addressing problems with service quality as well as public safety. The result is in a broad range of regulatory initiatives, including

- Driver training programs focused on safe driving and customer courtesy;
- Lease fee caps designed to limit the amounts that medallion/license owners can charge drivers so as to raise driver wages, attract and retain quality drivers, and limit "rent seeking" by owners;
- Requirements for partitions and cameras in vehicles to protect drivers;

- Requirements that independent drivers affiliate with a fleet or radio service (known as a "base") to relieve the regulatory burden of overseeing thousands of individual drivers; and
- Street enforcement squads to ensure regulatory compliance and to offer specialized or streamlined procedures for adjudicating citations written by inspectors and citizen complaints.

By no means have all cities become deeply involved with service regulations. Cities with fleet operators who maintain service standards and resolve service complaints often have little active regulatory oversight other than licensing checks and vehicle inspections. Cities with chronic service quality problems, on the other hand, tend to see growth in the regulatory regime since market forces have been unable to rectify the problems. Two particularly important service components are requirements for taxis to (1) serve all geographic areas of the regulating jurisdiction and (2) provide for access for travelers with disabilities, which are described in turn below.

*Geographic Requirements*

There is perhaps no more significant tension between the private for-profit and public social service aspects of for-hire transportation than geographic coverage of service. As private, for-profit enterprises, taxicab services tend to go where customers congregate: airports, train stations, major hotels, and central business districts. But when viewed as part of the urban transportation system and as filling important social service roles, the ability to call for a cab, be picked up, and be taken to any area destination can be seen as a right to be enjoyed by all, regardless of race/ethnicity, income, or location. The latter is most often an issue in outlying areas where demand is low and in low-income areas where fear of crime is common.

On-call taxi service is not universal in rural areas, but in jurisdictions where they are regulated, taxi companies often are required to serve all parts of the regulated jurisdiction, regardless of demand. Locally granted operating authority almost always carries with it the obligation to provide service to anyone requesting a cab ride within the local service area. The economic rationale is to have "dense markets cross-subsidize low-density and impoverished areas; [and] peak traffic cross-subsidizes off-peak service" (Dempsey 1996, p. 96). Without regulation, service to low-density areas and during off-peak hours would likely decline, and in many cases would not be available at all.

Failure to abide by geographic service requirements can be explicit, as when a driver refuses to pick up a prospective customer at a taxi stand for economic reasons (such as to avoid a short trip or "deadheading" back from an outlying area), to avoid perceived high-crime areas, or out of outright racism. This issue is typically addressed through enforcement and ultimately license revocation. Service refusal problems also can occur when a customer calls for a cab from an outlying or low-density part of a service area, and dispatchers cannot respond because all of the cabs are clustered far away in high-demand areas or no driver is willing to accept the call.

Studies of taxi service utilizing computerized company dispatch data have shown that cab companies tend to provide more service and have faster response times in certain areas of a city and, conversely, pick up fewer passengers and have longer response times elsewhere. This pattern has been documented in Boston (Nelson\Nygaard Consulting Associates 2004); San Diego (Schaller Consulting 2000); Miami-Dade County (Tennessee Transportation and Logistics Foundation 2006); and Fort Worth, Texas (Schaller Consulting 2006). The longer response times reflect, at least in part, spatial variations in demand.

Taxi regulators have developed a number of strategies intended to ensure minimum levels of cab service in all parts of their jurisdictions. These strategies include issuing various geographically specific licenses that require some portion of the taxicab fleet to be dedicated to lower-demand areas (as in Las Vegas) or particular geographic zones to be covered by different companies (as in Los Angeles); place restrictions on airport pickups by time of day, day of the week, or portion of the fleet; or impose other types of service requirements. As examples of the latter, Chicago adopted regulations that require every cab to provide a specified number of trips each day in certain zones, while taxi franchises in Los Angeles must conform to response time standards and reporting requirements for monitoring and compliance.

Geographic service requirements, while common, are neither ubiquitous nor always necessary. In New York City, which has substantial demand for dispatch taxi service throughout its five boroughs, more than 500 car service companies operate, each specializing in particular geographic and customer markets, in an open-entry system. While no one company provides prompt service throughout the city, service is apparently adequate enough that geographic service requirements have not been applied by local regulators.

*Accessibility for Those with Disabilities*

The accessibility of taxi service for those with disabilities has been a growing issue in recent years. Despite strong support from advocacy groups and elected officials, it has proven difficult in many cities to expand the ranks of accessible taxicabs. The primary obstacles are the cost of acquiring and operating accessible vehicles, including higher fuel and maintenance expenses and higher insurance premiums, and lower productivity due to the additional time that may be required to serve customers in wheelchairs.

Cities and other taxi regulatory authorities have instituted a variety of measures to encourage, subsidize, and mandate the availability of accessible taxicabs. These measures include requirements that a certain percentage of fleet cabs be accessible, grants and tax incentives for vehicle purchase, relaxed vehicle age limits, reduced licensing fees, passes to allow drivers to skip to the front of queues at airport taxi stands, and sales of medallion licenses that may be used only with accessible vehicles.

Despite these efforts, the number of accessible cabs has remained low, nearly always less than 10 percent of the entire fleet according to taxi regulators from many jurisdictions who were surveyed for the paper presented in Appendix B. Trip volumes for these cabs also remain modest, reflecting some combination of limited supply and limited demand. The percentages of trips in accessible cabs available in published sources range from a low of 1 percent in New York City to 8 percent in the District of Columbia (District of Columbia Taxicab Commission 2014; NYC TLC 2014).

Taxi regulators continue to explore how to increase the supply of accessible vehicles and make them available to disabled persons. Several cities—including Washington, DC, and New York—have established dispatch services to improve the response times of accessible vehicles. Several cities also have established funds paid for through industry or passenger fees to subsidize out-of-pocket capital and operating costs, as well as provide financial incentives to drivers. The fees include a 30-cent per trip fee to be added to every regular taxi fare in New York and a $100 annual fee imposed on Chicago medallion owners who fail to operate an accessible vehicle. The fees, collected from taxi passengers and medallion owners, respectively, are used to help offset the added expenses incurred by owners and drivers of accessible vehicles.

Recently, some taxi regulators have also moved toward outright mandates that vehicles newly put in service be accessible. Chicago and Washington, DC, have adopted requirements that fleets of a certain size have a minimum percentage of accessible vehicles (5 percent in Chicago and 6 percent in DC). New York City has mandated that one-half of new vehicles put into service as medallion cabs be accessible, starting no later than January 2016. Through that measure and the issuance of additional accessible medallions, New York has established an ambitious goal of having 50 percent or more of its taxicab fleet wheelchair-accessible by 2020.

**Service to Airports**

Airports are major trip generators and attractors in nearly all cities. They often represent the largest single for-hire transportation market in a metropolitan area and are thus a prized component of the taxi business. Airports have several unique characteristics that affect both how airport taxi service operates and how airports regulate it. Perhaps most important for regulation, access to airport property is controlled by the airport operating authority. Airport officials directly control who can pick up passengers, as well as the fees and system for doing so. Because taxi and limousine pickups occur in a spatially concentrated area, they present a more focused target for enforcement efforts relative to these services elsewhere.

Operationally, airports provide a steady flow of customers to cab drivers that is relatively easy to service—customers who are for the most part going to downtown hotels or office areas familiar to drivers or residential destinations that the passenger knows how to get to. Airports thus are magnets for taxi and limousine drivers. In the absence of access controls, airports often are vastly oversupplied with vehicles and drivers, creating long waits in so-called "taxi holds" where cabs queue while waiting to pick up passengers. Waits can extend to 3-4 hours, with hundreds of drivers congregating in the holding lots. Airports also attract drivers who are unlicensed, who lack commercial insurance, and who may be intending to overcharge or otherwise abuse passengers.

To address these issues, airport authorities tend to strictly regulate taxi and limousine service to their facilities[11] through various means. For taxi service, competitively bid concession systems are commonly used at midsized airports, such as Orange County (California), Tampa-St. Petersburg, Raleigh-Durham, and Sacramento, and at a few large airports, such as Dulles in Washington, DC. Airports in larger cities that have strong regulatory systems often are open to any driver licensed for service in the city. The airport may require that drivers obtain a permit and may take steps to prevent oversupply, long driver waiting times, and attendant ills. Los Angeles International and Portland (Oregon) have alternate-day systems that allow cabs to serve every fifth day and every other day, respectively (although the Los Angeles system is currently being revised to prevent drivers from working more than 12 hours a day). San Jose limits how many cabs from each fleet can be at the airport.

[11] The Transportation Research Board recently completed an Airport Cooperative Research Program (ACRP) study entitled "Commercial Ground Transportation at Airports: Best Practices." The study report reviews best practices for all ground transportation options, including both taxis and TNCs, and provides further information about airport practices (LeighFischer 2015).

## Deregulation, Reregulation, and the Differences Between Dispatch and Walk-Up Markets

During the 1970s, as the trucking, airline, and telecommunications industries were being deregulated, the idea that taxi deregulation would deliver similar benefits took hold. At the time, some economists predicted that unregulated entry and fares for taxi service providers would produce lower fares, a higher level of service to customers, and service innovations such as shared-ride services as new firms entered the market (Frankena and Pautler 1984). A leading academic predicted that open entry would afford smaller taxi companies the "entrepreneurial freedom" to service "marginal markets abandoned by large fleets" and would "open the way for a rich mix of new services to penetrate urban transportation markets" (Cervero 1985, pp. 222, 226-227).

The goals of encouraging competition and service innovation were primary motivations for changes to entry restrictions that were adopted in 19 cities from 1965 to 1983 (Shaw et al. 1983). The largest of these included San Diego, Seattle, Atlanta, Phoenix, Cincinnati, Indianapolis, Kansas City, and Sacramento.

In general, most of the cities that experimented with deregulation realized few of the hoped-for benefits and many unanticipated costs. For example, deregulated cities experienced a sharp influx of individual owner-operators who primarily, if not exclusively, worked taxi stands at airports and large hotels (Frankena and Pautler 1984; ITRE 1998; La Croix et al. 1992; Teal and Berglund 1987). The arrival of additional drivers did not improve taxi availability since there was no shortage of taxi service at these stands prior to deregulation. The proliferation of cabs did result in drivers waiting longer times between trips, which led to a reduction in drivers' productivity and real earnings (Teal and Berglund 1987). Those financial pressures resulted in turn in drivers seeking inflated fares and in "aggressive solicitation of passengers and confrontations among drivers," who sought to obtain the most lucrative trips and avoid unprofitable short trips (PriceWaterhouse 1993, p. 15). Open airport systems were found to be "unworkable," with "price gouging, dirty drivers, unsafe cabs, and unfair competition" (La Croix et al. 1992, p. 148).

The dispatch market also was affected, as were hotel and airport taxi stands. In Atlanta, service to minority neighborhoods decreased despite a doubling of the number of cabs as most new entrants focused on the airport (Frankena and Pautler 1984). Before the city closed entry in 2003, the main dispatch company in Sacramento reported an average response time of 30 minutes (Nelson\Nygaard Consulting Associates 2004).

Contrary to expectations, deregulation weakened fleets that focused on dispatch service because the proliferation of cabs at taxi stands and airports reduced dispatch fleets' revenues from these markets, upon which they partially depended. In addition, several factors resulted in few new entrants to the dispatch business. Entry for dispatch companies requires the accumulation of considerable capital that may be difficult to attract to an industry with "marginal financial status" (Teal and Berglund 1987, p. 53). New dispatch companies must advertise heavily to attract customers. They must quickly build the size of their fleets in order to achieve the economies of scale necessary to provide competitive response times for telephone requests for service. Another factor was that demand in the telephone dispatch market was either stable or declining in the cities that deregulated (Teal and Berglund 1987), so new entrants would have had to supplant existing companies with large fleets and well-established name recognition—something that proved difficult to do.

These results led most of the cities that had deregulated entry in the 1970s and early 1980s to reregulate entry within a few years. PriceWaterhouse (1993) found that 14 of 18 cities that removed entry limits from the mid-1960s to the mid-1980s later restricted entry at airports or throughout the entire jurisdiction. Other cities, such as Dallas and Sacramento, closed entry more recently. Notably, the PriceWaterhouse study also found that four smaller cities (Berkeley, California; Springfield, Illinois; and Spokane and Tacoma, Washington) retained fully deregulated systems.

The few larger cities that retained or have long had open-entry systems have seen negative results. Arizona officials report the presence of many unlicensed and uninsured cabs in the Phoenix and Tucson areas. In Orange County, Florida, cabs frequently fail to meet acceptable service and vehicle standards. In Washington, DC, cabs are plentiful downtown, but complaints about service quality and response times in outlying areas are chronic (Schaller 2007).

The apps on which TNCs rely to connect drivers and passengers challenge both the business and regulatory models that apply to taxis. Because TNC drivers are using apps to connect with passengers and typically are prohibited from picking up street hails, the problems of driver oversupply at taxi stands encouraged by past taxi deregulation efforts are unlikely to recur with the rise of TNCs. On the other hand, these same apps overcome barriers to entry into the taxi dispatch market that have shielded dispatch fleets from competition. These dynamics are creating new complexities for taxi regulators and local officials as they begin to regulate TNCs, as described in the section that follows.

## TNC GROWTH AND REGULATION

From companies little known just 5 years ago, TNCs have become nearly household names as a result of extensive coverage in the business media. The *Wall Street Journal* reported in February 2014 that Uber's net revenue (the amount it retains after paying drivers) was more than $400 million in 2014, with projections that this number would increase five-fold to more than $2 billion in 2015. Lyft has disclosed no financial data but has stated that its revenue increased five-fold during 2014, when it grew from 15 to 65 markets (Nagy 2014). While valuations are subject to rapid and significant change, as of July 2015, Uber was valued at about $51 billion (MacMillan and Demos 2015), while Lyft was valued at approximately $2 billion (Dugan 2015). Between May 2013 and May 2014, research based on credit and debit card transactions indicated that Uber's revenue nationwide was about 12 times that of Lyft (Metz 2014). Little or no public information is available about the growth and scale of other TNCs.

The entry of TNCs, especially Uber, into a new market often is met with protests from the existing taxi industry, both at the time of the TNCs' arrival and afterward (e.g., Aratani 2014b; Hanks 2015). TNCs frequently enter a new market without seeking prior approval of regulators and with significant promotional discounts. When Uber entered 22 college towns in late summer 2014, for example, it provided riders with the first five rides for free through September 1 (Uber.com 2014). This type of marketing quickly creates a sizable user base, which the company can then encourage to speak out if local regulators take steps to limit its ability to operate in the city.

Like the taxi industry, TNCs have to date been regulated mainly at the local, municipal level, although the approval processes in many major jurisdictions, ranging from San Francisco to New York City, have been contentious. New York City, for example, initially shut down Uber until it was licensed and has placed more restrictions on its operations relative to other cities. The number of Uber drivers more than doubled between mid-2014 and mid-2015, from about 11,000 to more than 23,000, and Uber indicated it wanted to add 10,000 more (Badger 2015b). City leaders initially resisted allowing the additional 10,000 drivers, but backed down in response to questions from the governor and fierce resistance from Uber, which had engaged in aggressive advertising and outreach to its customers.

Other cities also have faced contentious regulatory approval processes. Seattle, for example, initially set a cap of 150 drivers per TNC allowed to be operating at any one time. That ordinance was repealed a few months later in combination with an increase in the number of available taxi licenses (Vaughn 2014). In 2013, California was the first state to establish TNC-specific regulations. Many states and local jurisdictions that have begun regulating TNCs have followed the basic structure of California's approach (California Public Utilities Commission 2015), which entails far fewer fees and requirements for these services than are imposed on the established taxi, sedan, and limousine industries in many cities. This approach likely reflects the newness of the industry, its popularity and political clout, its willingness to start operations without first becoming licensed, and its (undocumented) claims that the unprecedented amount of information passengers and drivers have about one another (including permanent trip records and reciprocal ratings of both drivers and passengers) obviates the need for some of the regulations traditionally imposed on taxis.

Complete documentation of state and local jurisdictions' TNC regulations is not available, and the state of those regulations is still very much in flux. Based on information gathered from news accounts and websites, regulations in such jurisdictions as New York City, Houston, and Portland (Oregon) require TNC drivers to be licensed, to have a relatively new vehicle (although standards vary), to submit the vehicle to regular inspections (generally by state-licensed bodies), and to display trade dress (the TNC logo) whenever the vehicle is being used as a for-hire vehicle—regulations that are comparatively less stringent than those imposed on taxis. Regulating jurisdictions typically require TNCs to carry a minimum of $1 million in per incident liability insurance whenever a passenger is in the vehicle, and often while the driver is en route to pick up a passenger after having been matched. (TNC insurance issues are discussed in Chapter 7.) Most jurisdictions forbid a TNC driver from picking up a street hail, requiring that all rides be handled in advance through the app. (Issues regarding passenger security and safety are discussed in detail in Chapter 6.)

Some jurisdictions have mandated information sharing with TNCs. California, for example, requires TNCs to provide six reports each quarter on (1) the provision of accessible vehicles, (2) service provision by zip code, (3) problems reported about drivers, (4) hours logged by drivers, (5) miles logged by drivers, and (6) drivers completing a driver training course. Lyft has complied with these requirements, but Uber has not. In July 2015, a judge ruled that the California Public Utilities Commission can charge Uber $7.3 million for refusing to provide all required data, including the number of customers requesting accessible vehicles, the number of rides in each zip code, and the cause of each incident involving an Uber driver (Carson 2015). Uber also has declined to provide data to New York City's Taxi and Limousine Commission, citing confidentiality and privacy concerns; in January 2015, the company was required to shut down five of its six dispatch bases because of its failure to comply with the commission's request

for information about the date and time and pickup location of each trip (Colt 2015). (Because of the nature of Uber's digital dispatching, the closure of five dispatch bases had little effect on the company's operations, as it simply shifted all dispatching to the remaining base.) The following month, Uber complied with the request and provided the information; the commission then lifted the suspension of the five bases (Fischer 2015). In January 2015, Uber also announced a data sharing agreement with the City of Boston in which the company agreed to provide quarterly reports with anonymized data on the duration, general location (by zip code), and time of rides that begin or end within the city (Dungca 2015).

TNCs generally do not pay for business licenses, but where TNCs are regulated, the companies have paid fees to operate, the cost of which can vary dramatically. For example, California charged $1,000 per 3 years for a TNC permit (California Public Utilities Commission 2015), while Colorado charged $111,250 per year (State of Colorado 2015).

## EFFECTS ON INCUMBENT FIRMS

The information available for this study on the effects of TNCs on taxis is anecdotal. The Washington, DC, taxi commission reported that total taxi trips in the city were down 10 percent in the first year of TNC operation (Di Caro 2014), although both taxi company managers and individual drivers described their business as down by at least 20 percent (Ham 2014). The San Francisco Municipal Transportation Agency provided data indicating that the number of licensed taxi drivers declined by 11 percent between fiscal years 2013 and 2014, and data from the Los Angeles Department of Transportation show a 9 percent drop between 2014 and 2015. Similarly, New York's Taxi and Limousine Commission reported that traditional taxi trips declined by 5 percent across New York City compared with the previous year (YellowCabNYC.com 2015), and Seattle reported a 28 percent decline between 2012-2013 and 2013-2014 (Soper 2015). Part or all of these declines in taxi use may be due to former taxi users shifting to TNCs in search of more convenient service and lower fares (see Box 3-2). In addition, anecdotal information provided by dispatch companies in such cities as Denver, Houston, and Seattle indicates that the volume of trips has not declined, but their revenue potential has as longer trips (such as to airports) have been replaced by shorter trips.

At the moment, perhaps the best evidence that TNCs are affecting the taxi industry is the falling price of taxi medallions in jurisdictions that regulate entry through the sale or issuance of medallions. In the few, large cities that use them, medallions are essentially the stock of the taxi industry, with their value suggesting the industry's overall profit margin. Until very recently in many cities, medallion values appreciated reliably. Between 2009 and 2013, for example, taxi medallions outpaced the Standard and Poor's 500, and medallion values in Chicago doubled to $350,000 over that same period. Medallions in Boston have sold for more than $700,000, and in New York they have sold for more than $1.1 million (Badger 2014).

Medallion values fluctuate for a number of reasons, including speculative behavior, interest rates, and changing income from leases due to changes in supply or demand. The rise of TNCs, however, has coincided with falling medallion values. At the beginning of 2015, for example, medallion prices in New York had fallen by 23 to 28 percent (Barro 2015),[12] and sales in Chicago have fallen in both quantity and price (Badger 2014; Barro 2015). Medallion holders have protested the entrance of TNCs, and in some instances they have sued cities for allowing

[12] The city has two classes of medallions—one for owner-operators and one for owners who lease to drivers.

Box 3-2

## Fare Comparisons Between Taxi Service and Transportation Network Companies (TNCs)

News articles and reports have often described TNC fares as generally lower than those of taxis, particularly during periods when so-called "surge pricing" is not in effect. For example, one reported comparison of taxi fares with Uber and Lyft prices in Los Angeles, San Francisco, and New York, using publicly posted rates, found that Uber and Lyft were less expensive on average, but the percentage of rides that cost less than taxi service varied depending on the city and the shared mobility service. The analysis applied public information on fees to a set trip distance using Google Maps (Stone 2014). A July 2015 *Los Angeles Times* article reported that the "typical taxi trip from LAX to downtown Los Angeles is more than $50, not including tip. In periods of low demand, Uber or Lyft rides are closer to $30, but that can rise sharply during peak periods" (Nelson and Shepherd 2015). According to Certify, a travel expense management company, the average fare for taxi service for business travelers ($34.48) in the second quarter of 2015 was higher than that for Lyft ($22.51) or Uber ($30.03) (Certify 2015).

Other sources, however, have reported that TNC fares in New York City are higher than taxi fares for short trips (Guerrini 2015).* Yet as noted by *The Washington Post*, UberX service in New York is more expensive than that in Washington, DC. This may well be because in New York, UberX drivers are commercially licensed and insured livery drivers; city regulations do not allow drivers without a chauffeur's license to use personal cars to provide transportation services (Badger 2015a).

A recent study funded by Uber Technologies, Inc. found that UberX was less costly in terms of both time and money for low-income neighborhoods in Los Angeles (BOTEC Analysis Corporation 2015a). UberX prices were about half those of taxis, and the service arrived twice as fast on average (see Chapter 8 for a more complete description of this study). A similar comparison of Uber service with two taxi services in New York City—conventional yellow cabs and "boro cabs" that are not allowed to pick up in Manhattan—found (similar to the Los Angeles study) that in two randomly selected low-income and relatively low-crime areas (one in Brooklyn and one in Queens), total time from initiating a car request to entering the car was half as long for Uber as for the two taxi services. In contrast to Los Angeles, however, fares for both Uber and taxis were comparable (BOTEC Analysis Corporation 2015b).

In markets where the lower cost of TNCs allows them to underprice taxis, particularly for travel to airports, taxi fare regulations do not allow taxis to adjust their fares downward to compete with TNCs. Such constraints on the pricing of taxi services contribute to a shift in demand from taxis to TNCs. The advertising of reduced fares to those willing to share a ride and split the cost, which taxi price regulations generally do not permit, is part of what helps TNCs undercut taxi service prices in some areas. Both UberPool and Lyftline have at least occasionally advertised such reduced fares even if a person is not found to share the ride. Uber in Los Angeles has heavily promoted the fares, and Lyft has stated that it has paid some of the cost to encourage demand for the shared-ride option. The extent of such fare reduction offers and their effects, however, are not clear.

Until more comparable information across services and service areas is provided by TNCs and more consistent methods are used for comparisons, it will be difficult to determine with certainty which type of service is the least costly option in which cities and under which conditions.

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*For similar reports see http://arxiv.org/abs/1503.03021.

TNCs to operate. The basis for these lawsuits varies. In London, a lawsuit argued that a smartphone app should be considered a taxi meter, and that any vehicle using the app should therefore be regulated as a taxi. A court ultimately ruled against the plaintiffs, although the case remains open in another court (Weber 2014a). Chicago's lawsuit alleges that the city has breached an implicit contract with medallion holders; it sold medallions to investors but then permitted the entry of firms that devalued those medallions. As of this writing, this lawsuit was in its early stages.

Declining medallion value has clear implications for medallion owners—they lose wealth—but less clear implications for taxi drivers. Recall that the direct source of medallion value is not passenger fares but driver leases. Medallion value in New York City was bolstered by the high ratio of drivers to medallions: usually 4 to 1, with many other people hoping to drive (Badger 2014). This high demand inflated the medallion value and allowed medallion holders to charge high lease rates. These circumstances suggest that TNCs can erode medallion value not only by taking customers but also by taking drivers.

Ultimately, because the interests of medallion owners and taxi drivers are not aligned (an owner doing well means a driver paying a higher lease rate), declining medallion values could also lead to falling lease rates, in turn raising the possibility that net taxi driver income could rise. This outcome would, of course, depend on how much lease rates actually fell and whether the savings from lower lease payments were countered by business lost to TNCs.

The taxi industry also has responded to the innovations of the TNCs by beginning to mimic them, including by using a number of apps to eliminate the TNCs' current convenience advantage for smartphone-owning customers. Companies that produce these apps also offer cashless payment and app-based dispatching with no surge pricing; they work with existing taxi and limousine companies, ensuring that all of the vehicles ordered by an app user are locally licensed and regulated taxis. One of the first taxi apps was Hailo, which originated in London and was offered in several U.S. cities before being withdrawn because of "intense competition" from other apps and TNCs (Weber 2014b). Other taxi apps currently on the market include myTaxi, Flywheel, and Curb (rebranded from Taxi Magic in 2014). The app companies contract with individual cab companies/fleets in each city. The contracting process and the need to integrate business processes and computer systems with many small fleet operators (in contrast to a national business model like that offered by TNCs such as Uber and Lyft) have slowed the comparative expansion rate of these companies.

In addition to these apps that have been developed by companies and work (or are intended to work) in multiple cities, some cities have announced the development of their own apps. Washington, DC, is testing a Universal DC TaxiApp, which all taxicab drivers would be required to use. Drivers would still be welcome to use any other apps, including Curb, Flywheel, or myTaxi, and drivers would still be able to accept street hails (Aratani 2014a). In January 2015, the Los Angeles Taxicab Commission passed a measure requiring all taxis to use a city-certified e-hail app by August 20, 2015, or face a daily fine (Mai-Duc 2015). And in May 2015, Chicago sought bids for the development of a universal phone app for all city taxis (Hinz 2015).

Disrupting a regulated market may provide benefits to consumers but can harm people who work in or own firms in that market. The full extent of that harm, however, is difficult to determine a priori, and sometimes even while it is occurring. It is not yet clear how losses in the taxi industry may actually play out. Taxi drivers could lose income as a result of TNC services, but they could also begin driving for TNCs instead of (or in addition to) their taxi work. To the extent that taxi drivers could earn back some lost revenue through TNC work, the TNCs might

not be a pure loss for them. However, TNC employment might not be an option for all taxi drivers. Many taxi drivers have low incomes, and thus might not have access to a personal vehicle that would allow them to work for TNCs. Others might have felony records[13] or motor vehicle violations that, while allowing them to drive taxis, might prohibit them from driving for TNCs (this issue is addressed in more detail in Chapter 6). Additionally, in the long run, if the rise of TNCs dramatically expanded the customer base of rides for hire, taxis and TNCs could profitably coexist as complements.

## CONCLUSION

The rise of TNCs has expanded mobility for many while having what may well prove to be significant effects on the taxi and livery industry. The pre-TNC for-hire industry grew as a result of its own innovations in the early decades of the 1900s, particularly by using telephones and radios to provide dispatch services that efficiently linked riders with drivers. Over the last several decades, the industry has been heavily regulated, partially deregulated, and then mostly reregulated.

Although regulatory approaches vary considerably across jurisdictions, the level of taxi regulation in most large cities with substantial street-hail markets is extensive, covering virtually every aspect of operations—fares; service; entry; geographic coverage; safety; and, increasingly, service requirements for people with disabilities. In most other jurisdictions, taxi regulations are far less extensive, except in areas that have had chronic service problems. The for-hire industry that emerged in response to this diverse regulatory structure typically comprises local firms of varying sizes. The services these firms provide also are limited by the many and varied jurisdictions that regulate them, resulting in differences within the same metropolitan areas and limits on the ability of drivers from one jurisdiction to serve passengers in adjacent ones. As discussed in subsequent chapters, how the regulations governing these industries relate to one another, particularly when multiple jurisdictions regulate different industry segments within the same geographic area, needs to be assessed.

Whereas taxi markets have lent themselves historically to local, and sometimes state, oversight, TNC entry has raised questions about whether such local oversight remains tenable in large metropolitan areas made up of many jurisdictions. TNC drivers can operate throughout a metropolitan area as a unified market, picking up and dropping off passengers with uniformity and transparency to consumers that are lacking in the taxi industry. Competing considerations are entailed in achieving, on the one hand, uniformity and simplicity in the regulatory structure (which tends to argue for regional or even state-wide regulatory authorities) and, on the other hand, responsiveness to local needs and concerns (which tends to argue for local regulation). A critical issue, moreover, is the level of on-the-ground regulatory enforcement, regardless of the level of regulatory authority.

The vast differences in the scale of TNCs compared with taxis raise new considerations for regulators. Compared with the multinational, distributed contractor labor and capital of the TNC business model, the long-established taxi industry is complex. The rise of global corporations providing taxi-like services in cities around the world is in sharp contrast to the structure of the taxi and limousine industries. While a few taxi fleets are large, regional

[13] For instance, licensing authorities consider criminal records, but depending on the nature and age of the conviction, may end up issuing licenses to applicants with a criminal history.

enterprises, most consist of local firms, fleets of widely varying sizes, and highly varied employment and contractual relationships between firms and drivers. In comparison, the TNCs are a few increasingly large entities that operate globally. Taxi and limousine companies are adopting TNC-like technologies to enable them to better compete with TNCs. However, the innovations that TNCs provide challenge both the economic and regulatory models of the taxi industry. In heavily regulated taxi markets, state and local policy makers may need to consider reducing some constraints on taxis and limousines to allow them to compete more effectively with TNCs. This issue is examined further in Chapter 4, which presents an economic framework for addressing the competitive disparities between TNCs and taxi, sedan, and limousine providers.

Because TNCs have resisted regulation, local officials typically have been unable to determine the levels and types of services being provided in their jurisdictions. Negotiating for basic information from TNCs and other providers of innovative mobility services in exchange for allowing them to operate is giving some jurisdictions a better understanding of the types and locations of the services these companies provide. As innovative mobility service companies become an increasingly important component of urban transportation networks, such information becomes essential for both regulation and transportation planning purposes.

In general, little accurate and aggregated information is available about how jurisdictions across the country are balancing the interests of and regulating both traditional and innovative mobility service providers. Complete and up-to-date information about how jurisdictions are adjusting to disruptive mobility technologies to better serve their citizens would be of benefit to all.

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| | |
|---|---|
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| NYC TLC | New York City Taxi and Limousine Commission |

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4

# An Economic Framework for Regulation of Shared Mobility Services

This chapter offers an economic framework that regulators might apply in addressing the tensions outlined in Chapter 3 between the taxi and limousine industries and companies that provide technology-enabled innovative mobility services. This economic framework sets the stage for subsequent chapters that focus on specific public policy concerns associated with TNC and taxi competition, as well as other aspects of innovative mobility services, including labor, safety, insurance, and equity. This chapter concentrates primarily on the rise of transportation network companies (TNCs) because these companies have, in many jurisdictions, upended the business model of conventional taxi and limousine services and generated considerable controversy. Moreover, the technologies on which TNCs rely appear to be disrupting the regulatory model that has long applied to taxis and limousines, raising questions about whether existing regulations require revision, an issue taken up across multiple regulatory dimensions in subsequent chapters.

## THE ECONOMIC BENEFITS AND COSTS OF SHARED MOBILITY

Technology-enabled mobility services bring with them an array of economic impacts, both certain and speculative, small and large. The most straightforward of these impacts is increased mobility, and with it greater access to economic opportunities for users. Because travel is rarely undertaken simply for its own sake, most of its economic benefits flow from bringing people, goods, and services together in productive and satisfying ways. Mobility improvements generate economic benefits by giving people and firms access to jobs, customers, friends, services, and opportunities. These benefits flow to individuals and firms by reducing the time, cost, or risk/uncertainty of access. The benefits also flow to society more broadly by lowering travel's external costs—such as delay imposed on others, crashes, and emissions—and increasing its external benefits—such as lower unemployment and increased energy security.

The changes engendered by technology-enabled mobility can simultaneously confer both benefits and costs, and thus entail consequential distributional effects. New services can disrupt existing business models and regulatory regimes. Powerful new ideas and technology often offer consumers new services and potentially offer investors an opportunity for handsome returns, but in so doing, they can threaten the financial viability of incumbent firms and the livelihoods of the people they employ. Technology-enabled mobility services, and TNCs in particular, appear at this point to be prime examples of this phenomenon. To date, these new services have yielded a handful of successful companies; provided millions of rides to consumers willing to pay for them; and provided flexible work for more than 150,000 vehicle owners, most of whom work part-time (Hall and Krueger 2015). At the same time, the evidence suggests that these services also have undermined segments of the existing ride-for-hire industry, particularly the taxi industry, as discussed in Chapter 3. The taxi industry is an important source of both income and wealth for many people, and in many cities it has important social service responsibilities (e.g., Kwong 2014). With the advent of TNCs, large global firms have entered local ride-for-hire

markets that have long been dominated by smaller local firms; these new firms have also become an important source of income and wealth for many people, although currently they typically have fewer government-mandated social service responsibilities. As discussed in Chapter 3, these local firms frequently are heavily regulated, almost always (at least to date) more so than the newcomer TNCs. One of the most important near-term impacts of technology-enabled mobility, therefore, is the fate of the taxi industry and its drivers.

Further, the economic benefits that flow from increases in personal mobility can also engender social costs. The great promise of such services as car- and bikesharing systems and TNCs is that they offer many of the flexible mobility benefits of motor vehicle ownership without the high up-front costs of owning, insuring, and maintaining a car. So the benefits of expanded mobility among those without their own car may also bring increased energy consumption, congestion delays, and emissions, and with them increased external costs borne by society.

How these various private and societal costs and benefits will net out and who will "win" and "lose" as technology-enabled mobility services expand are critical questions, but difficult to answer with much certainty during this time of transition. Nonetheless, this chapter represents an attempt to describe systematically what is known about the likely and potential economic effects of these new services. As of 2015, TNCs were competing both with one another and with existing ride-for-hire businesses (including taxis and carsharing) for the existing pool of ride-for-hire customers. If this trend persists, TNCs are certain to have large economic impacts on the ride-for-hire market, but given their relatively small market share in overall metropolitan person travel, they may have a relatively small economic impact overall. If the ride-for-hire market changes little or grows only modestly, the new mobility services likely will have only minor effects on the number of trips taken and miles traveled in metropolitan areas. But while net effects on travel may be minor, if TNCs weaken or bankrupt many taxi services, then those without credit cards and smartphone access may find themselves with fewer mobility options than before.

Evidence to date, however, suggests that the growth rate of the ride-for-hire market has been accelerating with the introduction of TNCs, perhaps substantially. If current trends continue, these services could have a much larger and more transformative effect on travel behavior and metropolitan transportation systems. For example, car- and bikesharing services, TNCs, and yet-to-emerge innovative shared mobility services could not only offer significant mobility benefits for those who lack access to or the ability to drive a private vehicle, but also encourage many more current drivers to own fewer cars and travel more by other modes. Should this occur, overall vehicle-miles traveled (VMT) would likely fall, average vehicle occupancy would likely climb, and some valuable land and capital currently spent on parking would be freed up for other purposes. These shared services could complement existing travel modes, particularly public transit, both by functioning either as a first- or last-mile mode (that is, being used to travel to and from transit stops) or as a flexible backup when other modes—such as bus, train, carpool, or vanpool—could not adjust in response to unanticipated changes in travel or during times of limited or no service. If such travel markets expanded dramatically, innovative shared mobility services and traditional taxi services might well coexist comfortably, leaving intact the important social service roles played by taxis in many cities.

## THE ECONOMICS OF MOBILITY FOR HIRE

Uber and Lyft can be considered the most recent and most technologically evolved answer to the larger question of how to get a ride in someone else's vehicle. The primary obstacles to getting such a ride, historically, have been problems of information, negotiation, and trust. In particular, those problems have involved asymmetric information and high transaction costs. Asymmetric information refers to situations in which not all knowledge relevant to a transaction is available to both parties (Akerlof 1970; Stiglitz 2001). Some information important to the buyer is known only to the seller, and vice versa. Transaction costs are simply what they sound like—the nonmonetary costs (in time, negotiation, energy, and so on) of arriving at an agreement (Coase 1937, 1960; Williamson 1979).

These problems are most evident when one considers the oldest approach to getting a ride from someone else: hitchhiking. Standing at a roadside and hoping to be picked up by a stranger involves high levels of uncertainty—about where and when to stand, about whether a vehicle will stop and after how long, about whether the driver who stops is going in the direction the passenger wishes to travel. Perhaps the greatest uncertainty relates to whether the passenger really wants to get into this strange vehicle (and for the driver, whether the passenger should be allowed in). Then there are questions about compensation: there are no standard fares for a hitched ride, so should the passenger contribute money for fuel, offer to drive, give the driver cash, or some combination of these? In short, both driver and passenger must make important decisions while having little information. Efforts to gather more information may reduce uncertainty, but they cost time—the more the driver and passenger talk, the more time each of them loses by not being in motion.

The advent of dispatch taxi service solved a number of these problems. A centralized telephone number and a fleet of vehicles reduced the uncertainty associated with finding a ride: calling for a cab reduces much of the uncertainty associated with location, waiting, safety, and compensation. The taxi comes to the traveler, its destination is the traveler's, and the driver works for an established company that can be penalized (legally, in reputation, or both) if something goes wrong. With rates often being regulated and certified-accurate taximeters in the vehicles, prices are transparent and require no negotiation (with the exception of tipping at the end of the ride). A similar situation holds for livery and limousine services, which a passenger also books ahead of time, usually for a set price.

Dispatch taxi and livery firms reduce information and negotiation costs by incurring large up-front costs. Dispatch service promises a vehicle that will come to the passenger within a reasonable amount of time or at a predetermined time. Delivering on such promises requires a fleet of easily identified vehicles (ideally outfitted with meters), a dispatcher to handle calls and direct drivers, and money spent to advertise. Most if not all of these costs are incurred before a single ride is given. These high barriers to entry into the taxi business give the dispatch taxi firms some qualities of a natural monopoly.

The high barriers to entry also make dispatch taxi service very different from the street-hail taxi business, whereby passengers can wave down a vehicle and get a ride. The street-hail business—if unregulated—entails very low barriers to entry. A person with a vehicle can drive along crowded streets and find riders. Street hailing also transfers some costs to passengers. Passengers cannot simply call for a cab but must do something more akin to hitchhiking by choosing a location where they are likely to find a vehicle, then hoping the vehicle slows and

agrees to take them to their destination. Tension thus exists between low barriers to entry and high information costs, with much of the cost of arranging the ride devolving to the consumer.

As discussed in Chapter 3, the low barriers to entry in the street-hail business make it subject to oversupply, resulting in congestion and competition for passengers that may extend to physical violence. Many drivers can end up competing with one another for customers in the relatively small number of areas that have large numbers of street-hail passengers (dense downtowns, airports, and so on). Oversupply in the taxi business was one of the original motivations behind taxi entry regulations.

Cities enacted these regulations to solve real problems. However, standard microeconomic theory suggests that many of the attributes of the dispatch industry—price controls, quantity controls, location controls, and a market structure that tends toward monopoly—create inefficiency and poor service (Demsetz 1982; McAfee et al. 2004). This inefficiency may be revealed in a number of ways, but the most common and most evident is shortages.[14] People willing to pay for rides cannot get them, either because the supply of vehicles is limited or because drivers cannot charge the price at which they believe a trip is worthwhile, even if passengers are willing to pay it.

For example, taxi drivers subject to fare regulations may be unwilling to make long trips to places where return fares are unlikely because picking up a passenger in another jurisdiction is not permitted or there simply are few available passengers. Such a trip might be to a neighboring jurisdiction where the driver would be forced to deadhead back (e.g., Boston to Cambridge) or simply to an outlying neighborhood where most people have vehicles and few need taxis. These trips entail higher per mile costs for the driver (more of their miles are likely to be unpaid), but the price earned per mile remains unchanged. In principle, if the driver could charge more for these trips to compensate for the opportunity cost of deadheading and if the customer were willing to pay more, both would be better off. Rate regulation, however, prevents this mutually beneficial exchange from occurring. Similarly, taxi drivers may be unwilling to work in hazardous conditions such as snowstorms or other emergencies because the job becomes more difficult but the pay no better.[15] Again, some people wishing to travel in bad weather might be willing to pay a premium to do so, yet would legally lack that option. Lastly, there may be times when demand for taxis spikes, but quantity controls mean that too few taxis are available to meet that demand. In February 2015, winter storms shut down Boston's subway network for two full days, and full service was not restored to the entire mass transit system for a month. As a result, thousands of people who normally did not drive were forced out onto the streets (which were largely clear) to look for rides. Many wanted taxis, but Boston has only about 1,800 cabs and could not satisfy the spike in demand. In such instances, shortages result. The shortage might manifest either as taxi companies turning people away or as long and unreliable waits for service—for example, people calling taxi services and being told a vehicle is coming, but then enduring long delays.

[14] Shortages result in lost time, which is a pure loss (when time is lost, no one gains it). Monopolies also often result in a transfer of income from consumers to producers. Strictly speaking, this is not a loss (it is a transfer), but consumers often find it objectionable because the lower supply of rides drives up the per ride price. Because taxis are regulated, however, the extent to which this increase in producer surplus occurs will vary depending on the jurisdiction. Regulated fares make it difficult for taxi drivers to earn excess profits. In medallion cities, taxi owners might earn such windfalls, but this again would depend on whether and by how much the cities regulated the lease agreements between owners and drivers.

[15] To be clear, some cities do allow increased fares or surcharges during snow emergencies.

Other forms of shared mobility entail variants of the same problems. Traditional carpooling, for example, shares many of the information and coordination problems of hitchhiking, although on a less ad hoc basis. Carsharing services resolve some of these problems because a vehicle can be booked in advance, but travelers do need to be able to drive. Moreover, carsharing companies may also have high fixed costs since they need many vehicles and also need to locate (and relocate) them in prime locations.

This tension between information costs and entry barriers helps explain why TNCs such as Uber and Lyft have seen rapid growth and success—they have resolved this tension in a way other services have not been able to emulate. Certainly some TNCs' advantages arise simply from lower levels of regulation: Uber and Lyft are not subject to price, location, or quantity controls, and often face less costly requirements for vehicle liability insurance, driver background checks, and vehicle inspections. But these companies also have created a business model that sheds important nonregulatory up-front costs typically confronted by firms that sell prearranged rides. TNCs require that drivers provide the vehicle to be used in service—traditionally one of the largest up-front costs of the business. Their digital platform also allows direct coordination between drivers and passengers, eliminating the need for and cost of centralized dispatch services. Moreover, the app injects transparency into the customer-driver transaction: customers opening the apps on their phones see a map that prominently displays the location of nearby vehicles and provides an estimated wait time for pickup. Most apps also provide a fare estimate. Once the ride has been booked, the customer receives regular text message updates on the driver's location and can track the vehicle's progress on the map. The app, in other words, reduces both information costs between the firm's passengers and drivers and fixed costs for the firm itself.

TNCs also can reduce shortages by raising prices in response to high demand. Uber's "surge pricing" and Lyft's "prime time" exemplify this approach: when demand is high, passengers are charged some multiple of normal fare rates—for instance, a surge rate of 2 means rides normally costing $5 will cost $10 instead. The surge is designed to lure drivers who are not driving (or who are working in other neighborhoods) to places where demand is high. While taxis can sometimes increase prices—for example, a $15 surcharge is added to each trip during snow emergencies in Washington, DC—TNCs have much more flexibility with their prices in response to changing levels of demand for service.[16]

TNCs can employ surge pricing effectively for four reasons. First and most obviously, they are not subject to formal price controls, so they can legally raise or lower their fares in response to changing conditions in nearly real time. Second, the dispersed and flexible nature of TNC employment means that firms have a large pool of capital and labor (cars and people) to call on at any given time. Third, there is no legal limit on the number of TNC vehicles that can be on the road at any given time. And fourth, drivers are not restricted to picking up passengers in particular municipalities. Thus it is not just the absence of price controls that allows surge pricing to work; the absence of quantity and location controls and the fact that TNC drivers do not work assigned shifts also are crucial. After all, high prices cannot prevent shortages if regulations prevent new supply from reaching those places where demand is increasing. More specifically, raising prices without increasing supply can reduce shortages only by encouraging some people not to take vehicle trips, whereas raising prices and allowing those increases to

[16] http://dctaxi.dc.gov/page/taxicab-fares.

attract new supply can reduce shortages by providing more trips. For example, Uber used surge[17] pricing when Boston's transit service suffered delays and cancellations. The company could call on more than 10,000 drivers in the city and its surrounding areas, and these vehicles could arrive from outside the city to give rides. Providing these rides was worthwhile for drivers because Uber charged up to three times its normal fares during the transit shutdown (Szaniszlo 2015).

Surge pricing has been controversial. Critics have argued that price spikes disadvantage lower-income people or that they violate laws against price gouging. New York state officials criticized Uber for using surge pricing during Hurricane Sandy, for instance, and later signed an agreement with the company that would restrict the use of such pricing during states of emergency (New York State Attorney General 2014). TNCs have agreed to limit the use of surge pricing in other cities as well.

From an economic perspective, however, surge pricing is best practice. Economists generally frown on price controls of any sort, and many view the concept of price gouging (and laws prohibiting it) with suspicion. Although it may appear unfair to charge passengers more during emergencies, it may also be unfair to expect drivers to provide service during emergencies without extra compensation. Moreover, customers knowingly and freely pay surge rates: the higher rate is displayed as soon as the phone app is opened, and passengers must explicitly consent to the increased rate by typing it into their mobile device. Thus while riders almost certainly do not like high prices, and little evidence suggests they are being deceived into paying them, the variation in prices adds a degree of unpredictability to the service, as does the unpredictability of response time in taxi service.

One rejoinder to this logic is that during emergencies, consumers pay more only because they have little choice, and that surge pricing is therefore a form of coercion. The validity of this argument hinges on the most likely counterfactual—what would happen in the absence of a surge. Certainly if the most probable alternative to a surge price is the same number of rides at a lower price, then companies may be coercing riders. But this scenario is unlikely: the more likely counterfactual to a price surge that delivers 100 rides for double the normal rate is not 100 rides at a lower rate, but fewer rides. And if this is the case, then the surge gives people choices; in its absence, some people who could choose between paying and waiting will be left with no option but to wait.

Nor is there much reason to believe that low-income people would benefit from lower prices if those low prices were also accompanied by shortages in service. A price control only regulates the price of the ride; it says nothing about who gets the ride. Thus while price controls enhance equality, they may do so at the expense of quality: during times of high demand, instead of making rides more accessible to everyone, price controls simply may make rides equally inaccessible by subjecting everyone to a shortage. From an economic perspective, concerns about the inability of low-income people to afford transportation should ideally be addressed by programs that explicitly target low-income travelers, not by laws that lower prices across the board.

TNCs, in sum, can offer more reliable rides (as a result of more flexible prices), and often lower fares (a result of having more vehicles), relative to traditional for-hire mobility services. In some markets, TNCs also may draw drivers away from the taxi industry. And once both customers and drivers have established loyalty to TNCs, that loyalty is globally transferable. Uber is a global brand, and Lyft operates across the United States; the presence of such

[17] Drivers throughout the taxi industry can also choose when and how much they work, but since fares are typically regulated, taxi prices cannot surge pricing when demand increases.

widespread branding reduces the transaction costs of arriving in a new city. Travelers and movers need not learn which taxi companies are or are not reliable, nor need they worry (in the case of international travel) about having the correct currency to get a ride or (for business travelers) remembering to get a receipt. They can simply switch on their phone and arrange a ride, and have a digital receipt emailed to them. Similarly, a person earning money by driving for a TNC has portable skills and can drive professionally (with the aid of navigation software) wherever that TNC platform is supported.

**TNCs as Monopolists**

Regulators might worry about whether TNCs could transition from injecting new competition into closed markets to becoming monopolists themselves. Some aspects of the current TNC market suggest this possibility. There are currently two dominant TNCs, and one (Uber) is much larger than the other (Lyft). Because TNCs are network companies, they are more efficient if they penetrate more of the market. It is therefore a natural concern that one or two large companies might come to dominate the ride-for-hire industry in many markets. What would happen, for example, if Uber and Lyft began colluding and raising prices or if Uber were to buy Lyft and become the lone dominant TNC?

One can never answer such questions with certainty, of course. But one can consider a few factors. First, active collusion—creating a cartel to fix prices—is illegal. Some industries that have one or two large players are able to engage in what is called *tacit collusion*: keeping prices high without explicitly agreeing to do so (Green and Porter 1984; Ivaldi et al. 2003). The hallmark of these industries, however, is that they compete on quantity when it is extremely difficult to add new supply. One classic example is makers of large jet airplanes (Krugman and Wells 2013). Commercial airplane manufacturing is dominated by Boeing and Airbus, and it is easy for each company to know how many airplanes the other will produce in a given year. As a result, both firms can set prices high because they know the other firm has little incentive to undersell them (lowering prices is advantageous only when it allows a firm to win new business, but winning new business is pointless if the firm cannot produce more airplanes). When this condition of sticky supply does not hold—when supply can be quickly added—tacit collusion becomes impossible, and even firms in oligopolistic markets will compete on price. Coke and Pepsi, for example, dominate the American soft drink market, but ramping up soft drink production is fairly easy, so rather than collude, the two companies ferociously compete.

TNCs resemble Coke and Pepsi more than Boeing and Airbus. Adding supply is very easy with TNCs. New drivers are easily recruited, and drivers can work for multiple firms. Lyft and Uber currently engage in price battles for precisely this reason. The ease of recruiting drivers points to a larger idea: the same factor that has allowed TNCs to undermine taxi firms—low barriers to entry—should, in theory, also prevent TNCs from becoming monopolies themselves. If one TNC completely took over a market and ramped up its prices, a competing platform could enter the market at relatively low cost and, through lower prices, take some of that TNC's business.

Nonetheless, freedom from market dominance by one TNC is by no means guaranteed. One could imagine commercial practices that would facilitate dominance, such as ubiquitous service coverage that consistently gave one TNC response time advantages over competitors, a dominant TNC that required drivers to work exclusively for that company, or the preloading of smartphones with the app of a single TNC. For example, as of 2015, Uber is partnered with

Google to promote Uber as a travel option in the Google Maps app. Barriers to entry can also be created by governments. If a dominant TNC successfully lobbied for regulations to protect its market (for instance, if it supported legislation saying that no new TNCs could be licensed unless they had a minimum number of drivers), that TNC might well become a monopoly. Of course, if new entrants simply entered markets without seeking permission from regulators, as TNCs currently do, even government barriers to entry might not be effective.

**Lessons of Deregulation**

The experience with taxi deregulation 30-plus years ago (reviewed in Chapter 3) is informative for current consideration of the role and possible effects of rapidly expanding TNCs. Problems resulting from deregulation were focused on taxi stand and street-hail markets that became oversupplied by newly licensed independent drivers. TNCs, by contrast, serve the dispatch segment of the market, where they have the same incentive as traditional taxi dispatch operations to balance supply and demand of trips. Predictions that de facto deregulation of entry for TNCs would have the same effect as the earlier move to open up entry for taxis need to address this difference.

At the same time, the experience with deregulation points to the important interdependence of market segments. Taxi drivers tend to serve multiple markets: taxi stands downtown and at the airport, dispatch trips throughout the city. In so doing, they gain efficiencies from, for example, being able to respond to a dispatch call in an outlying residential neighborhood after dropping off a passenger whose trip started at an airport taxi stand. Without this mix of trips, drivers spend precious time and fuel deadheading back to more lucrative areas.

TNCs in the current regulatory regime have an advantage over taxis insofar as they have better opportunities to avoid deadheading when crossing jurisdictional boundaries within a metropolitan area. As discussed in Chapter 3, in many regions, a taxi dropping off a passenger outside of that taxi's home jurisdiction cannot then pick up a passenger in that same jurisdiction. For TNCs, by comparison, a metropolitan area is a unified market, with no restrictions on dropping off and picking up passengers. One way for policy makers at the regional level to equalize competition between TNCs and taxis would be to allow taxis crossing jurisdictional boundaries the same ability to pick up passengers. But geographic restrictions on taxis evolved for a reason.

If TNC and taxi drivers had information on the demand for rides at a given time in a given area but limited or no information on the supply of vehicles at that time in that area (which aptly describes the current situation for street-hail cabs), removing geographic pickup restrictions might result in both TNCs and taxis (with TNC-like apps) clustering in areas with high demand while awaiting requests for rides. Less densely developed areas thus would be left with little service that could respond within a short period of time. However, if the apps provided the drivers with real-time information on places where the *ratio* of drivers to customers was high and where it was low, then the incentive for drivers to cluster and saturate high-demand locations irrespective of vehicle supply (which is common with street-hail cabs) would be considerably diminished.

To address problems with taxis clustering in the absence of real-time information on both the demand for service and the supply of vehicles, taxi-regulating jurisdictions have adopted regulations that limit when and where cabs may pick up customers. New York City, Los Angeles, and Las Vegas, for example, have created zones and restrict certain cabs to picking up

in particular zones. Anaheim/Orange County and Seattle/King County have achieved similar effects by different means. Whether such geographic time and place pickup restrictions might need to be extended to TNCs, be limited to street-hail cabs, or be dropped altogether for taxis remains to be seen. This example, however, illustrates the complexities and trade-offs faced by regulators in attempting to level the competitive playing field between TNCs and taxis.

## CONCLUSION

Securing a ride in someone else's vehicle typically involves balancing information and negotiation costs against barriers to entry for firms providing rides, which before smartphone app–enabled TNCs involved the high cost of entering taxi dispatch markets. Of the many technology-enabled mobility services that have emerged to date, TNCs have resolved this tension most successfully because their apps not only provide greater transparency for drivers and passengers, but also reduce the up-front costs for the firms themselves. In the short run, this innovation, combined with a typically lighter regulatory burden, allows TNCs to offer, at least in some instances, service and pricing superior to those of traditional taxis while incurring fewer of the regulation-associated costs that taxis must bear, potentially eliminating social costs in the process, as described in subsequent chapters. Moreover, the lighter regulation of TNCs facilitates the development of national and international companies with economies of scale and brand identities that provide a competitive edge over locally regulated for-hire firms and a motivation to protect the market image of the multinational brand.

Probably the most obvious and least controversial result of the rise of TNCs is that many people now avail themselves of their services, suggesting that these firms offer real improvements in mobility. The more difficult near-term question is what the rise of TNCs means for the taxi industry economically and for the current set of regulations to which it is subject. TNCs offer strong efficiency benefits, but cities have come to rely on taxi operators to advance a number of social service and equity goals as well—goals whose attainment is for the most part cross-subsidized directly by taxi customers or indirectly by cab or medallion owners. Taxis often ferry riders with disabilities, and they also are an important means of mobility for low-income people unable to purchase or insure private vehicles. If TNCs harm or (at the extreme) eliminate the taxi industry in some markets, people with disabilities and low incomes could find themselves with fewer means of getting around in the absence of some public policy intervention. These issues are considered more fully in Chapter 8.

During this time of uncertainty and transition in mobility services, the ultimate impact of TNCs on the taxi industry is unknown. Perhaps the two services will coexist to the extent that regulators equalize their regulatory treatment to some degree. It is not clear, however, whether or how to make taxis more competitive with TNCs. The taxi industry is responding to the competition from TNCs by beginning to adopt technologies that match passengers with drivers. On the other hand, regulating TNCs more heavily could undermine many of their price and responsiveness advantages (if, for instance, controls on surge pricing were applied to the currently variable TNC fares). Reducing some or many of the pricing and supply regulations imposed on taxis might be a better approach to leveling the taxi/TNC playing field, and some regulating authorities have recently moved in this direction. Lessons from taxi deregulation suggest that allowing TNCs to compete in the street-hail market would lead to oversupply and excess competition; thus, the street-hail business does not appear to be a promising area for

lighter regulation. Opening up competition in the dispatch market, by contrast, appears to hold promise for consumers. However, a less regulated taxi industry competing with TNCs would be very different from what currently exists in those jurisdictions where medallion holders (for example) are guaranteed a good deal of heavily regulated market power in exchange for agreeing to provide equity-based social services. If TNCs continue to erode the demand for taxis in for-hire transportation, regulating authorities may have a more difficult time attaching conditions to taxi licenses for purposes of geographic coverage and service for passengers with disabilities.

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5

# Labor and Employment Issues

Many people in the United States get paid to drive others in buses, shuttles, limousines, taxis, and, increasingly, their own cars. In just the taxi and limousine industries, more than 300,000 people in the United States worked as drivers in 2012.[18] Among the transportation network companies (TNCs), more than 160,000 people in the United States drove cars for Uber alone in 2015 (Hall and Krueger 2015).[19] Much of the discussion of ride services in this chapter focuses on Uber, partly because it is the largest TNC, but mainly because there are almost no publicly available data on other similar ride service companies. The discussion addresses earnings, benefits, and payment practices for for-hire drivers, along with the shift in for-hire drivers from predominantly full-time work with taxi services to predominantly part-time work with TNCs.[20] Job security and the potential for unionization are also concerns facing drivers, and are addressed as well. The scope of the discussion is limited to taxi and TNC drivers; employment issues related to carsharing, bikesharing, and microtransit are not included.

## COMPENSATION

### Earnings

Labor issues common to driving for hire include pay, benefits and job security, and safety from crime. Pay is generally the foremost issue, whether in the context of traditional cab driving or the new technology-enabled ride services. People who lack a high school diploma or whose English language skills may exclude them from other employment opportunities can often find a job driving a cab.[21] (Many drivers, of course, are well educated and fluent in English.) Cab driving also provides relatively easy entry into paid work and can offer the flexibility to enter, leave, and return if desired. The job is typically flexible; drivers can work a few days a week or full-time. They also can generally leave the job at will for extended periods—for example, for a visit to their home country—albeit without pay or benefits, and upon their return can usually find work again. Given the high turnover in the industry, drivers are rarely subject to layoffs in a recession.

[18] Data from the U.S. Census Bureau's American Community Survey for the years 2006 to 2010 (data are published for a 5-year average). The census definition includes workers who "drive automobiles, vans, or limousines to transport passengers" and thus is broadly consistent with the industry classification for taxi and limousine services.
[19] No data on the number of people driving for other TNCs were available for this study.
[20] The census data on taxi and livery driver compensation discussed in this chapter represent earned income that includes tips less such driver expenses as gasoline and lease costs, enabling a direct comparison with TNC drivers' earned incomes, which may rely less than those of taxi drivers on tips as part of compensation (U.S. Department of Labor, 2015).
[21] Forty-four percent of taxi and limousine drivers are foreign-born according to the U.S. Census Bureau's American Community Survey for November 2007, the most recent data available. Among full-time drivers, the percentage foreign-born rises to 53 percent. In New York City, Chicago, and Los Angeles, 65 percent or more of full-time drivers are foreign-born (U.S. Census and American Community Survey 2015).

Nationally, taxi drivers and chauffeurs working full-time averaged $31,471 in earned income in 2007-2011, or $12.85 an hour.[22] Earnings for cab drivers were comparable to those for butchers, laborers, janitors, stock clerks, shipping clerks, and medical assistants. Taxi and limousine drivers rarely have health insurance or other employee benefits, however, reducing their relative total compensation to the extent that those other jobs include benefits.

Incomes vary substantially, even among full-time cab drivers. The upper quartile of full-time drivers earned $65,427 in 2007-2011, while the bottom quartile earned $11,659. This range is attributable in part to variations among geographic markets. But driver earnings vary considerably even within a market, based in part on driver skill, know-how, and hustle. This variation is illustrated in a report on the Chicago taxi industry, with the earnings of some drivers being more than double those of other drivers per hour worked (Nelson\Nygaard Consulting Associates 2014). Overall, income for cab drivers declined by 11 percent in the 2000s, from $35,465 in 1999, adjusted for inflation, after holding steady over the previous two decades (U.S. Census and American Community Survey 2015).

Less is known about compensation for drivers who work for ride service companies. Some of these companies, and Uber in particular, have claimed that drivers can make far more money if affiliated with their company instead of driving a cab. In 2014, Uber cited $90,766 as the median annual income of a driver for UberX in New York City (Uber.com 2014). This claim was widely questioned, and Uber failed to provide a reporter for the online magazine *Slate* with the name of even one driver with that income level (Griswold 2014). More recently, Uber posted data online showing that incomes of its drivers in New York City and Chicago rose as a result of increased trip volumes even as the company cut fares. Uber also released a report showing driver "earnings" of $16-20 per hour for UberX and $20-25 per hour for UberBlack in most markets, with variation by city and by the number of hours worked. Reported earnings in New York City and San Francisco exceeded these figures, going as high as $34.32 per hour for some UberBlack drivers in San Francisco (Hall and Krueger 2015).

At first glance, these figures appear to be two to three times greater than the average pay of cab drivers. However, these "bookings" and "earnings" data should for the most part be considered gross and not net earnings, as they must be netted out against many driver expenses. These expenses include driver costs for fuel and for vehicle insurance, maintenance, upkeep, and, importantly, depreciation (as drivers must supply their own vehicle), as well as any taxes such as sales taxes on fare income. As noted above, taxi and limousine driver incomes often vary greatly, and it appears that the same can be said of TNC drivers. Journalists have interviewed TNC drivers who have reported earning as much as $75,000-85,000 per year (Anderson 2014; Dallke 2015; Pizarro 2015). The higher earnings tend to be achieved by UberSUV drivers, and are comparable to the earnings of drivers of luxury limousines (TLPA 2013). By comparison, press accounts suggest that when expenses are taken into account, UberX drivers' take-home earnings are closer to $12 per hour (Griswold 2014). When Uber recently lowered fares, it guaranteed drivers in selected markets $12.80 per hour (after the company's 20 percent cut). Once drivers' expenses had been deducted from that amount, their earnings at this minimum would be well below what an average cab driver earns.

*The Washington Post* has estimated that an Uber driver who grosses $62,000 annually may have only about $27,600 remaining after paying the company's commission and the costs of gas, maintenance, health insurance, car insurance, and federal taxes (Weiner 2015). Other reports

[22] Earnings are for drivers who work full-time, defined as working at least 40 hours a week and 40 weeks a year. Full-time drivers work, on average, 49 hours a week and 50 weeks a year.

indicate that 40 hours of driving per week in Dallas could net a driver about $37,000 annually (about $18.50 per hour) (Dickey 2014) and that Chicago drivers net $12.62 per hour (Carney 2015). The Hall and Krueger (2015) study estimates that in six major metropolitan areas, average hourly earnings of UberX drivers exceed those of taxi drivers and chauffeurs by roughly $6, although the authors acknowledge that UberX drivers would have to net out driving expenses from this figure, that these expenses would vary across drivers, and that the drivers' net earnings would also depend on their tax status.

Many drivers working for technology-enabled ride services report being happy with the job because of its flexibility, its attractiveness relative to their previous job, or the escape from unemployment it can offer. But when Uber cut fares recently, its drivers mounted protests in several major cities, claiming that the fare reductions would yield incomes they could not live on (Kosoff 2014).

**Benefits**

Whereas there has been much public discussion of pay and some discussion of job security for TNC drivers, there has been relatively little discussion of benefits. The reason for this is simple: neither the new nor traditional for-hire car transport industries offer much in the way of benefits with the notable exception of limousine companies, which hire drivers as employees and provide benefits. As a rule, traditional taxi drivers do not receive paid leave days, sick leave days, health insurance, retirement benefits, or the like.

Employment conditions for taxi drivers vary substantially. Prior to coverage available through the Affordable Care Act, many drivers lacked health insurance. This was the case for 61 percent of drivers in Los Angeles and approximately half of those in San Francisco (Blasi and Leavitt 2006; Evans et al. 2006) and for about 70 percent of those in Chicago (Corley 2014). In several major jurisdictions in which taxi drivers are classified as independent contractors—including the states of Washington, Colorado, and New York, plus San Francisco and Chicago, among others—they nonetheless receive workers' compensation (Huet 2015). Uber's CEO called the Affordable Care Act "huge" for the large number of drivers working for that company (Bhuiyan and Smith 2014). He described the "democratization" of health care as allowing people to have more flexible ways to earn a living. Allowing individuals to obtain subsidized insurance without being reliant on an employer enables independent contractors, such as those working for the ride service companies, to obtain individually the benefits traditionally provided by employers.

**Payment Practices**

As their fee, ride service companies deduct from drivers' earnings a percentage of the fare (20 percent and up) rather than a flat per-day or per-week lease fee, the common practice in the taxi industry. (The practice in the limousine industry is different; as noted, limousine companies generally hire drivers as employees, who are paid on a commission or hourly wage basis.) Cab drivers must generate enough fare income to pay the lease fee and their gasoline cost for the day before they have any take-home income. On a bad day, the amount left after these expenses can be quite meager, or even negative. Working on commission, as is the case with ride services and some limousine companies, means that a bad day is shared between company and driver. The commission arrangement also enables drivers to readily work part of a day rather than a full day.

Cab drivers, who must pay either a daily or weekly lease for the vehicles they drive, have less flexibility than TNC drivers with respect to hours worked because of the need to work long enough to earn sufficient fares to cover the fixed cost of the lease. Lease costs include the cost of the company-provided vehicle and its maintenance, insurance, and depreciation, as well as company advertising, overhead, and the provision of dispatch services. These daily or weekly lease payments can be substantial, with the result that drivers bear the brunt of a low-revenue day on the road, or work very long hours to earn income over expenses. In contrast, a higher proportion of the costs that TNC drivers must pay are variable: commission, maintenance, and depreciation costs all depend on the amount of time TNC drivers spend operating their vehicles to carry passengers. This high proportion of variable relative to fixed costs means that TNC drivers cover their costs (at the margin) more quickly and easily relative to cab drivers, making it much easier for them to work part-time and very short shifts if they prefer.

## THE SHIFT FROM FULL-TIME EMPLOYMENT

In the United States at the end of 2014, more than 160,000 drivers were actively partnered with Uber (defined as giving more than four rides per month), and during the last quarter of 2014, these drivers received $656.8 million in payments. In March 2015, Uber announced plans to increase the number of drivers in New York from 13,000 to 23,000 (Hawkins 2015). In April 2015, the company announced that its drivers numbered more than 20,000 in the San Francisco Bay area, a figure that had more than doubled from the previous year. While many of these drivers are part-time, that number nonetheless classifies Uber as one of the five largest San Francisco Bay area places to work (Said 2015).

Fully 80 percent of Uber drivers were employed full- or part-time before beginning to drive for the company, and 62 percent are employed either full- or part-time in addition to their driving (Hall and Krueger 2015). Because driving for a TNC is a very flexible work option, and drivers can enter or leave the driver pool at will on a daily basis, many become inactive over time. However, 70 percent of those who started driving for Uber in the first half of 2013 were still active drivers 6 months later. Although the Hall and Krueger (2015) study has a small sample size (601 drivers), Uber would appear to operate as a bridge to other employment options for some individuals, while for others, it represents a longer-term earnings source.

Thus firms like Uber and Lyft do not simply provide alternative transportation for taxi customers, but also offer alternative employment options for would-be drivers—and in the process make medallion leases less valuable, as described in Chapter 3. And because TNCs collect a proportional fee rather than rent from their drivers, driving for a TNC often involves less financial risk and thus holds more appeal for some drivers. TNCs deduct their fee only when drivers carry passengers, while taxi drivers typically pay fixed daily lease fees to license/medallion holders even if they carry no passengers at all.

Many taxi drivers have shifted to ride service companies, either instead of or in addition to their work for the taxi industry, and cab companies have noted driver shortages as a result. Many cities have reported that the number of available taxi drivers has been shrinking. The San Francisco Cab Drivers Association estimates that one-third of the TNC drivers in the city were originally (or are still) cab drivers (Sovern 2014). New York is facing similar issues, as more than 10 percent of the approximately 50,000 taxi drivers in the city have switched to driving for a TNC (Gartland 2014).

In a time of rapid change in the ride-for-hire industry, the workforce shifting among service providers is a key way for the industry as a whole to adapt to change while also addressing quality-of-service issues for consumers. In that sense, driver movements are a natural, desirable, and important part of this process.

Yet while drivers shifting from taxis to TNCs can advance the process of adaptation and change in the vehicle-for-hire sector, both communities and drivers could well find it problematic if technology-enabled ride service providers came to dominate the industry, particularly if one firm became dominant. For drivers, a major part of the promise of the technology-enabled companies is the potential for better pay and broader choice of work arrangements to suit their preferred compensation and work terms. Replacing one or two dominant cab companies with an equal number of dominant ride service providers would not represent an expansion of employment choices for drivers. Working for Uber, Lyft, and other ride service companies requires that drivers supply their own car; procure automobile insurance; and deal with the varied business details of entrepreneurship, from paying business taxes to handling accident claims. Not all drivers have the ability or the desire to take on these tasks, and not every driver will want or be able to acquire a vehicle and drive for TNCs; some will prefer the traditional taxi business model.

If TNCs continue to grow, they may make professional driving a less rare occupation, and thus all else being equal, wages for professional driving may fall (however, all else may not be equal—for example, if the demand for rides increases). Drivers for hire were historically limited in number and characterized by unique stores of knowledge; cities capped the number of vehicles, and by virtue of practice and native ability, the drivers had wayfinding capabilities and knowledge of local streets that many other people lacked. As an extreme example, London taxi drivers often train for years by riding mopeds through the city's dense street network, and then sit for a test of the city’s geography and landmarks that only half of trainees pass (Jabr 2011; Rosen 2014). This human capital has been integral to the quality of service drivers can deliver. As navigational software continues to improve, however, and as for-hire vehicles become less scarce, the value of this human capital is also likely to fall. Uber, for instance, does not require such a navigational knowledge test of its drivers in London, yet has successfully taken market share from London’s taxis. Lyft has made clear its goal of allowing any solo driver to take on a passenger, increasing the efficiency of the transportation system by filling otherwise unoccupied vehicle seats. While reaching this complete level of penetration for providers of shared rides is unlikely, it is entirely possible that the future will see fewer full-time drivers at lower wages.

## WORKING CONDITIONS

Another issue raised by TNC drivers and their representatives concerns job security. A key aspect of the business model of ride service companies is the ratings of drivers that customers can assign at the end of each ride. The companies believe that these rating systems are key to the quality of service their affiliated drivers provide to consumers. It has been noted that such ratings tend to be skewed high, with a large incidence of the highest possible rating (Slee 2013). The ride service companies thus set a high threshold below which drivers are “deactivated,” although Uber has noted that only 2-3 percent of its drivers are at risk at any given time (Cook 2015). Even so, drivers may feel insecure, as a relatively small number of very low ratings could result in the loss of their job.

The for-hire driving industry is in general not unionized in the classic sense. There are many reasons for this, including the fact that most of the workforce is classified as independent contractors instead of employees, and the Fair Labor Standards Act does not apply to contractors. In many places, however, drivers have organized into associations advocating for better working conditions and, more recently, a level playing field with ride service companies. For example, the National Taxi Workers Alliance became affiliated with the AFL-CIO in 2011 and now has affiliate member organizations in Philadelphia, Austin, Montgomery County (Maryland), and San Francisco, with additional organizing efforts in Prince George's County, Maryland, and Chicago (Lazo 2014a). The Washington, D.C. Taxi Operators Association has aligned itself with Teamsters Local 922 and described its concerns about ridesharing services, better representation on the District of Columbia Taxicab Commission, the credit card system, new dome lights, and the taxi paint scheme (Washington, D.C. Taxi Operators Association 2015). The Greater Philadelphia Taxi Association represents the voices of "taxicab medallion owners and operators, dispatchers, taxi companies, and allied industries"—notably not including the drivers themselves (Greater Philadelphia Taxi Association 2015). These and other organizations have increased in number and membership in recent years, in large part as a result of the rapid growth of ride service companies (Lazo 2014a). Taxi drivers want more control over the costs they are asked to bear, including lease costs, credit card processing fees, and outfitting of a vehicle to meet regulatory specifications, along with redress of the perceived unfairness of ride service companies facing fewer regulations and costs (Lazo 2014b).

## EMPLOYMENT STATUS

As of this writing, Uber and Lyft are facing lawsuits from drivers who want to be classified as employees rather than as independent contractors. Because such drivers say the companies exert significant control over their work, set compensation levels, and can terminate them at will (if their ratings fall too low), they believe they should be treated as employees, entitled to the protections that most full-time workers receive (Silverman 2015). In mid-July 2015, the U.S. Department of Labor issued guidance to employers summarizing legal cases interpreting application of the Fair Labor Standards Act to the question of when workers can be classified as contractors rather than employees (Weil 2015). The determination is a complex, multipronged test of interacting factors, including whether the work is an integral part of the employer's business, whether the workers' managerial skills determine their profit or loss, the workers' investment relative to that of the employer, whether a worker's special skill and initiative determine economic independence, whether the relationship is permanent or indefinite, and the nature and degree of the employer's control. According to the guidance, no single factor is determinative; instead, all the factors are to be weighed in determining whether workers are truly in business for themselves (Weil 2015).

If the lawsuits currently under way are resolved in favor of the drivers, the TNCs will be forced to handle taxes and social security, pay benefits, and reimburse the drivers for such costs as gas and vehicle maintenance. These verdicts could alter the profitability of the companies' business models and set a precedent for other worker classifications in the shared or on-demand economy. In June 2015, the California Labor Commission ruled that an Uber driver should be classified as an employee instead of an independent contractor; the ruling states that drivers' services are "integral" to the company's business model and that Uber is involved in "every

aspect of the operation" (Uber versus Berwick 2015). Uber has appealed that decision, which applies only in California and only for a single driver. If the ruling stands through what are certain to be several levels of rulings and appeals, TNC drivers in California will need to be reimbursed for gas, tolls, insurance, employment benefits, workers' compensation, and social security (Kirkham et al. 2015). More recently, the Oregon Bureau of Labor and Industries ruled in October 2015 that Uber drivers are employees instead of independent contractors (Njus 2015). Depending on how courts in other states decide, the implications for the business models of TNCs, as well as of taxi companies, most of whose workers are also independent contractors, are substantial.

## CONCLUSION

State and local policy makers concerned about the labor impact of TNCs face an array of unsettled issues. First, the pay, work rules, and job status of traditional taxi and limousine drivers vary widely from place to place. Drivers in some areas are advocating collectively for improved employment conditions, while in other areas, virtually no such labor advocacy is taking place. In this environment, TNCs have created opportunities for part- and full-time employment for many people who previously were under- or unemployed. Driving for Uber, Lyft, and similar companies may be most beneficial for those for whom driving is a part-time or short-term endeavor, or for those requiring a high degree of flexibility with respect to the timing and duration of work. Driving for TNCs may also be beneficial on a long-term basis for self-reliant individuals who can prosper without the supports of traditional employment that range from health insurance to daily social interaction with coworkers. Moreover, as discussed in Chapter 2, there is some indication that TNCs are expanding the market for rides for hire.

Although many people believe that TNCs are threatening the livelihoods of traditional taxi drivers, how this threat will play out remains to be seen. If net income for TNC drivers is consistently below that of taxi drivers, as currently may be the case after netting out expenses, the current shift of drivers from taxi companies to TNCs could reverse, especially as the taxi companies incorporate technologies for summoning drivers and paying for rides that make TNCs so attractive to travelers. At this unsettled point in time, labor markets appear to be adjusting as drivers seek better opportunities for themselves. In addition, as the overall economy and especially unemployment rates fluctuate, the relative attractiveness of driving for a TNC or traditional taxi operation may change in ways that could impact everything from rates and passenger demand to service availability and quality. In a way, labor issues mirror broader regulatory issues and underline the importance of fairness and equity across vehicle-for-hire sectors. The role of policy makers is to ensure that both taxi and TNC drivers have the opportunity for gainful employment, are subject to fair labor practices, and provide trips to the riding public that meet safety standards. (The safety and security issues raised by TNCs are discussed in the next chapter.)

On the other hand, the outcome of driver lawsuits against TNCs could alter the business models and employment opportunities of these and other firms in the shared economy. At the time of this writing, the California Labor Commission's ruling that an Uber driver is an employee rather than a contractor is under appeal, and the Oregon Bureau of Labor and Industries has ruled that Uber drivers are employees instead of independent contractors. While

these cases are limited in scope, they could lead other states to reconsider the status of TNC drivers and possibly even taxi drivers, who generally also are independent contractors.

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TLPA Taxicab, Limousine & Paratransit Association


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6

# Personal Security and Public Safety

The advent of many of the innovative mobility services, and particularly app-based ride services, has been accompanied by considerable concerns about safety—both personal security (criminal behavior) and public safety (driver and vehicle safety). Critics have argued that because transportation network companies (TNCs) are subject to fewer safety regulations than other for-hire services, they may pose a greater risk to passengers and the public. These concerns have been amplified by a handful of high-profile safety incidents—both crashes and assaults—involving TNC drivers. In this respect, TNCs have encountered the same dynamic as long-time shared-ride services such as taxis: public demand for action based on high-profile cases, but without a systematic analysis of the risks, costs, and benefits of potential approaches to risk management.

This chapter focuses on questions of personal security and safety given that these issues are considerably more complex than many imagine, and because of the current lively debates over the security and safety regulation of TNCs compared with taxis. Security and safety issues have not arisen for other mobility services to the same degree, except for debate over helmet requirements in bikesharing programs, which the chapter does address.

## PERSONAL SECURITY

### Driver Security

Driving other people for money has historically been a dangerous job; drivers are sometimes an easy target for the criminally minded or simply desperate. All for-hire drivers are essentially in the business of letting strangers into their vehicles, and this activity fundamentally involves some risk. (It should be noted that casual carpooling, which occurs in some United States cities, also involves strangers driving together.) Driving a taxi, in particular, is quite dangerous relative to other occupations. The Census of Fatal Occupational Injuries shows that drivers and chauffeurs have a much higher rate of violent death (15 to 20 fatalities per 100,000 workers, 56 to 80 percent of which were homicides, from 2006 to 2012) than workers in general (3 to 5 deaths per 100,000 workers) (Feeney 2015). Taxi drivers, in other words, are more likely to be murdered than the average worker is likely to die of any cause.[23]

Taxi driving has historically been a dangerous occupation because, while the drivers are usually vetted, the passengers are not, and the vehicles typically are not tracked. Particularly in the case of street-hail service, drivers pick up unidentified people off streets, and there may be no record (in the vehicle or with the dispatcher) of where that pickup occurred or where the passenger was dropped off. Taxis also often hold substantial amounts of cash, and many lack secure driver/passenger partitions. In most cities today, taxis are dispatched through computer-

[23] The frequency of taxi and chauffeur homicides is high compared with the frequency for other transportation workers. In 2012, for example there were 28 murders of taxi and chauffeur drivers compared with none of intercity and transit bus drivers (U.S. BLS 2012).

aided systems with GPS, making locations known at all times, but many unknowns still characterize a taxi trip, including passenger identity and destination, particularly with street hails.

The risk of violence against drivers can be reduced if the rider becomes less of a stranger (less anonymous) and/or if the rider has less means or motivation to attack the driver. Anonymity can be reduced by identifying passengers and tracking vehicles, while the means for committing crime can be reduced through physical changes to a vehicle, such as bulletproof partitions separating drivers and passengers. Finally, the motivation for crime can be diminished by reducing the amount of cash in the vehicle. There is some evidence that making street transactions cashless can reduce street crime (Wright 2014).

TNC technologies that match passengers and drivers offer some solutions to these problems by removing the anonymity associated with taxi trips—both among drivers and, especially, passengers. When a passenger books a trip, there is a record of who that passenger is, his or her credit information, where the pickup took place, and the drop-off location and time. The driver and managers at the TNC know the passenger's name, and the trip can be tracked via GPS. Perhaps most important, no cash changes hands—the entire transaction, including any tip, occurs digitally and is not negotiated in the vehicle. TNC vehicles, unlike some taxis, do not have partitions, bulletproof or otherwise, but the absence of both cash transactions and anonymity may make such barriers less necessary (Smith 2005).

**Passenger Security**

Passengers in TNC vehicles can be exposed to risk if drivers behave recklessly, are less skilled than professional drivers, are prone to distraction, or criminally assault passengers. Many critics of app-based ridesharing have raised concerns about the skill and potential criminality of TNC drivers. Some critics also claim that the background checks used to ferret out unsavory drivers are generally more extensive, and effective, for taxi drivers than for TNC drivers, while others counter that less extensive vetting is needed for the latter because passengers retain an electronic record of each trip and driver, including his/her photo. In 2014 and 2015, there were several media reports of (primarily Uber) drivers assaulting passengers (e.g., Annear and Pattani 2015; Huet 2014; Lafrance and Eveleth 2015); there were also several reports of taxi drivers assaulting passengers (Manning 2014; NBC Connecticut 2014; Pulkkinen 2014). The committee was unable to determine whether the rate at which such incidents occur is higher in for-hire transportation than among other types of worker/customer interactions, or whether these incident rates vary appreciably between taxis and TNCs. Therefore, while companies and governments need to take reasonable precautions to prevent such behavior, appropriate precautions are difficult to determine in the absence of good data. The current practice across the car-for-hire industry is to review the criminal background of driver applicants (Daus and Russo 2015). (The lack of a criminal record does not ensure that a driver will not commit an offense in the future, but presence of a criminal record has been shown to be a strong indicator of likelihood to offend again [Kurlychek et al. 2006].)

Most crimes are prosecuted at the state level. Therefore, local and state governments most commonly check for state criminal records of taxi driver applicants. In some cases, these checks include fingerprints; in other cases, just the applicant's name and date of birth are used. In the latter case, the background checks are subject to potential errors resulting from variance in the spelling of names, inclusion of middle names/initials, and so forth. In addition to state criminal record checks, local and state governments have increasingly checked the FBI criminal

record database, which goes back to 1924, and also performed interstate checks to pick up criminal records in neighboring states, a process that can take up to 16 weeks (Lafrance and Eveleth 2015). It is important to note, however, that while the FBI database is national in scope, reporting to that database is voluntary, and thus it is less comprehensive than state records. In addition, local police often send the FBI the fingerprints of people who have been arrested for a felony, but may fail to follow up if that person is later acquitted of the crime or if the charges were dropped or reduced to a misdemeanor. Because almost one-third of felony arrests do not result in a conviction, the possibility of a fingerprint scan's yielding a false positive may be high (Neighly and Emsellem 2013).

Little detailed information is available about the procedures used to assess any criminal records that are found and how many drivers are rejected as a result of background checks. Anecdotal information indicates that regulators make decisions on a case-by-case basis to protect the public while also being fair to applicants.

Uber and Lyft both use private companies to perform background checks on their applicants. The companies providing this service report an average turnaround time of less than 2 days for all applicants (Isaac 2014). The methods the companies use do not include fingerprinting, but do include checks of government criminal records in drivers' counties of residence. These checks are generally less comprehensive than FBI background checks in a geographic sense and have limitations in terms of name matches. Nonetheless, the companies argue that their checks pick up records that are lost in processing before they arrive at a state or federal agency. Uber also has stated that up to 10 percent of driver applicants, including some current taxi drivers, fail the background check (Hui 2015; Lafrance and Eveleth 2015).

Driver background checks are an area in which anecdotes are many but reliable data are few. The International Association of Transport Regulators is developing a national criminal background check clearinghouse for regulators, which will allow the trade organization to collect data on licensee criminal convictions and share those data among states (IATR New Orleans 2014 Recap 2014). Further study of both background check procedures and the frequency and types of incidents that occur in the for-hire industry could be used to evaluate how well these regulatory efforts protect the public and what improvements may be necessary.

Currently, jurisdictions that have legislation specific to TNCs require that each TNC conduct a background check on each potential driver before accepting that driver on its service. Where regulation applies, the state requires completion of a criminal background check that includes a review of the national sex offender database, based on applicant name and social security number. TNCs began driver background checks prior to regulatory mandates, but these background checks are now codified in regulations currently affecting the companies. TNCs reject driver applicants who have had any convictions within 7 years for driving under the influence (DUI), fraud, sexual offenses, any felonies that include a motor vehicle, any crimes involving property damage and/or theft, or acts of violence or terror. Without fingerprints, however, TNCs cannot access the FBI's national criminal database. TNC representatives claim that databases may not be up to date, and external audits have found that the TNCs' background check methodologies offer some improvements over traditional taxi background checks (Isaac 2014). Nonetheless, drivers with driving or arrest records that should have raised red flags do occasionally pass the screening (e.g., *New York Times* Editorial Board 2014).

As of this writing, Uber is using the background screener Hirease to review 7 years of county and federal courthouse records, a multistate criminal database, the National Sex Offender Registry, a social security trace, and motor vehicle records. The company's policy is to reject any

potential driver with a history of any of the following within the past 7 years: (1) any DUI or drug-related violation or severe infraction, (2) hit-and-run, (3) fatal accident, (4) reckless driving history, (5) violent crime, (6) sexual offense, (7) gun-related violation, (8) resisting/evading arrest, or (9) driving without insurance or with a suspended license (Uber.com 2014).

Similarly, as of this writing, Lyft is using the service Sterling (Isaac 2014) to check that a driver applicant (1) is at least 21 years old, (2) has had an active U.S. driver's license for at least 1 year, (3) has had no more than three moving violations in the past 3 years, (4) has had no major traffic violations in the past 3 years, (5) has had no DUIs or other drug-related driving violations in the past 7 years, and (6) has had no extreme infractions (e.g., hit-and-run, felony involving a vehicle) in the last 7 years. For a criminal background check, Lyft checks as well for violent crimes, sexual offenses, theft, property damage, felonies, and drug-related offenses within the past 7 years. Lyft also states that the service does "not allow individuals to drive who are registered on the National Sex Offender Registry and DOJ50-State Sex Offender Registry at the time our background check is conducted, regardless of how long ago the individual was put on that registry" (Lyft.com 2015).

In addition to background checks, neither Uber nor Lyft allows drivers to carry weapons in the vehicle. Uber initially required drivers to adhere to local and state laws on transporting firearms (Shavin 2015), but in June 2015, the company amended its policy to prohibit "firearms of any kind" for both passengers and drivers (MacMillan and Palazzolo 2015). Lyft has a strict no-weapons policy, and if a driver is reported to have a weapon in the vehicle, he or she is removed from the platform. Lyft retains the right to determine "what constitutes a 'weapon'" (Shavin 2015). Rules about weapons in taxis vary by jurisdiction. New York City's Taxi and Limousine Commission, for example, does not permit drivers to carry firearms (Smith 2015), but it is legal for taxi drivers in Washington, DC, to carry a firearm if they have a concealed carry permit (Conneen 2014).

TNCs provide a passenger with information about his or her driver (name, vehicle type, license plate, and anonymized contact information) as soon as the match between rider and driver is made. This information is also included on the emailed receipt so the passenger can access the information after the trip is complete. Most taxi regulations require that the name, photo, and license number of the driver be posted in the cab, but such postings are sometimes difficult to read and quickly forgotten unless the passenger writes down or photographs them, which itself could be perceived as a hostile act by a passenger. In contrast, the sharing of information about driver and passenger occurs automatically with TNCs once a transaction has been agreed upon, and this information is available to the TNC, the passenger, and ultimately law enforcement if required.

Although both the established taxi industry and the new TNCs provide detail about their background check methodologies, the committee was unable to find any careful empirical studies on the effectiveness of any of these methodologies with respect to passenger safety. Current practice, which strikes many as reasonable and prudent, is not evidence of best possible practice.

## PUBLIC SAFETY

### Vehicle Safety Inspections

In addition to driver safety records, which would be uncovered as part of the background checks described above, public regulators regularly impose vehicle safety requirements on taxis and limousines, while TNCs conduct safety checks on drivers' vehicles before approving them for service. Taxi regulators typically conduct vehicle inspections that are more detailed and/or more frequent than state inspection requirements for private passenger vehicles. Nearly all agencies mandate periodic inspections of taxis, and nearly all agencies that regulate limousines impose mandatory inspections as well.[24] Inspections typically are conducted annually, although a few jurisdictions have semiannual inspections, and New York City cabs are inspected three times a year. The inspections vary by jurisdiction but can be highly detailed; San Francisco's inspections, for example, entail approximately 90 criteria on which vehicles are checked, from brakes and steering to interior cleanliness (Scribd 2014).

As of this writing, nearly all regulations by jurisdictions that permit TNC operations require vehicles to undergo an inspection covering all their major components before joining the service and annually thereafter. The inspections of Uber and SideCar vehicles must be performed by certified third-party mechanics. However, Lyft permits the vehicles to be inspected by other drivers, using a checklist provided by the company (Scribd 2015). Uber has expressed interest in allowing "peer mentors" to conduct inspections as well instead of requiring the use of licensed mechanics (Tyrrell 2015).

Vehicle-sharing services typically are not subject to public agency–imposed inspection requirements. Except for peer-to-peer services, carshare and bikeshare vehicles are maintained by the fleet operators and may be subject to safety-related requirements imposed by their insurance policies. Peer-to-peer carsharing companies typically have an age and mileage limit on eligible vehicles to help ensure quality.

### Driver Distraction

An open question is whether the smartphone technologies upon which TNCs rely increase the risk of distracting drivers. While the proven risks of using a phone while driving, even in hands-free mode, have been widely publicized in recent years (e.g., Fitch et al. 2013; Klauer et al. 2014), drivers for TNCs must be alert to their phones continually and respond quickly to requests in order to accept paid rides and earn an income. Uber, for example, alerts an available driver of a service call by beeping, and the driver has 15 seconds to accept the fare by tapping the phone. If the driver does not respond within the 15-second window, regardless of the driving situation, the ride possibility is retracted and provided to another nearby driver. Flywheel, an app dedicated to taxi drivers, also requires very quick responses from a driver; when a customer requests a taxi, the message is sent to several nearby taxis, and the first driver to accept the request gets the fare (Richtel 2014). Uber has been sued by the family of a girl killed by an Uber driver in San Francisco. The suit alleges that the company's use of the app runs afoul of California's distracted driving laws (Williams and Alexander 2014).[25] At this point in time, no research is available on

[24] Based on all agencies responding to the survey conducted for the paper presented in Appendix B and a 2012 International Association of Taxicab Regulators (IATR) survey of taxi regulators (IATR 2012).

[25] Conceivably the driver is not moving when he or she is pinged, since TNC drivers cannot pick up street hails.

the risks of driver distraction from app-enabled services, but given the known risks of cell phone use while driving, the committee believes this is an issue worthy of examination.

### TNCs and Drunk Driving

Driving while intoxicated is a significant cause of both motor vehicle crashes and vehicle-related mortality, and imposes large costs in terms of not only lost lives but also broader economic damage (Blincoe et al. 2014; Subramanian 2012). An analysis released jointly by Uber and Mothers Against Drunk Driving (using public data on drunk driving–related crashes and Uber's own proprietary data) suggests that Uber's entry into different cities may have resulted in less drunk driving. The analysis show that demand for Uber spikes at times when bars close, that crashes declined in months after Uber began operating, and that crashes did not decline in markets Uber did not enter. The analysis further shows, albeit using only one city (Austin, Texas), that taxi availability declines after midnight, when Uber supply rises, in part because of surge pricing that brings Uber drivers out at late hours (Uber and MADD 2015). One possible interpretation of this fact is that without TNCs, many drinkers would not have rides home. Another analysis indicates that the entrance of UberX into a metropolitan area results in a 3.6 to 5.6 percent decrease in the rate of motor vehicle homicides per quarter in California, a potential savings of up to 500 lives annually (Greenwood and Wattal 2015). These results are specific to California and, while encouraging, still leave a great deal of the variation in death rates unexplained.

While these results are promising, they are far from conclusive. The studies conducted to date measured drunk driving in only a few cities, and many factors affect drunk driving, including socioeconomic conditions, population changes, enforcement, and cultural factors. Crash data sets typically lag other traffic-related data by 1-2 years; because TNCs are still fairly new, sufficient data are as yet unavailable with which to complete analytical before-and-after studies measuring the changes in DUI-related crashes after the introduction of TNC services.

### Other Issues

Many carsharing services charge a user based on the time that the vehicle is used, with some services charging by the minute and others by half-hour increments. This may lead to more dangerous driving (e.g., speeding) in order to reduce the length of the trip and therefore the monetary cost to the driver. In addition, driving an unfamiliar vehicle, as carshare drivers do, could potentially pose a safety risk, although such risk would be reduced over time as drivers used the service and the same cars frequently. The committee is unaware of any quantitative research on this topic.

It is worth noting that public safety regulations protecting passengers appear to be missing an important opportunity. One of the most cost-effective passenger safety regulations is the requirement for seatbelt use. Lack of seatbelt use is particularly pronounced in taxis. In New York, for example, the state's seatbelt law does not apply to taxis and livery vehicles (Hu 2015), and in a rider survey conducted by the city's Taxi and Limousine Commission, only 38 percent of passengers reported regularly wearing seatbelts (NYC TLC 2014), even though the state's overall rate of seatbelt use is 90 percent (U.S. BTS 2013).

## BIKESHARE SAFETY

Data limitations make it difficult to draw conclusions about the frequency of bikesharing-related crash injuries (Appendix C contains a summary of research on bikeshare safety). Cycling advocates view requirements to wear a helmet as an impediment to cycling, and many dispute whether helmets reduce injury risk for cyclists. Regarding the latter debate, a paucity of data on cycling crashes and injuries makes it difficult to conduct convincing epidemiological studies. Some recent studies, based on limited crash data, suggest that helmets may not reduce injury risk (Rivara et al. 2015), whereas other recent studies indicate that they are beneficial (Bonander et al. 2014; Wang et al. 2015). Biomechanical analyses suggest that helmets should be highly effective in reducing the risk of head injury in head impacts (Cripton et al. 2014).

The available evidence indicates that between 18 and 40 percent of bikeshare users in selected North American cities wear a helmet regularly, and 15 to 54 percent never wear one (Shaheen et al. 2012, 2013, 2014; see Appendix C). The main explanations given by those who do not wear a helmet are lack of helmet availability for spontaneous trips and the inconvenience of carrying a helmet even when trips are planned (Shaheen et al. 2014).

## CONCLUSION

Personal security and public safety are major concerns for many of the new mobility services, as they are for the conventional for-hire industry, but little research has been done to guide public policy in these areas. Incidents involving abuses of passengers by TNC drivers have drawn considerable media attention. Conversely, little attention has been given to security issues faced by for-hire drivers, who are at higher risk of fatal assault and injury than other workers in general. TNC technologies (and similar apps being adopted by the taxi industry) may mitigate risks to both passengers and drivers by documenting the details of trips and removing anonymity, as may the cashless transactions made possible through TNC billing systems. The lack of similar documentation for routine taxi street hails makes it more difficult to establish abuse by or of taxi drivers. A more thorough evaluation of the benefits of TNC technology for driver and passenger security would help in determining how to approach regulation in this area.

Appropriately, public entities—local authorities and municipal, regional, and state governments—are implementing public safety regulations for TNCs and other shared mobility services. Much has been made of the inconsistencies between the background checks applied to taxi and TNC drivers and of different vehicle inspection requirements for the two types of services. The committee understands the calls for consistent safety regulations across competing providers, but it is also struck by how little information is available on the efficacy of the existing background check requirements. Likewise, vehicle safety inspection requirements vary in their rigor across the for-hire industry. Cities such as San Francisco and New York have stringent inspection requirements for taxis that exceed those for TNCs. That said, the committee could find no evidence on the efficacy of the existing requirements for either taxis or TNCs. Research on the efficacy and relative costs of the different background check and vehicle inspection requirements would be informative for policy makers.

Other public safety issues are worthy of deeper investigation as well. Some evidence suggests that the availability of TNC services reduces drunk driving, although that evidence is preliminary and in need of verification. Taxis also may have this effect, but the technologies and

policies used by TNCs, including surge pricing that expands supply, may encourage better service in late-night hours. Of concern, however, is whether TNC drivers' heavy reliance on smartphones increases the risk of distracted driving; the committee can only speculate on this issue, but it is clearly an area in which further research would be helpful to policy makers.

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### Abbreviations

| | |
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| MADD | Mothers Against Drunk Driving |
| NYC TLC | New York City Taxi and Limousine Commission |
| U.S. BLS | United States Bureau of Labor Statistics |
| U.S. BTS | United States Bureau of Transportation Statistics |


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7

# Insurance

Insurance is an important and complex issue that has been the subject of considerable attention in the transportation network company (TNC) arena. It is a significant consideration for other forms of shared mobility services as well, such as car- and bikesharing. Insurance is critical to compensating injured parties and to providing financial incentives for responsible operation of mobility services. It also is a major cost of operations for providers and a major component of prices paid by users. This chapter begins by briefly reviewing current insurance requirements for taxis. It then explores the considerable insurance challenges facing new technology-enabled mobility services, whose vehicles can shift quickly between private and commercial operation. To this end, the chapter describes both the existing insurance requirements for current and emerging for-hire mobility services and the new "hybrid" policies that are beginning to enter the market. Finally, while much has been made in the media about insurance concerns facing TNCs, other forms of shared mobility, such as car- and bikesharing and microtransit, also face challenging insurance issues; thus, the chapter describes how those services are currently managing financial risk and insurance policies.

## INSURANCE REQUIREMENTS FOR TAXIS

Insurance requirements for taxis are set by local jurisdictions, which nearly always require commercial policies. The coverage limits for these required policies vary greatly, ranging from $35,000 in combined single limits (CSL) (the dollar limit, covering all injured people and all damaged property, that an insurance company will pay per incident) to $2 million in CSL. As of 2013, the median limit required by state taxi regulators was $300,000 in CSL, and the median limits required by local regulators ranged from $300,000 to $1 million in CSL. The committee is aware of no data-based justification for this variation in insurance requirements. The average annual per car insurance premium paid by taxi operators in 2013 was $5,632 for fleets with fewer than 25 vehicles, $6,475 for fleets with 25 to 99 vehicles, and $8,192 for fleets with 100 or more vehicles (TLPA 2013).[26]

## INSURANCE REQUIREMENTS FOR TNCs

As of 2015, few traditional insurance companies offered insurance to TNCs because their risk profile was largely unknown. TNCs instead work with specialty insurers who are able to assume their higher and/or unknown risk in exchange for higher premiums.[27] Traditional insurance

[26] These figures exclude companies that were self-insured.

[27] Often called the "safety valve" of the insurance industry, "surplus lines" insurers fill the need for coverage in the marketplace by assuming those risks that are declined in accordance with the standard underwriting and pricing processes of "admitted" insurance carriers. With the ability to accommodate a wide variety of risks, the surplus lines market acts as an effective supplement to the admitted market. Risks typically covered in the surplus lines market fall into three basic categories: (1) nonstandard risks, which have unusual underwriting characteristics; (2) unique

carriers receive a license from the state's department of insurance for the authority to write specific lines of insurance. Specialty insurers are not required to have a license with a given state and cannot write policies that are typically available from traditional insurance carriers.

There are at least two types of insurance relevant to TNCs. The first is personal insurance specific to each vehicle with a standard insurance carrier; this is the traditional car insurance that any private vehicle owner must carry under state law. The second type is commercial insurance with a specialty insurance carrier that issues a policy to the TNC, not the individual vehicle owner. This latter insurance applies to commercial activities including driving for hire, as opposed to personal activities such as driving alone or with a relative or coworker.

Initially, the TNCs professed the view that the driver's existing automobile insurance would suffice for rides offered through the TNC. Existing insurance included personal insurance for a Lyft or UberX driver and commercial insurance for UberBlack drivers, who were already in the for-hire business. The TNCs strongly opposed insurance requirements that went beyond the individual driver's existing policy; they claimed that since they were simply connecting drivers with customers and were not themselves in the transportation business, they did not need insurance related to the vehicle trips. Private passenger automobile insurers expressed concern about the notion that carrying passengers via one of the TNCs was not a commercial activity and threatened to refuse a policy to individuals driving for the companies. Taxi companies likewise expressed concern that they were being undercut by TNCs because the insurance requirements and costs imposed on traditional taxis were considerably greater than those imposed on TNC drivers. Thus, the shift to commercial insurance for TNCs began.

Commercial insurance is nearly always priced higher than personal insurance for two basic reasons. First, commercial vehicles are driven more miles than personal vehicles—often 50,000 or more miles a year as compared with 7,000 to 12,000 miles for typical personal vehicles. More miles (exposure) equates to greater risk of crashes and therefore higher costs for insurance. Second, the risk of crashes per mile driven is often (though not always) higher for commercial vehicles. Two reasons for higher crash rates for commercial vehicles are posited. First, time is money, and drivers have an incentive to move quickly to deliver goods (for trucks) and passengers (for cabs) so as to move on to the next paying job. Second, research in many fields has found that people tend to treat their own property with more care than property (in this case vehicles) owned by others, such as a taxi fleet company or a permit/medallion holder. Some studies have shown, however, that cab drivers have lower crash rates when the rates are adjusted for miles driven, so the higher crash risk per mile driven is not universal (Schaller Consulting 2006).

In addition to the question of whether a TNC driver's private vehicle insurance will cover incidents that occur while he or she is carrying paying passengers is the question of when and under what circumstances commercial TNC insurance coverage or the driver's personal vehicle insurance is the primary policy. Without clarity on this question, increased transaction costs and litigation are likely to occur in response to crashes and claims involving vehicles used for TNC services.

A second key consideration is ensuring that all of the risk caused by for-hire operations—the added TNC-related mileage when the driver would not otherwise be on the road—is borne by the commercial TNC and not the driver's private insurer, unless the private passenger automobile insurer specifically provides for coverage. As discussed in Chapter 5, most TNC drivers work

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risks for which admitted carriers do not offer a filed policy form or rate; and (3) capacity risks, where an insured party seeks a higher level of coverage than most insurers are willing to provide (NAPSLO 2015).

part-time, some providing just a few paid rides in a month. It is difficult to argue that these part-time drivers should be required to buy commercial policies that are rated and priced on the assumption of full-time, high-mileage operations.

Thus, the keys to resolving the questions around TNC insurance have proven to be clear rules for determining

- Which insurer is the primary carrier, and
- Which insurance company has the sole duty to defend.[28]

Requiring primary commercial coverage and sole duty to defend designation reduces the costs and time delays associated with determining which insurer is responsible for defending the policyholder and primarily responsible for coverage. To the extent that the risks of the ride service operations are greater than the risk of private vehicle use, the insurance costs to the TNC and/or TNC driver might increase. Despite these increased costs, the injured party would still be compensated for bodily injury, property damage, and limited loss of earnings (Uber.com 2015). If the risks associated with issuing the policy were properly calculated and the policy were therefore priced appropriately, settlement costs would be confined to the for-hire pool of vehicles and not paid by private passenger automobile insurers.

California was the first jurisdiction to define periods of TNC service and require varying insurance levels for each. Period 1 is the time during which the driver has the app open and is waiting for a match. In period 2, the driver has accepted a match and is on his/her way to pick up the passenger. Period 3 consists of the time when the passenger is in the vehicle. In period 1, California requires that TNCs provide primary insurance with minimum coverage of $50,000 for bodily injury per person, $100,000 for total bodily injury per accident, and $30,000 for property damage; California also requires the TNCs to provide excess coverage of $200,000 during period 1 to cover any additional costs. In periods 2 and 3, TNCs must provide primary commercial insurance of $1,000,000, with an additional $1,000,000 in uninsured/underinsured motorist coverage during period 3 (California Public Utilities Commission 2015). Many jurisdictions, such as Colorado and Portland (Oregon), followed the lead of California in enacting similar regulations (PFHT Task Force 2015; Salazar 2015). As of July 2015, 27 states and the District of Columbia had enacted legislation that set specific insurance coverage requirements for TNCs, and 5 state legislatures were actively considering such bills (PCI 2015). Many of these bills are based on the California insurance requirements, which reflect compromises reached between the insurance industry and TNCs. Such bills have failed to advance in 14 states—notably New York and Oregon—where regulators have pushed back on TNCs on a variety of fronts; 4 states have no active legislation.

These policies, broadly speaking, require one level of insurance while the ride service app is activated in the vehicle and a higher level of insurance once a passenger is present. The rationale is to scale the insurance coverage limit requirement to the level of for-hire activity risk. This approach addresses the incremental risk of for-hire operation that exists once a call has been assigned to a vehicle. It does not, however, address the risk of the vehicle mileage prior to assignment of a call or after passenger drop-off. This risk can be considerable, as when TNC

[28] The duty to defend is defined as "an insurer's obligation to provide an insured with defense to claims made under a liability insurance policy. As a general rule, an insured need only establish that there is potential for coverage under a policy to give rise to the insurer's duty to defend. Therefore, the duty to defend may exist even where coverage is in doubt and ultimately does not apply" (International Risk Management Institute 2015).

drivers deadhead into downtown areas or airports for the purpose of finding passengers. This approach also risks misclassification of crashes that might reasonably be covered by the TNC policy, as when injured parties may not know that the vehicle was being operated for hire. In that case, the cost of claims paid goes into the experience pool for personal insurance instead of being covered by the commercial policy, as should be the case.

While many jurisdictions have promulgated this sort of a tiered approach to private individual and commercial TNC insurance, another approach is simply to require the same commercial insurance of TNC vehicles as of taxis and other licensed for-hire vehicles (limousine, sedan, or black car services)—the approach taken by Houston, New York City, and others. These policies can have higher costs than coverage for personal vehicles, reflecting the higher risks and mileage involved. While the TNCs opposed these regulations when initially proposed, they have largely complied and were operating in these cities as of 2015. The advantage of this approach lies in the simplicity of having one policy cover all vehicle operations and in the equity across segments of the ride-for-hire industry. It is expected that insurance premiums will be adjusted based on actual losses as insurers gain experience with this class of business.

The disadvantage to wider application of such regulatory simplicity is that it would likely come at a high cost. Classifying and insuring private vehicles that may carry only a few paying passengers each month as full-time commercial vehicles might considerably increase the cost of TNC services or reduce driver incomes, particularly among occasional drivers, for uncertain public interest gain. Moreover, because the GPS-enabled TNC app records all vehicle movements in time and space from call to pickup and from pickup to drop-off, including the routes taken, the opportunity to fine tune coverage such that marginal risk reflects marginal price—as many private insurers are doing with in-vehicle travel-monitoring devices for personal insurance policies—would be lost with a blanket commercial coverage requirement. In fact, as data on the movements of taxis improve, the opportunity for taxi services to shift from expensive full-time commercial coverage also improves. The full-time commercial coverage creates an adverse selection problem, motivating taxi owners to drive their vehicles in commercial service as much as possible. Shifting away from this could potentially reduce commercial insurance costs for taxi companies and would be another approach to leveling the playing field with TNCs.

## HYBRID INSURANCE POLICIES

Some insurance companies are beginning to create policy endorsements that will fill the current gaps between personal automobile policies and commercial coverage for TNC drivers. As of 2015, these policies were being offered by a limited number of insurers, which established coverage using differing methods. Metromile, Farmers Insurance, MetLife, GEICO, the United Services Automobile Association (USAA), Liberty Mutual, Travelers Insurance, Progressive, and Erie Insurance all began offering some sort of insurance policy that either removes the "livery exemption"[29] from existing policies or transforms the TNC driver's personal policy into an excess policy for the period of TNC activity (NAIC 2015). As of 2015, all of these hybrid policies were limited in scope and offered in only a few states. For example, Erie Insurance's policy was available only in Illinois and Indiana; Geico's in Georgia, Maryland, Virginia, and

[29] A livery exemption excludes the transporting of people and/or goods for hire, such as by a taxi service, motor carrier, or delivery service, from being covered under an automobile insurance policy.

Texas; and USAA's in Colorado and Texas (NAIC 2015; The RideShare Guy 2015). If these hybrid policies become better established and widespread, insurance companies will have continually better actuarial-based data for analyses of crashes and exposure risks associated with TNC service.

## CARSHARING

Carsharing presents its own set of insurance challenges, many of which emerged after the terrorist attacks of 9/11. At that time, North American carsharing operators were faced with substantially higher premiums relative to those of individual private vehicle owners, premiums that often exceeded $2,500 per vehicle annually (Shaheen et al. 2006). Although insurance has become increasingly available and more affordable for carsharing operators, the situation remains far from settled. For instance, Buffalo CarShare, a nonprofit provider, ceased operation in June 2015 because of loss of insurance coverage. The insurance carrier, Philadelphia Insurance, decided to withdraw coverage in part because of New York State's personal injury protection laws, which require insurance carriers to pay for medical bills due to a crash regardless of fault. These laws have greatly limited the number of companies offering carsharing insurance, and the provider could not find another insurance carrier willing to offer coverage (Johnson 2015). In other states, similar nonprofit carsharing programs are covered through the Alliance of Nonprofit Insurers (ANI), which at present does not operate in New York and cannot provide service there. ANI currently provides automobile coverage in 34 states (Drury 2015).

In 2005, Congress passed the Graves Amendment as part of the surface transportation funding reauthorization bill; this amendment protected rental car companies from vicarious liability.[30] In 2009, a driver rear-ended by a Zipcar vehicle sued both the driver and Zipcar, claiming that Zipcar should be held responsible for deaths, injuries, and property damage resulting from negligence in the use and operation of its vehicles. In 2010, the New York Supreme Court ruled that Zipcar was entitled to protections against vicarious liability afforded by the Graves Amendment.

Zipcar provides third-party automobile liability coverage to its members as either personal injury protection (PIP) or no-fault coverage, depending on the requirements of the jurisdiction in which the accident occurs. Members are generally responsible for a $1,000 damage fee per incident, and Zipcar provides liability coverage of $100,000 bodily injury per person, $300,000 bodily injury maximum, and $25,000 property damage (Zipcar 2015).[31] In general, many carsharing programs are moving toward providing blanket $1 million liability policies, making Zipcar an outlier in terms of coverage limits.

[30] Vicarious liability is defined as liability that a supervisory party (such as an employer or, in this case, the rental car company) bears for the actionable conduct of a subordinate or associate (such as an employee or, in this case, renter) based on the relationship between the two parties. Under common law, a member of a conspiracy can be held vicariously liable for the crimes of his or her coconspirators if the crimes committed by the coconspirators were foreseeable and if they were committed with the intent of furthering the objectives of the conspiracy.

[31] Listed insurance limits are for members aged 21 and over. Members under 21 receive coverage only up to the minimum financial responsibility limits required in the jurisdiction in which the accident occurs. However, members who joined Zipcar with a university may see different financial responsibility limits, depending on the school's agreement with the company. Listed insurance limits are also for members who joined Zipcar on or after March 1, 2015. Members who joined prior to this date receive liability coverage of $300,000 in CSL per incident.

Insurance coverage for car2go (a one-way carsharing provider) varies by state, but it generally provides $100,000/$300,000/$50,000 bodily injury liability per person/bodily injury liability per incident/property damage liability, respectively, plus uninsured motorist coverage of at least $10,000 and often more, as well as collision and comprehensive coverage with a $1,000 deductible (car2go 2015). In these two large carsharing programs, drivers using carsharing services are covered, but the coverage varies by company.

Peer-to-peer carsharing (e.g., RelayRides, Getraround, FlightCar) also raises insurance questions. As with TNCs, most state insurance laws have not kept pace with the growing array of peer-to-peer models. And as with TNCs, the fundamental insurance issue with peer-to-peer carsharing is defining when the vehicle owner's policy ends and when the peer-to-peer carsharing operator's commercial policy begins. Legislation covering peer-to-peer vehicle insurance was ratified in California, Oregon, and Washington as part of AB 1871, HB 3149, and HB 2384, respectively (Shaheen et al. 2012a). The first U.S. peer-to-peer insurance legislation, California's AB 1871, in particular has served as a model for such legislation in other states. These three laws classify peer-to-peer carsharing as noncommercial use and limit "the circumstances under which the vehicle owner's automobile liability insurance can be subject to liability" to prevent cancellation of primary automobile insurance policies (AB 1871 2010). The peer-to-peer carsharing operator assumes liability when the vehicle is rented in a shared capacity, and the owner's insurance policy resumes coverage once the vehicle has been returned. Because the vehicles are being used for commercial purposes, the driver's personal automobile policy typically becomes void because of exclusions for rentals and commercial activity. Vehicle owners who share their automobiles in states lacking peer-to-peer carsharing legislation risk nonrenewal of primary insurance policies or premium spikes resulting from increased use (Shaheen et al. 2012a).

As of 2015, RelayRides, for example, covered vehicle owners with a $1 million liability insurance policy and provided three insurance options for renters: (1) a premium package with a deductible of $500; (2) a basic package with a deductible of $2,500; and (3) an option to decline coverage, meaning that the renter is personally accountable for all costs related to vehicle damage or liability (RelayRides 2015). In February 2012, the driver of a vehicle rented from RelayRides caused a crash in Boston, which injured four others and killed the driver. The four survivors sued the estate of the driver, the car's owner, and RelayRides. All four cases were settled out of court for an undisclosed amount (McQueen 2013).

## BIKESHARING AND MICROTRANSIT

Bikesharing programs do not have statutory protections against vicarious liability. Unlike car renters, bikeshare users lack the ability to purchase insurance at the time of a mobility transaction. Thus, the user and possibly the bikesharing operator are responsible for the conduct and damages associated with their program's equipment. Increasingly, bikesharing programs are purchasing a variety of insurance types to protect them from a wide range of liability (Shaheen et al. 2012b). Although most bikesharing operators maintain insurance to protect against litigation, most policies do not protect riders against medical bills and lost wages associated with bicycle collisions (Glover 2013).

Owners and operators of bikesharing programs can also be sued if one of their bicycles is involved in a serious collision resulting in injuries, fatalities, or property damage. Bikesharing

owners and operators can manage risk and limit their liability by having users sign waivers or indemnification clauses, keeping equipment well maintained, and educating users about bicycle and roadway safety. As of 2012, all North American bikeshare operators required users to sign liability waivers prior to using their services (Shaheen et al. 2012b); these waivers severely limit the coverage available to a user in case of an incident. Some homeowners' insurance policies will also provide coverage to their policyholders.

While these waivers certainly make financial sense for the bikesharing programs, they may not be in the public interest. For example, New York's Citi Bike does not provide insurance coverage for its users, who are responsible for all injuries and damages incurred while using the bikes. Motivate, the company that operates the service, has a $10 million insurance policy, but the user contract limits customers to $100 in claims against the operator (Citi Bike 2015). Liability insurance for the bikesharing operator can start at $5,000 annually for a $1 million policy, with minimum liability coverage varying depending on the requirements of the property owners where the bikesharing stations are located.

Finally, microtransit services generally are required to be covered by commercial automobile insurance. Bridj's application to provide service within the City of Boston was not approved until the service provided proof of its insurance coverage (Byju 2014). The California Public Utility Commission required Leap Transit to suspend its California operations in May 2015 in part because it had not provided proof of insurance to the state (Rauber 2015); the company later filed for bankruptcy. Chariot, another service operating in San Francisco, simply states that "all Chariot riders are fully insured above the state's minimum" (Chariot Transit Inc. 2015).

## CONCLUSION

Insurance coverage for the growing array of technology-enabled mobility services is still evolving, complicated by the fluid and contingent nature of shared mobility. When is a vehicle private, and when is it commercial? How is risk assessed and insurance secured for vehicles shared among many, even thousands of drivers/riders? These and related questions are only now being addressed in the face of continued rapid growth in the sharing economy generally and these new transportation services in particular. A major challenge to insuring these services is that the insurance industry evolves more slowly relative to technology startup companies. Insurance underwriting is based on risk, which underwriters estimate based on experience that, in the realm of these new services, is often in short supply. As these new shared mobility services established track records, providers' access to a robust set of insurance options is likely to broaden. To date, moreover, 27 states have adopted laws that are based largely on the precedent-setting insurance requirements adopted earlier in California that close the gap between coverage applying to taxi drivers and to TNC drivers while engaged in a commercial activity.

A major public policy issue at present concerns the costs of insurance for taxi operators and TNCs. Data were available to the committee on taxi industry insurance costs per vehicle per year, but the only available information about TNC insurance is on the coverage provided and not the cost. Part of the issue is that most TNC drivers work part-time, and much of the insurance coverage provided applies when the driver has a passenger; hence the insurance is a marginal rather than an average cost. In comparison, taxi operators are paying an average cost since their vehicles tend to be operated on a full-time basis. To the extent that TNCs have lower insurance

costs, they have a cost advantage over traditional taxi and sedan operators. One solution would be to require traditional full-time commercial vehicle coverage of TNCs, as is currently common with taxis; another would be to shift taxis to similar variable insurance rates that take into account level, location, and time of travel.

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### Abbreviations

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| AB | Assembly Bill |
| NAIC | National Association of Insurance Commissioners |
| NAPSLO | National Association of Professional Surplus Lines Offices |
| PCI | Property Casualty Insurers Association of America |
| PFHT | Private For-Hire Transportation |
| TLPA | Taxicab, Limousine & Paratransit Association |

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8

# Equity and Access

Many of the public policy debates over the rise of new technology-enabled mobility services concern matters of fairness and equity. For example, is the taxi industry being treated fairly vis-à-vis the new transportation network companies (TNCs)? Are those without smartphones unfairly excluded from these new services? Are TNC drivers treated fairly as workers?

Transportation access is an issue of particular concern, as it is central to nearly all aspects of economic and social life. Many segments of the population have limited access to jobs, goods, services, health care, recreation, and social interaction because of a lack of transportation options. The reasons behind this limited access are varied, including physical disabilities, low incomes, and discrimination, among others. The innovative mobility options discussed in this report have the potential to increase the accessibility of transportation for many Americans, including these disadvantaged populations. But they may also leave people who are already transportation-disadvantaged further behind, either because they will not be able to take advantage of these new services (making them relatively worse off) or because the rise of these new services could reduce some existing services (making them absolutely worse off).

This chapter examines both the potential challenges and opportunities related to equity and access presented by the burgeoning innovative mobility services in the United States. It begins by proposing a framework for thinking about the dimensions of equity with respect to these new services. The chapter then considers issues of equity and access for various disadvantaged groups, including racial and ethnic minorities, people with disabilities, low-income households, "unbanked" populations,[32] people without smartphones, and rural residents.

## DIMENSIONS OF EQUITY

Because the new technology-enabled services are provided primarily by the private sector and because they are evolving so rapidly, issues of fairness and equity raised by these services and the established modes with which they often compete are complex, multidimensional, and sometimes conflicting. The dimensions of these issues can be characterized in terms of

- Firms, markets, and competition;
- Regulations, subsidies, and social services;
- Geographies and jurisdictions; and
- Stakeholder groups (see Table 8-1).

[32] The term "unbanked" refers to people who lack credit or bank accounts.

**TABLE 8-1 Four Dimensions of Equity in Public Policy Debates over Technology-Enabled Mobility Services**

| Equity Dimension | Issues Raised |
|---|---|
| Firms, markets, and competition | Market dominance, unfair competition, regulatory capture |
| Regulations, subsidies, and social services | Regulatory consistency, public subsidy winners and losers, social service transportation obligations |
| Geographies and jurisdictions | Service in high- versus low-demand areas; service in poor, minority neighborhoods |
| Stakeholder groups | People without smartphones, "unbanked" populations, workers, etc. |

This section addresses each of these dimensions in turn.

### Firms, Markets, and Competition

Most of the new and emerging mobility services discussed in this report are financed privately, with little in the way of direct public subsidy. They typically compete for customers on price and service quality, both of which can depend significantly on the firms' economies of scope and scale. Large firms are better able to provide service over wide geographic areas and around the clock, which can give them a competitive advantage over smaller rivals, and a substantial market share can give them leverage with drivers and suppliers that enables them to hold costs down. But the emergence of dominant players in private markets also can lead to market-cornering behaviors, efforts to convince public officials to erect barriers to market entry so as to squelch competition, and the "regulatory capture" of public agencies that may succumb to especially dominant firms. Thus the public policy equity challenge with respect to firms and competition in these private markets is to ensure fair, open, and competitive markets among new and yet-to-emerge private service providers. In addition, because these services do not receive direct public subsidies, and most also do not benefit from public regulations that restrict competition, one of the main tools local governments use to advance equity agendas—conditioning a subsidy to or privilege for a firm on that firm's performing some redistributive function—may not be available.

### Regulations, Subsidies, and Social Services

Nearly all of the new services examined in this report are, or likely will be, regulated in some manner in the interests of safety, public health, worker protections, and other public concerns. And many of these regulations, such as those imposed on TNCs and the taxi industry, entail different sets of rules applied to very different, competing new and long-established industries. Further, some of these new services, such as car- and especially bikeshare services, entail varying degrees of public collaboration with and/or subsidy of some private firms but not others. Finally, some of these new services compete with existing firms that provide both private, for-profit services and social service transportation—such as mandated wheelchair-equipped door-to-door services provided by taxi operators. Ensuring fair regulatory treatment across industries, transparent treatment of firms engaged in public–private partnerships, and continuation of current social service transportation thus poses significant challenges for public officials in a rapidly evolving mobility service environment.

### Geographies and Jurisdictions

Almost by definition, many of the newly emerging technology-enabled mobility services defy traditional geographies of service provision. Most (though not all) of the new services entail door-to-door or station-to-station travel that adheres to neither fixed routes nor fixed schedules. Further, as private, primarily for-profit enterprises, these new firms tend to arise and propagate where customer demand is greatest: generally in the largest metropolitan areas, in the most densely settled parts of cities, and in more affluent areas with large numbers of potential customers who have the disposable income to pay for the services. If these services are viewed largely as the product of private transactions between willing buyers and sellers, then the boundary crossing and geographic concentration of these services is not necessarily a public concern. But if carshare, bikeshare, microtransit, TNC, and other services rise in scope and scale to become important components of urban transportation systems, cross jurisdictional regulatory regimes, or provide quality service in lucrative (and affluent) areas but not in others, they become important matters for public policy.

### Stakeholder Groups

Federal laws prohibit discrimination on the basis of race or ethnicity and require that accommodations be made for those with disabilities. Such rules, for example, significantly affect the provision of public transit services in ways that both ensure justice and often raise the costs of service provision. Other classes of travelers may not enjoy such explicit federal protections, but nonetheless warrant consideration of treatment on fairness grounds. They include, among others, (1) people who, because of income limitations or disability, are unable to have or fully use smartphones; (2) workers in existing industries (such as the taxi industry) who may be displaced by these new services; and (3) “unbanked” travelers unable to make use of most of these new cashless services.

With the rise of mobility services in general and TNCs in particular, equity dimensions are in play for all of the above groups. The next section examines equity issues related to the subgroups of stakeholders whose interests may be furthered or harmed depending on how the urban mobility services evolve in the coming years.

## INTERGROUP EQUITY ISSUES

### Racial and Ethnic Minorities

The extent to which different racial and ethnic groups use and have access to technology-enabled mobility services may have implications under Title VI of the Civil Rights Act of 1964. While the use of these services across various racial/ethnic groups has not been well studied, the limited data available suggest that they tend to be used disproportionately by whites. With respect to carsharing, a 2005 study that examined carsharing in 13 U.S. cities found that 87 percent of the carshare users surveyed were white (Millard-Ball et al. 2005). Likewise a study of bikesharing in Washington, DC, found that about 80 percent of the members were white, and under 4 percent were African American (Buck et al. 2013), as compared with a city population that was 43 percent white and 50 percent African American (U.S. Census Bureau 2014). Surveys of

bikeshare members in four North American cities (Washington, Minneapolis, Toronto, and Montreal) found that 79 percent were white (Shaheen et al. 2012b). The reasons for generally low rates of usage of these services among nonwhites are not clear, although they may relate to some combination of the geographic availability of the services, differences in average income levels across racial/ethnic groups, and differences in modal preferences and demands across groups.

There has been much debate in the popular media concerning TNCs and race/ethnicity. Some journalists, based mainly on personal experience, have suggested that TNCs may provide racial/ethnic minorities with more frequent service than taxis with fewer trip rejections (Wortham 2015). Critics have long complained about (and documented) racial/ethnic discrimination in the taxi industry: in many cities, racial and ethnic minorities have difficulty getting taxi rides, and neighborhoods that are disproportionately minority have traditionally been underserved. A recent poll of Chicago residents, for example, which was funded by Uber, found that 66 percent of African Americans surveyed believe that taxis deliberately avoid serving them; 55 percent have experienced a refusal by a taxi company to serve their community; and 48 percent believe that if they tried to hail a cab, it would pass them by (Brilliant Corners 2015). This same poll showed that a plurality of white citizens of Chicago agree that cabs deliberately avoid serving African American citizens.

The technology used by TNCs could conceivably help counter such abuses (Rogers 2015) because, for example, TNC drivers must accept a ride request without knowing in advance either the destination or the race/ethnicity of the passenger. Officials with Uber have asserted that its drivers serve diverse communities often underserved by taxis (MacDonald 2014). On the other hand, systems that rely on user-generated ratings and shared profiles are susceptible to bias and possible abuse (Harman 2014; Rogers 2015). One study found that African American hosts of Airbnb properties in New York City received lower rental prices, even after controlling for other factors; the authors concluded that discrimination occurred via the online profiles (Edelman and Luca 2014). Many TNCs, however, do not show the driver either the photo or profile of the passenger or the destination when a ride is requested, reducing the possibility of discrimination against riders. Yet anecdotal accounts in the popular press indicate that bias may be exercised through the rating systems that come into play after the ride takes place—both by the driver toward the passenger and by the passenger toward the driver (see, for example, Barrie 2015; Hern 2014; and Weissmann 2014). While few data are currently available from TNCs with which to examine these questions, research in other fields has documented racial bias in hiring processes based on both photographs and names (Bertrand and Mullainathan 2003; Pager and Western 2012). It is possible that a TNC could refuse to accept ride requests from passengers with ethnic-sounding names, although frequent declinations can put TNC drivers at risk of probation for failing to meet the TNC's take-up mandate. Lacking data on TNC services, users, and drivers, it is not possible to assess these arguments.

### People with Disabilities

Roughly 10 percent of the U.S. population (30.6 million) has a physical limitation of some kind; among those with such limitations, 3.6 million use a wheelchair, and another 11.6 million use a cane, crutches, or a walker (U.S. Census Bureau 2012). Access to car-for-hire services for those with disabilities has been an issue in the taxi and limousine industries for many years. While some jurisdictions, such as New York City, have seen success in expanding the supply and

availability of wheelchair-accessible cabs, many other areas have struggled to expand their accessible vehicle fleets. The primary obstacles involve the cost of acquiring and operating accessible vehicles, including fuel and maintenance expenses, higher insurance premiums, the need for special driver training, and lower productivity due to the extra time involved in serving customers in wheelchairs.

Some cities have imposed fees on taxi permit holders or on all passengers to subsidize the higher capital and operating costs of serving passengers with disabilities. Such fees include a 30-cent per trip fee added to fares in New York and a $100 annual fee imposed on Chicago medallion owners that do not operate an accessible vehicle. Although the funds are used to help offset the added expenses incurred by owners and drivers of accessible vehicles, such financing mechanisms raise equity questions of their own by singling out a particular group, such as other taxi passengers, rather than taxpayers more broadly to underwrite the costs of a social service (accessible door-to-door transportation) widely viewed as both socially desirable and mandated by federal law.[33]

Aside from tradition, there is no inherent logic in having taxi riders, rather than taxpayers more broadly, subsidize the accessible rides of people with disabilities. This is the case particularly because taxi riders tend to be either highly educated (and affluent) or quite poor. Low-income households use taxis more often than middle-income households and at about the same rate as high-income households (Pucher and Renne 2003; Renne and Bennett 2014). Although fewer than 1 percent of trips made by low-income households are in taxis, more than 40 percent of all taxi users in urban areas are from households with incomes under $20,000 (which account for only 22 percent of all households) (Renne and Bennett 2014). On the other hand, only about 28 percent of people with severe disabilities are poor. So under schemes to impose per ride fees to increase access for people with disabilities, low-income taxi riders would pay disproportionately high per trip and per mile fees to subsidize people in wheelchairs who might well be more affluent than they are.

In some jurisdictions, then, a per ride fee that finances accessible vehicles may well be regressive. Given that it is in the interest of all Americans to provide mobility for people with disabilities, it may be wiser to finance these subsidies with a broader tax instrument. Moreover, basic public finance principles suggest that redistribution should be accomplished through broad tax instruments at high levels of government. In the absence of intergovernmental help, cities may be justified on equity grounds in using general fund revenues to pay for such programs.

There is also debate over how well, and to what extent, TNCs should be obligated to serve the needs of people with disabilities. If TNCs are viewed primarily as ridematching and payment processing services that link people driving their own cars with willing customers, the obligations of these drivers to accommodate the special needs of particular passengers are unclear. But if these services are viewed as a central new component of public and private urban transportation systems, the requirements of the Americans with Disabilities Act (ADA) may need to apply to TNCs—a question that has yet to be settled. It is not certain what role, if any, TNCs might play in helping transit agencies with ADA paratransit. TNC representatives claim that they are not providing public accommodations and therefore need not comply with the ADA accessibility provisions. For the reporting year 2013, the Federal Transportation Administration's National Transit Database (NTD) shows that almost 10 percent of the approximately 850 urban

[33] The city of Portland, Oregon, is testing the use of a service performance standard tied to response times and service requests that would apply to both taxis and TNCs, instead of relying on fleet vehicle requirements for taxis (PBOT 2015).

transit agencies use taxis for their demand response mode, which is mostly paratransit. To the extent that TNC competition hurts the taxi industry, the public transit industry loses or at least has a very diminished and weakened resource that many transit agencies use to help meet their ADA paratransit requirements (KFH Group, Inc. 2015).

TNC apps may facilitate automobile access for the blind; for example, they provide voice options, allowing easy vehicle requests from a smartphone without the need to see a passing taxi and hail it on the street. Cashless transactions eliminate the question of what change a taxi driver has provided, and the driver is not aware that the passenger is sight-impaired before accepting the ride. And an Uber black car competitor has added features to make its service more accessible to the blind (Alba 2015). At the same time, however, accommodating guide dogs in TNCs has become an issue. A lawsuit filed in San Francisco by the National Federation of the Blind alleged that Uber discriminated against blind passengers with service dogs (Bay City News 2014). Disability rights advocates also have filed lawsuits against TNCs in Texas and California regarding access for passengers with wheelchairs (Rosenthal 2014; Wieczner 2015). The Department of Justice issued a "Statement of Interest" in the San Francisco case, supporting the application of the ADA to Uber services and indicating that "Plaintiffs do not need to show that Defendants are public accommodations or operate a place of public accommodation to succeed on their ADA claim" (Gupta vs. U.S. Department of Justice 2015). As of this writing, the case is pending.

As courts continue to deliberate whether ADA rules apply to TNCs, there is a related potential consequence of TNCs for access by people with disabilities: as mentioned in Chapter 3, the rise of TNCs could result in a net loss of wheelchair-accessible vehicles if other services operating these vehicles are reduced or driven out of business by TNCs. The cities and other jurisdictions that typically regulate taxis have provided various incentives for both taxi companies and drivers to operate them, which have met with varying degrees of success. But as TNCs have grown and, in some places, taken a substantial share of taxi business, these incentives may no longer be effective. In San Francisco, for example, the Metropolitan Transportation Authority reported in 2014 that a quarter of the city's accessible taxis were idle because no drivers with proper training were available to operate them. Also reported was a significant decline in the number of wheelchair trips made in cabs over the same period (Kwong 2014). Data provided by the San Francisco Municipal Transportation Agency indicate a 43 percent decline in wheelchair-accessible taxi trips between fiscal years 2012 and 2014.

For both taxis and TNCs, moreover, serving the needs of patrons who use wheelchairs by having accessible vehicles on hand is only one aspect of providing access for people with disabilities; having the vehicles does not equate to having service. Some cities, such as New York and Washington, have mandated having a central dispatching mechanism for accessible cabs so as to reduce response times, as well as having drivers properly trained and motivated to serve the unique needs of these customers (see Appendix B).

As the largest operators in the TNC industry, Uber and Lyft are likely to play central roles in addressing issues of access for people with disabilities. Uber approached the City and County of San Francisco, for example, to take over the city's paratransit services for the elderly and those with disabilities (Rodriguez 2015). Because of unresolved insurance issues, however, those talks did not culminate in an Uber/San Francisco agreement (Kwong 2014). Uber also has created a variation of its service, known as UberWAV, that provides wheelchair-accessible vehicles (WAVs) as a specific request option. UberWAV connects riders with wheelchair-accessible "boro taxis" in the outer boroughs of New York City. Payment is not made through

the Uber app; instead, it is made to the driver as in traditional taxi transactions (Uber.com 2014). In mid-2015, Uber introduced UberAssist in Los Angeles, a service that offers drivers with special training and vehicles capable of handling wheelchairs, walkers, and scooters (Alba 2015). Similarly, Lyft allows users to enable an "Access Mode." Both of these services dispatch vehicles that are specially outfitted to accommodate wheelchairs, typically at a cost that compares with that of limousine or UberBlack service.

### Low-Income Households

While the cost burden of vehicle ownership is significant for lower-income households (Blumenberg and Manville 2004; Deka 2002), studies have shown that ownership of private vehicles substantially increases accessibility, which helps people acquire and keep better jobs (Blumenberg and Ong 2001; Grengs 2010; Shen 2001; Taylor and Ong 1995). In this context, innovative mobility services have the potential to provide enhanced accessibility without the cost burden of vehicle ownership.

Carsharing can reduce household transportation costs, often through reduced vehicle ownership costs (Lane 2005; Martin et al. 2010). However, some surveys of carsharing members have found low participation rates among lower-income households (Martin and Shaheen 2011; Martin et al. 2010; Millard-Ball et al. 2005). Similarly, surveys of bikeshare members have found that the services tend to attract disproportionately customers with moderate and higher incomes (Buck et al. 2013; Shaheen et al. 2012a). Identified barriers to participation in shared vehicle services by low-income individuals include a dearth of stations in low-income neighborhoods; transactionally complicated rules of membership and use; requirements to hold credit cards and have Internet access; high prices; lack of information about the new services; and cultural factors, including distrust of authority or discomfort with shared mobility systems (Kodransky and Lewenstein 2014). Nonetheless, many low-income households may participate in informal sharing of cars within their community (Giuliano and Moore 2000; Blumenberg and Smart 2013; Roy et al. 2004).

Car- and bikesharing providers locate vehicle stations largely on the basis of demand. In addition, for-profit providers and those relying on advertising revenues may be influenced by neighborhood income levels in locating stations. The same observations could apply to the boundaries of a floating or one-way carsharing system.

The evidence on this issue related to carshare stations is not conclusive. An analysis of carsharing stations in 13 cities found that income levels around the stations were not noticeably different from those for the region, although there were "substantial variations from city to city" (Millard-Ball et al. 2005). The share of households with incomes over $100,000 was positively correlated with the level of carsharing service (as measured by the number of vehicles available) in one city and negatively correlated in three others. The study did find that stations were more likely to be in neighborhoods with smaller households, higher education levels, lower vehicle ownership rates, more transit use, and higher density. In contrast, however, an analysis of carshare stations in a single city did not find that neighborhood income was a significant factor in predicting use (Stillwater et al. 2009).

There are ways to overcome the barriers to participation in vehicle sharing among low-income individuals. Nonprofit carsharing services, such as Buffalo CarShare in Buffalo, New York, target services to lower-income households and neighborhoods. In contrast to many other systems, about half of Buffalo CarShare members were found to have incomes of $25,000 or less

(Randall 2011). The City of Denver's regulation allowing carsharing vehicles to have dedicated on-street parking spaces requires operators to locate at least two vehicles in higher-poverty neighborhoods (City and County of Denver 2013). Similarly, Washington, DC, requires providers to locate vehicles in low-income neighborhoods (Shaheen et al. 2010). And officials with the California Air Resources Board are planning to fund pilot carsharing projects in disadvantaged communities using funds from the state's Cap-and-Trade program (California Air Resources Board 2015).

Peer-to-peer (P2P) carsharing has the potential to increase low-income people's access to carsharing vehicles, since the vehicles can be located anywhere a willing owner lives (Dill et al. 2014), although little research has evaluated this potential (Ballus-Armet et al. 2014; Shaheen et al. 2012a). One early study of renters signing up for a P2P service in Portland, Oregon, found that about 40 percent of those surveyed had incomes under $35,000, only slightly higher than the city average overall. However, lower-income adults aged 35 or older were the most frequent users of the system (Dill et al. 2015).

Bikeshare operators also have been criticized for not placing stations in low-income communities (Kodransky and Lewenstein 2014). However, several bikesharing programs are offering reduced memberships for low-income users and programs targeting the unbanked population (Kodransky and Lewenstein 2014), and the Better Bike Share Partnership is using grant funding to increase access for low-income users in Philadelphia and other cities.[34] The effectiveness of these efforts in increasing bikesharing among low-income individuals has yet to be proven. Some early efforts, such as discounted and free memberships in Denver, were not as successful as hoped, pointing to the need for more comprehensive approaches that also address cultural and other barriers beyond cost (Kodransky and Lewenstein 2014).

Very little research to date has examined low-income individuals' access to TNCs. In a study of 380 TNC passengers in San Francisco, Rayle and colleagues (2015) found that users generally were younger and more highly educated than the city average (84 percent had a bachelor's degree or higher). As noted earlier, however, taxi use is relatively high among low-income households (Renne and Bennett 2014). Thus, taxi riders tend to be either highly educated (and affluent) or quite poor. Low-income households use taxis more often than middle-income households and at about the same rate as high-income households (Pucher and Renne 2003; Renne and Bennett 2014).

Renne and Bennett (2014) also found that taxi trips by the lowest-income households in urban areas are the shortest compared with those of other income groups, averaging just 4.3 miles. To the extent that TNCs provide services similar to those of taxis for people without automobile access but at a lower cost, TNC services could meaningfully increase accessibility for low-income individuals. However, some of the barriers faced by low-income individuals with respect to vehicle sharing, such as lower levels of access to credit, the Internet, and smartphones, would similarly apply to TNCs.

Despite the frequent use of cabs among lower-income travelers, taxi regulators have long contended with cab companies over the level and quality of taxi service provided in low-income communities (Gilbert and Samuels 1982). With the rise of TNCs, those concerned about equity have suggested that TNC service in low-income communities is not monitored as carefully as it tends to be for taxis.

At least one carefully designed study comparing TNC and taxi service and prices in Los Angeles suggests that TNCs may provide residents in low-income neighborhoods who have

[34] See http://www.peopleforbikes.org/pages/better-bike-share-partnership.

smartphones and credit cards with a faster and more economical transportation option relative to taxis (BOTEC Analysis Corporation 2015). In the study, pairs of riders were recruited to simultaneously call for taxi service and use a mobile app to call for an UberX car along routes preplanned for the study. Initial findings showed that the average total wait time for UberX was almost 8 minutes from the time of a ride request until a driver arrived for pickup, compared with a total wait time for taxi service of almost 19 minutes. The average cost of an UberX ride, $7.26, was less than half that of a taxi, which cost an average of $17.09. The researchers then conducted a series of follow-up tests to check the validity of the initial findings and data management procedures, such as the exclusion of outlier wait times that were exceptionally long and could have skewed the results; the follow-up tests produced similar results. The findings of this study thus suggest both that TNCs (in this case Uber) do serve low-income neighborhoods in the absence of regulation requiring them to do so and that the prices for their service (at least in Los Angeles) are consistently lower than those for taxi service.

This study, it should be noted, was funded by Uber Technologies, Inc. and requires independent replication in other cities and in different types of low-income neighborhoods to produce generalizable findings about the relative geography, service quality, and price of TNC and taxi service. For example, the neighborhoods in the study had average incomes of $50,000 or less (a definition of low-income that is used by the Los Angeles Housing Authority and is less than 80 percent of the Los Angeles median income for a family of three), but the neighborhoods selected were not those with the highest crime rates. If the study findings hold, low-income travelers who are more likely than those in higher-income households to have limited or no private vehicle access may benefit significantly from faster and more affordable door-to-door service offered by TNCs relative to taxis. But because the findings are from a sample of low-income neighborhoods in just one large city, they should be viewed as preliminary and not definitive.

### Unbanked Populations

A sizable number of Americans currently do not have access to many of the technology-enabled mobility services examined in this report because of their lack of revolving credit and/or bank accounts. The Federal Deposit Insurance Corporation (FDIC) has done extensive research on the so-called “underbanked” and “unbanked” populations, whom they collectively term the “underserved” (FDIC 2014). The FDIC estimates that 17 million people (8 percent of U.S. households) are unbanked in that they do not have a bank account. The percentage of unbanked households has remained fairly steady since 2009 (7.6 percent in 2009, 8.2 percent in 2011, and 7.7 percent in 2013), suggesting that this rate is likely to remain consistent (FDIC 2014), at least in the near term. The reasons for a lack of banking services are related to both income (insufficient funds and costly services for low-balance customers) and attitude (lack of trust in institutions and privacy concerns) (FDIC 2014).

If the burgeoning new technology-enabled mobility services are to be available to all passengers willing to pay, alternative payment options for those without credit or bank accounts will be needed.[35] To date, however, TNCs appear to have made little effort to address the

[35] While such policies may aim to increase access for the unbanked, they could inadvertently undermine safety aspects of TNCs for drivers if not implemented with care. The current TNC credit card requirement eliminates passenger anonymity, thereby increasing safety. If passengers were permitted to use anonymous prepaid debit cards on a prepaid cell phone, their identity could be lost should problems arise.

financially underserved, although Uber is conducting a pilot in India to test cash payment (Kona 2015). Carsharing services also have limited experience with alternative payment arrangements, instead focusing on other equity issues, such as geography and cost. Upstate New York carshare has done the most to offer such alternatives: Buffalo Carshare accepts money orders in lieu of credit cards, while Ithaca Carshare has always offered cash payment as an option (Carney and Jaffe 2012; Ithaca Carshare 2015).

Public transit agencies and bikeshare operators could serve as a model for how alternative payment options might work. As public transit agencies around the United States have modernized their fare collection systems to be "all electronic" and upgraded to smartcard payment systems and mobile apps, they have had to consider alternatives to bank accounts for their underserved customers as part of that transition. These alternatives include accepting prepaid debit cards, working with nonbanking institutions such as check cashing services, or continuing to offer cash as an alternative payment. Since 2011, for example, Greyhound has partnered successfully with PayNearMe—a private electronic cash payment service that allows members to pay for their membership using cash by going to a local convenience store instead of using a credit card online—and 7-Eleven to provide an option that entails cash payment and online purchase with applicable Internet discounts (Greyhound.com 2011). Relative to most other private shared mobility services, bikeshare services have a more extensive record of supporting financial alternatives to address equity concerns, perhaps as a result of their typically closer partnerships with public agencies. About one-third of the 19 technology-based bikeshare operators in North America offer debit cards as an option to encourage use by the underserved (Shaheen et al. 2012b). More recently, BikeArlington in Arlington County, Virginia, and Indego, Philadelphia's new bikeshare system, have been offering cash payment options (BikeArlington 2015; Corbin 2015). Indego offers a monthly cash membership using PayNearMe (Indego 2015).

### People Without Smartphones

As discussed previously, many innovative mobility services are app-based and operate exclusively through smartphones. In many cases, then, not having a smartphone means not having access to technology-enabled mobility services.

Currently, 64 percent of Americans own smartphones (Pew Research Center 2015b), a percentage that reflects rapid growth (from 35 percent in 2011) across all common demographic categories (income, gender, age, and race) (Pew Research Center 2015b). Among those earning less than $30,000, 50 percent owned a smartphone in 2015, compared with 43 percent in 2013. Smartphone access, on average, varies more by age than by income: just 27 percent of adults over age 65 have a smartphone, compared with 18 percent in 2013. Smartphone use among this age group lags that among all other demographic categories, at about half the level of the next-lowest category (Pew Research Center 2015b). In 2015, for example two-thirds of teens in low-income families owned a smartphone; ownership among African American teens (85 percent) is higher than that among either white or Hispanic teens (both 71 percent) (Pew Research Center 2015a).

### Rural Residents

Because their average trip distances tend to be long and trip origins and destinations spatially dispersed, rural residents rely more heavily on private vehicles relative to urban or suburban

residents. In rural areas, residents who cannot drive, such as some elderly people, may find their travel significantly restricted. According to the 2009 National Household Transportation Survey (NHTS), nearly all (97 percent) of households in rural areas have at least one motorized vehicle, and 92 percent of adults are drivers, compared with, respectively, 90 percent and 86 percent in urban areas. In rural areas, however, 22 percent of adults aged 65 and over have a medical condition making it difficult for them to travel, and 36 percent of these individuals have given up driving (NHTS 2009 data). Transit is available to only about 13 percent of the rural population and to 37 percent of people living in small urban areas (NCTR 2014).

Some shared mobility services, particularly carsharing and bikesharing, generally do not exist in rural areas outside of selected university campuses. Both of these services rely on the relatively high land use densities of cities and inner-ring suburbs. On the other hand, TNCs can provide rides anywhere drivers with cars are willing to operate, and thus could increase mobility options for people living in rural areas, where public transit and taxi services often are less available. In very low-density areas, the TNC model could be more cost-effective than current demand-response services. The latter services are the most common form of public transit available in rural areas, and the average operating cost per ride is high—$18.86 in 2012 (NCTR 2014).

While the extent to which for-profit TNCs are operating in rural areas is unclear at this stage, at least one nonprofit mobility service is entering this market. The Independent Transportation Network (ITN), a nonprofit focused on older adults, has introduced ITN*Everywhere*, a service whereby members can earn credits by sharing rides or earn rides by trading a car they no longer drive (ITN*America* 2015). As of early 2015, this service was operating in 18 areas in the United States. Programs with volunteer drivers for older adults exist in other communities, such as those run by individual organizations in large urban areas (an example is TRIP, which began in Riverside, California), but there are no data on the overall scale or impact of these efforts. TNC drivers are not likely to expand service to rural residents because drivers are incentivized to operate in densely populated areas for earnings that a rural market typically will not support (Hall and Krueger 2015, Figure 4). As a result, the provision of ride services to rural areas by TNCs may require some form of subsidy.

## CONCLUSION

This chapter has considered four dimensions of equity issues related to new technology-enabled mobility services: (1) firms, markets, and competition; (2) regulations, subsidies, and social services; (3) geographies and jurisdictions; and (4) stakeholder groups. Innovative mobility services have the potential to enhance mobility for many disadvantaged groups, including racial/ethnic minorities, people with disabilities, low-income households, unbanked populations, people without smartphones, and rural residents. These services also may be easier to use than other mobility services for people with some disabilities, and they may reduce some forms of discrimination and provide alternatives to traditional public transit and taxi services where the availability of the latter services is limited. Absent sufficient data on usage, however, it is unclear whether discrimination may occur more or less often with these services than with other existing transportation services. Moreover, there are barriers to use of these new services for some people, particularly the 8 percent of households made up of unbanked individuals (who are more

likely than other groups to be poor), the 36 percent of the population without smartphones, and people in wheelchairs.

Equity issues related to being unbanked and to smartphone ownership are quite different. Lack of access to banking services can serve as barrier to the use of innovative mobility services for underserved populations. Public transit agencies and bikeshare operators could provide models for alternative financial services for these populations, including the use of third-party electronic cash payment systems. TNCs in particular may have to find ways to accommodate the un- and underbanked if they want to continue their global expansion. TNCs, for example, will need to find alternative financial solutions in countries where personal banking is less ubiquitous than is the case in the United States. With respect to smartphone ownership, the digital divide for smartphones is based less on income and more on age. Those over age 65 are potentially the most excluded, a problem that is certain to diminish with time.

Of particular concern is a potential reduction in accessible taxis because of TNC competition, especially in areas where taxi companies also provide ADA/paratransit services. Whether and how TNCs, and perhaps other innovative services, will be expected or required to provide accessible services is an open question. However, if the increased popularity of TNCs reduces taxi fleets significantly without provisions being made for accessibility for all people with disabilities, the mobility options for these people could be negatively affected. The ultimate resolution of this issue could have a significant impact on TNCs. It could affect the pace of their growth, their productivity, and the impacts associated with their services. For example, the resolution of accessibility issues could influence vehicle sizes, energy efficiency, emissions, user costs, utilization levels, and the subsequent impact on mobility.

In the short term, public agencies and regulatory authorities will likely need to address barriers to use of the new mobility services among people with disabilities and those who are unbanked if the potential for these services to enhance the mobility options of these groups is to be realized. On the other hand, should these services continue to expand over larger and larger geographic areas, they may increase considerably the opportunities for relatively affordable door-to-door motor vehicle access for those who, because of age, income, or disability, cannot own or drive a car, increasing mobility for transportation-disadvantaged groups in the process. Achieving these goals, however, may require deliberate public policies.

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### Abbreviations

| | |
|---|---|
| FDIC | Federal Deposit Insurance Corporation |
| NCTR | National Center for Transit Research |
| PBOT | Portland Bureau of Transportation |

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# Conclusions and Recommendations

Over the last several decades, information and communication technologies have enhanced the operation and use of transportation networks across the United States, enabling innovations ranging from real-time traffic and transit information, to real-time data for system management, to new methods of transit fare payment. In recent years, information and communication technologies such as location data from global positioning systems (GPS) and smartphone apps have not only enhanced existing transportation services but also made possible innovative services that epitomize the new sharing economy. These services include carsharing; bikesharing; microtransit services; and, most notably, transportation network companies (TNCs) such as Uber and Lyft.

These innovative services allow travelers to use their smartphones to arrange for trips by car, shuttle, and public transit and for short-term rental of cars and bikes. The near-instant availability of on-demand services accessible through a smartphone and easily paid for by debit or credit card makes it possible for an increasing number of people to leave their personal car at home for the day, or even reduce the number of household vehicles. Some people are beginning to rethink how they go about their daily travel, with potentially far-reaching implications for longer-term travel and development patterns. Notably, most of these innovative services are being deployed in the private sector, without public financial support, the exception being bikesharing, which typically is publicly subsidized.

To date, the most rapidly growing forms of shared mobility have remained within the traditional paradigm of exclusive use: motor vehicles and bicycles are shared *sequentially*, with each user (or preformed group of users) having exclusive use of the vehicle. Potentially more far-reaching, but still in its infancy, is *concurrent* sharing of vehicles among strangers. To the extent that they increase vehicle occupancy, concurrently shared services may collectively have greater effects (in terms of personal mobility, vehicle use, energy consumption, traffic congestion, livability, and environmental impacts) than today's most popular innovative mobility options.

Many of the new technology-enabled mobility services are widely welcomed additions to travelers' slate of transportation options and—with some exceptions, such as insurance for many services, especially transportation network companies (TNCs), and helmet requirements for bikesharing services—pose few significant public policy concerns. The most controversial new services to date are clearly TNCs, which are disrupting the regulated for-hire taxi industry and pose a series of challenges to transportation policy makers and regulators. The challenge for policy makers and regulators at all levels is to encourage and facilitate innovations that meet the public's mobility needs while ensuring greater public policy consistency between these new services and traditional taxi and livery services so as to protect the public interest in safety, driver pay and working conditions, and accessibility for people with disabilities. Addressing this challenge in such rapidly growing and evolving industries is itself challenging, requiring political will, more information about the scale and nature of the services being provided, and insightful public policy to guide the evolution of these innovative services so that they continue to enhance mobility and sustainability.

In the longer term, widespread use of services that involve concurrent vehicle sharing could have implications for location preferences and both automobile ownership and public

transit patronage in ways that could affect, for better or worse, the goals of resource-efficient and environmentally sustainable lifestyles. Although it is too early to make definitive statements, the potential benefits and risks of this type of shared mobility service are an important focus for future exploration.

This chapter summarizes the overall conclusions resulting from this study, and offers the study committee's recommendations for policy makers and regulators[36] as they seek to address the many issues detailed in this report. In addition, as emphasized throughout the preceding chapters, the information needed to inform policy and regulations for the new mobility services is lacking in a number of crucial areas. Therefore, this chapter also outlines areas in which research, as well as data to inform planning and policy making, is needed to provide the information necessary for effective implementation of the committee's recommendations and the fair and equitable advancement of these new services.

## CONCLUSIONS

*Innovative mobility services are expanding travel choices and being widely embraced by millions of travelers.*

The rapid growth in use of these new services is occurring amid an upswing in travel by taxis and public transit that began more than a decade ago. App-enabled transportation services are among the most remarkable urban transportation innovations in a generation; the technologies being deployed for these services are improving mobility in ways that have been proposed and discussed for decades but never before realized on a large scale. While TNCs have received the greatest media attention to date, car- and bikesharing, employee shuttles, microtransit services, and apps that aggregate all travel options are growing, evolving, and affecting travel behavior for many users in profound ways. Experience with U.S. car- and bikesharing programs implemented to date suggests that they reduce personal vehicle travel, emissions, and vehicle ownership. Although travel by innovative mobility services currently represents a small share of total trips, the effects of these programs on driving and a continued rapid expansion of their reach and use may significantly affect personal travel in the years ahead.

*On its current course, continued expansion of TNCs threatens to exacerbate the "digital divide," although these services have the potential to enhance mobility for low-income and older adults.*

The lack of access to services by those without credit cards or Internet access is an economy-wide phenomenon and not unique to transportation, but innovative mobility services are bringing this issue to the fore. Most shared mobility services require users to have a credit card on file with the service provider and arrange service using a smartphone. Yet substantial numbers of Americans fail to meet one or both of these prerequisites. Roughly 8 percent of U.S. households, most of which are low-income, lack bank accounts that allow them to have credit cards. Moreover, 36 percent of Americans currently do not own smartphones, a percentage that is even

[36] Multiple actors are responsible for establishing policies and regulations for taxis, limousines, TNCs, and other mobility services because of the different jurisdictions (state, county, city) and various types of agencies that have and exercise these responsibilities nationwide.

higher among those earning less than $30,000 (50 percent) and adults over age 65 (73 percent). Although smartphone ownership rates have been rising rapidly in recent years, it is unclear where they will level off, particularly for those with low incomes, and current ownership rates leave substantial portions of the population without access to most innovative shared mobility services. This becomes an even greater concern if growth in the new services, such as TNCs, results in shrinkage in existing travel options, such as taxi services, that can be summoned with a landline or basic mobile phone and for which payment can be made by cash.

If private providers fail to address these access issues on a broad scale, public agencies and regulatory authorities may choose to address them through regulation, mandates, or incentives designed to make these services fully and equitably available. To the extent that shared mobility services are available to disadvantaged populations, they have the potential to enhance mobility among these groups. The emerging services frequently cost less than taxi services, and impose lower up-front costs (for vehicles) for travelers than owning a personal vehicle. Furthermore, if shared (concurrent) ride TNC services continue to expand and cost less per trip than most traditional door-to-door services, low-income travelers who can access them may benefit considerably. The expansion of the relatively new multiple-passenger shared-ride options presents the opportunity for even lower-cost door-to-door service (albeit with stops).

> *Regulated taxis offer critical lifeline transportation services for people with disabilities. Absent some public policy response, a TNC-fueled decline in taxi services could affect the availability of vehicle-for-hire services to a substantial number of travelers with disabilities.*

Roughly 10 percent of the U.S. population (30.6 million people) has a physical limitation of some kind; 3.6 million of them use a wheelchair, and another 11.6 million a cane, crutches, or a walker. Many cab companies operate wheelchair-accessible vehicles for the general public, sometimes supported through medical, social service, and Americans with Disabilities Act (ADA)–mandated paratransit. Moreover, a number of jurisdictions, primarily large cities such as New York City, Chicago, and Washington, DC, mandate a specified number of wheelchair-accessible taxis, although the efficacy of these regulations in serving disadvantaged populations is unclear. Although they have introduced pilot programs, the more lightly regulated TNCs have not to date provided wheelchair-accessible services on an extensive or reliable basis. If competition from the increasingly popular TNCs reduces current taxi fleets, the near-term result may be fewer door-to-door transportation services for wheelchair users.

Although legal cases involving refusal of some TNCs to accept service dogs remain to be resolved, TNC services are seen as beneficial to those who are blind or visually impaired. TNC apps provide voice options, allowing easy vehicle requests from a smartphone without the need to see a passing taxi to hail it on the street. Cashless transactions eliminate the potential question of what change a taxi driver has provided, and the driver is not informed that the passenger is sight-impaired before accepting the ride.

> *Public safety is a central and to date not fully resolved public policy concern with the new shared mobility services.*

Regulation has traditionally been employed to rectify market failures, such as a lack of information about the safety of vehicles and drivers and the quality of services—particularly for

taxi stand and street-hail services, where customers lack the opportunity to exercise informed choice among providers. Information and communication technologies may have reduced the need for some regulations aimed at service quality, as customers can choose among well-known global brands and obtain information about drivers and vehicles in advance of riding. Public safety, however, remains a central regulatory concern.

Appropriately, public entities at the municipal, regional, and state levels are implementing public safety regulations for TNCs and other shared mobility services, including regulations addressing helmet wearing among bikesharing users. These evolving regulatory processes, however, have illuminated a long-standing weakness in the formulation of such regulations: a paucity of systematic evaluations of the effectiveness or costs of the public safety regulations that exist and are being proposed. For example, procedures for driver background checks often are based on common practice but have not been evaluated in any rigorous way. Therefore, the current practices of regulators, the taxi industry, and TNC operators in this area may not represent best practices. Equally important, minimum limits of automobile liability insurance for taxis, TNCs, and other for-hire services, and in particular "tiered" insurance requirements for TNCs, vary across jurisdictions and do not appear to be based on a systematic analysis of the risks of for-hire operations. Similarly, although the use of technology to facilitate the production and sharing of driver ratings, operator and vehicle images, and electronic itineraries may mitigate requirements for certain service quality and safety regulations, the benefits of these enhancements have not yet been well documented. Finally, the potential for TNC drivers' heavy reliance on smartphones to lead to distracted driving has not been systematically examined. In sum, the most effective ways to ensure safe operations of vehicles and by drivers, as well as appropriate allocation of the costs imposed by the risk of crashes, remain to be settled and are deserving of careful study.

> *TNC drivers, like most taxi drivers and workers in the shared economy generally, are classified by their companies as independent contractors rather than employees. This status limits their access to benefits that are currently tied to employment.*

Independent contractors typically do not receive employer-provided health insurance or employer contributions to Social Security and Medicare, sick leave, workers' compensation for injuries, disability insurance, and other benefits that come with employee status. Although many drivers report valuing the part-time and transitional employment opportunities the TNCs provide, some have sued their company, claiming that the degree of control it exerts over them indicates they are employees under federal law. The TNCs have responded that the drivers are contractors since the company exercises virtually no control over the time or place of trips, and the drivers own the vehicles. Legal precedents under the federal Fair Labor Standards Act, however, involve multiple tests, no one of which is determinative. This issue is likely to be decided in the legal system; absent state or federal legislation, however, classifying mobility service contractors as employees would have major ramifications for drivers, company finances, and consumer costs.

> *The vast differences in the scale of TNCs compared with taxi services raise new considerations for regulators.*

The rise of multinational corporations providing taxi-like services in cities around the world is in sharp contrast to the structure of the taxi and limousine industries. While a few taxi fleets are large, regional enterprises, most consist of local firms, fleets of widely varying sizes, and highly varied employment and contractual relationships between firms and drivers. In comparison, the TNCs are a few increasingly large entities that operate globally, which gives them multicity brand awareness and potential market power with respect to customers, drivers, and regulators. The scale and resources of TNCs provide opportunities to exert political as well as economic influence beyond that of existing livery service companies. In response, many taxi and limousine companies are adopting TNC-like technologies to better compete with TNCs. In heavily regulated taxi markets, state and local policy makers may need to consider reducing some constraints on taxi and limousine services so they can compete more effectively. Further, some aspects of regulation, such as labor standards and background checks, may lend themselves more logically to national-scale rather than state or local regulation.

*Innovations in shared mobility services have the potential to change long-term travel and land use patterns.*

By affecting the cost, convenience, and flexibility of travel, technology-enabled mobility services may significantly alter travel behavior and potentially even land use patterns, particularly if these services continue to proliferate. Two major potential effects are particularly critical.

First, success in aggregating travel into a single vehicle for multiple travelers with similar origins and destinations will be important to producing lower travel costs for users and reduced negative impacts of vehicle travel. These new services have the potential to increase carpooling and ridesharing, which may in turn lead to increased average vehicle occupancies—ultimately reducing vehicle travel overall and ameliorating automotive externalities such as congestion, nonrenewable energy use, and emissions.

Second, by increasing convenient travel alternatives, the new services may encourage lower household vehicle ownership levels without sacrificing personal mobility, thus eliminating the bias toward high-fixed/low-variable costs in mode choice decisions implicit in vehicle ownership. This, in turn, could spur travel by public transit, walking, and biking and potentially favor urban over suburban residential location choices. These changes would have even more profound effects in the future if automated driving were to become widespread.

It should be noted, however, that less expensive and more convenient travel options, all things being equal, encourage more travel and may enhance mobility for dispersed (“sprawl”) locations, thus making such places more attractive to residents and businesses, although TNC and related services currently are concentrated in central, urban locations. In addition, to the extent that TNC drivers travel without passengers between customers, these services could increase total vehicle travel and contribute to increased congestion, energy consumption, and emissions. Finally, to the extent that lower fares draw travelers from public transportation to shared-ride services in large numbers, the effect could be to increase total vehicle-miles traveled, emissions, and energy consumption. It is too early to determine which of these competing forces will predominate, and effects are likely to play out in different ways depending on local circumstances.

## RECOMMENDATIONS

Innovative mobility services are already enhancing mobility for millions and have the potential to yield even greater benefits while also serving other societal goals. If the potential of these services is to be realized, policy makers and regulators will need to address the issues discussed in this report. The committee offers the following recommendations in the spirit of expanding the promise of these services, and doing so with effective and appropriately scaled public oversight.

> **Recommendation 1: Policy makers and regulators should formulate public policies and regulations designed to steer the development of innovative services to improve mobility, safety, and sustainability.**

Public officials have a responsibility to encourage transportation systems that promote access while minimizing environmental costs. Enhancing sustainable mobility may come in part through fewer trips, shorter trips, and/or more shared-ride trips, which may lead in turn to reduced congestion, energy consumption, and emissions. Crafting public policies that influence the development of innovative mobility services to advance societal goals is thus in the public interest. Such policies might include encouraging car-for-hire services, shared vehicles, and microtransit through economic incentives; easing barriers to market entry; and increasing coordination of private services with publicly provided services such as public transit.

> **Recommendation 1a: To the extent that technology features can accomplish the same customer service protections that previously required regulatory intervention, regulations should be adapted to embrace that opportunity. Local and state governments should reassess current taxi, limousine, and (where separately adopted) TNC regulations for market entry, geographic coverage, span of service, and the like in light of these new services and the service quality information available to both passengers and drivers.**

Regulation of taxi and limousine services has evolved and been refined for more than a century in many U.S. jurisdictions. The rise of technology-enabled mobility raises the question of whether both traditional and emerging mobility services should continue to be regulated as traditional services were in the past. Reassessment of current regulations is most pertinent to advance-reservation (non-street-hail) services, which allow customers to use technology to choose knowledgably among competing providers and obtain information about their driver and his/her customer reviews. Importantly, the committee is not recommending that TNCs be regulated the same as traditional for-hire transportation services. TNCs offer many innovations that may mitigate the need for some regulations, and their ability to vary prices enhances service and overall efficiency. Nor is the committee recommending removal of entry controls to street-hail and taxi stand services, particularly in dense downtown business districts or airports. Instead, the committee urges local and state regulators to reassess existing regulations governing prearranged taxi and limousine services to determine the minimum necessary for them to provide quality service and be able to compete effectively with TNCs.

> **Recommendation 1b: These assessments should also examine public safety requirements covering drivers and vehicles, which should be applied in**

**similar fashion across competing industry segments, ensuring consistency and a level playing field.**

Examples of these requirements include driver background checks, vehicle inspections, and automobile liability insurance coverage. While the transparency enabled by new technologies can reduce the need for service quality–focused regulations, it may not reduce the need for these critical public safety requirements.

**Recommendation 1c: Similarly, in consideration of both the multijurisdictional travel patterns in metropolitan areas and the large scale of business operations, state and local governments should assess how the regulations governing the various industries relate to one another, particularly when multiple jurisdictions regulate different industry segments within the same geographic area. Policy makers and regulators should consider whether traditional for-hire and shared mobility services are best monitored and regulated at the state, regional, or local level on the basis of market and service characteristics and regulatory capabilities.**

A tension exists between considerations for uniformity and simplicity in the regulatory structure (which tend to argue for regional or even state-wide regulatory authorities) and for responsiveness to local needs and concerns (which tend to argue for local regulation). Regardless of the level of regulatory authority, a critical issue is providing a local presence for regulatory enforcement.

**Recommendation 1d: Policy makers and regulators at the state and federal levels should conduct systematic evaluations of safety requirements, examining the core issues of effectiveness and cost.**

Whatever the locus of regulatory responsibility may be, it is difficult to make sense of the highly varied approaches to basic safety regulations applied to drivers and vehicles across various jurisdictions. Results of the systematic evaluations suggested in recommendation 1d could be used to set state-established safety parameters to guide the promulgation of local or regional regulations; create uniform statewide standards; or possibly establish cost-effective and consistent national-level driver and vehicle safety protocols and standards, including insurance requirements, based on best practices defined by research.

**Recommendation 1e: Given the importance of accessibility for all users (which is frequently operationalized in terms of vehicles that can accommodate wheelchairs), policy makers and regulators should address the potential disparity between access for people with various disabilities and other travelers as these new services expand.**

The uneven regulatory playing field on this issue between taxi services and TNCs is pronounced, as taxis often are required to provide lift-equipped vehicles subsidized by fares charged to all passengers. Regulators should consider ways of ensuring access to TNC-like services for those with disabilities, perhaps by either using general public revenues (with the idea that subsidizing access to door-to-door for-hire transportation service should not necessarily be the sole

responsibility of other taxi or TNC customers) or applying an across-the-board supplemental fee for all for-hire trips (as is done in the taxi industry in several major cities).

> **Recommendation 2: Policy makers, planners, and regulators should identify the information needed to set policies on, plan for, and regulate mobility services, and require this information from all regulated entities.**

Among the many innovations by mobility service providers is widespread use of automated reporting systems and digital databases to measure and improve service. The information needed by policy makers, planners, and regulators—largely information about types and volumes of trips—can be culled from these databases and anonymized to protect proprietary interests and individual privacy without requiring private companies to collect new information. In determining information needs, policy makers, planners, and regulators should, of course, remain aware of issues of respondent burden and propriety and confidential information, as well as alternative means for securing needed information. There is also a public interest in gathering information necessary to understand the effects of these services so that public policy decisions can be made and plans formulated on the basis of accurate knowledge about all transportation services offered and consumed. Given the potential of these new business models to significantly influence transportation and land use systems, having this information is critical.

> **Recommendation 3: Policy makers and regulators should carefully examine and consider the pros and cons of alternative employment classifications for TNC and taxi drivers.**

The new mobility services offer expanded opportunities for flexible, part-time employment for students, those seeking supplemental income from a second job, and those needing transitional income between careers. Nonetheless, the lack of the benefits (sick and vacation leave, retirement savings, and so on) frequently provided to employees in other sectors of the economy raises important public policy issues concerning employer-provided health care, workers' compensation for injuries, and vacation and sick leave for those for whom such work is the sole source of income or a desired career. The shifting of the costs of these benefits to low-wage workers who may be unable to afford those costs (or health insurance provided under the Affordable Care Act) makes these workers vulnerable should they become, for example, injured and unable to work.

> **Recommendation 4: Policy makers and regulators should seek to integrate the features of TNCs and other innovative shared mobility services into existing transportation systems and services in ways that leverage the new services' strengths and features.**

With appropriate regulation, and perhaps even subsidization to meet specific public policy goals, these new services can and should be integrated into metropolitan transportation systems to improve accessibility and sustainability.

## RESEARCH NEEDS

Research is needed in several areas to help realize the promise of the new mobility services and enable effective implementation of the committee's recommendations to that end:

- **Given the rapid proliferation of the new shared mobility services and the limited information on their scale and effects, research is needed to develop a richer understanding of their effects on (1) travel choices and behaviors, (2) personal mobility, (3) the environment, (4) the economy, (5) safety, (6) equity and civil rights, (7) transportation system capacity and performance, and (8) labor.** The U.S. Department of Transportation (USDOT) could perform a valuable service for transportation policy makers and researchers by supporting such a research initiative.
- **As these new transportation modes and associated business models develop and mature, an information clearinghouse is needed to capture and disseminate information on these new services and their effects on transportation and land use systems, their legal issues and regulation, and emerging planning and regulatory strategies/models.** Such a resource would be of particular value as multiple jurisdictions strive to adapt to these new services. The USDOT could fund an appropriate existing organization to provide these clearinghouse services.
- **Transportation planning bodies need to develop methodologies for incorporating shared mobility services into transportation planning initiatives and promote collaboration between public- and private-sector transportation providers**. Because most shared mobility services are privately funded and operated, most metropolitan planning organizations and other transportation planning entities, such as cities and states, do not systematically include the effects of these new services in transportation planning initiatives. Nor do most current planning activities consider how these services might be operated to complement substantial public investments in multimodal sustainable transportation systems. As these new services continue to expand, this general omission in transportation planning will become more glaring and problematic.
- **There is a need to develop a consistent set of definitions and basic information requirements that regulatory entities can adopt to describe and evaluate both shared mobility services and established taxi and limousine services.** The USDOT could fund an independent organization or panel to address this need for better-quality, comparable information, with input from stakeholders and drawing on best practices already in place. Given (1) the potentially substantial scale and influence of shared mobility services and (2) the importance of data in establishing cost-effective safety rules and regulations, policy makers and officials at all levels of government need to know more about these services. The federal government has successfully established consistent data definitions and reporting requirements for largely local phenomena such as personal and property crime and public transit provision. These data are used at the local level by policy makers and planners and also can be aggregated to the national level to understand broader trends, evaluate program effectiveness, and plan for future services and infrastructure.

## CONCLUDING OBSERVATIONS

Innovative urban mobility services will continue to evolve, and the research and public policy communities will need to react quickly and in partnership. Use of these and yet-to-be-developed technology-enabled services is likely to continue transforming both passenger and freight travel, and the many stakeholders will need to cooperate to ensure that the outcomes of these developments are in the public interest. Collaboration among these various stakeholders may become precedent setting as connected and automated vehicles develop and become common. Addressing this report's findings can provide a foundation for the technological evolution of the U.S. transportation system.

# Online Appendixes

Appendix A:
***Taxonomy of Established and Emerging Personal Transportation Services***

http://onlinepubs.trb.org/onlinepubs/sr/sr319_AppendixA.pdf

Appendix B:
**Schaller, Bruce.** ***Taxi, Sedan, and Limousine Industries and Regulations***

http://onlinepubs.trb.org/onlinepubs/sr/sr319_AppendixB.pdf

Appendix C:
***Bikesharing Safety and Helmet Use***

http://onlinepubs.trb.org/onlinepubs/sr/sr319_AppendixC.pdf

# Study Committee Biographical Information

**Brian Taylor (Chair)** is professor of urban planning, director of the Lewis Center for Regional Policy Studies, and director of the Institute of Transportation Studies at the University of California at Los Angeles (UCLA) Luskin School of Public Affairs. He served as chair of the Department of Urban Planning from 2008 to 2011. Previously, he was a member of the faculty at the University of North Carolina at Chapel Hill and a transportation planner with the Metropolitan Transportation Commission of Oakland, California. His research centers on transportation finance, politics and planning, and travel behavior. He has been a member of Transportation Research Board (TRB) policy study committees on equity implications of transportation finance mechanisms, on potential energy savings and greenhouse gas reductions from transportation, and on contracting out of transit services. He received TRB's 2001 Pyke Johnson award for the best paper submitted in transportation planning or administration. He has served on the editorial boards of the *Journal of the American Planning Association* and *Transport Policy* and is a member of the American Institute of Certified Planners and the American Planning Association. He received a Ph.D. in urban planning from UCLA, M.C.P. and M.S. degrees from the University of California at Berkeley, and a B.A. from UCLA.

**Ryan Chin** is managing director of the City Science Initiative at the MIT Media Lab, and his research focuses on developing new urban systems for a connected world. He earned his doctorate by creating Mobility-on-Demand (MoD) systems—a network of one-way, shared-use, lightweight electric vehicles (LEVs) enabled by electric charging infrastructure and smart fleet management systems. Under Dr. Chin's leadership, the Smart Cities research group developed a series of LEVs for MoD systems in collaboration with industry, including the CityCar (with GM), the RoboScooter (with Sanyang Motors), and the GreenWheel Electric Bicycle (startup in Taiwan). This research led to the group's first major publication, *Reinventing the Automobile: Personal Urban Mobility for the 21st Century*. Dr. Chin has been a keynote speaker and panelist at conferences such as MIT's Emerging Technologies Conference (EmTech), TEDx, SIGGRAPH, Convergence, China Planning Network (CPN), MIT World, and Gridweek. He holds bachelor's degrees in civil engineering and architecture from the Catholic University of America, along with a master of architecture and an M.S. and Ph.D. in media arts and sciences from MIT.

**Melanie Crotty** is director of the Travel Coordination and Information Section at the Metropolitan Transportation Commission (MTC), the regional transportation planning, finance, and coordinating agency for the nine-county San Francisco Bay Area. She has worked at MTC for 14 years. Her responsibilities include the delivery and operations of a variety of customer service projects, including the 511 traveler information program, the TransLink® transit smartcard program, the regional rideshare program, and the Vehicle Infrastructure Integration (VII) California testbed. Her group is also responsible for implementation of the Regional ITS Architecture, the regional marketing program, and regional transit connectivity services. Ms. Crotty currently serves on the ITS California Board of Directors and the U.S. Department of Transportation (USDOT) VII Working Group. She holds an M.S. in transportation engineering and an M.A. in city planning from the University of California at Berkeley and a B.S. in systems engineering from the University of Virginia.

**Jennifer Dill** is professor at Portland State University (PSU) in the Nohad A. Toulan School of Urban Studies and Planning. She is also director of the Transportation Research and Education Center at PSU, which houses the National Institute for Transportation and Communities, the USDOT's national university transportation center for livable communities. Her research interests include travel behavior, transportation–land use interactions, and environmental aspects of transportation. Current projects include evaluations of peer-to-peer carsharing and equity aspects of bikesharing. She serves on the TRB Committee on Transportation Demand Management and previously chaired the Committee on Bicycle Transportation. Prior to joining PSU, she worked for the Bay Area Air Quality Management District, the Local Government Commission in Sacramento, and the U.S. Environmental Protection Agency's (EPA) regional office in San Francisco. She holds a B.S. in environmental policy analysis and planning from the University of California at Davis, an M.A. in urban planning from UCLA, and a Ph.D. in city and regional planning from the University of California at Berkeley.

**Lester Hoel**, now retired, was L.A. Lacy distinguished professor of engineering at the University of Virginia, and was previously professor of civil engineering at Carnegie Mellon University. His area of expertise is the engineering planning and design of surface transportation infrastructure, with emphasis on highway and transit systems. He co-authored the textbook *Traffic and Highway Engineering* and co-edited the text *Public Transportation*. His research contributions have dealt with such infrastructure issues as travel demand, advanced transit technology applications, design of public transportation terminals, transit maintenance facilities, scenic byways, toll facilities, airport access, and interstate trucking. Dr. Hoel received the Stanley Gustavson Award from the Highway Users Federation for contributions to the advancement of knowledge in the field of highway transportation; the American Society of Civil Engineers (ASCE) Frank Masters Award for outstanding contributions to and leadership in urban and highway transportation research and education; and the ASCE James Laurie Prize for his sustained and outstanding contributions to the advancement of transportation engineering through his teaching, research, and service to professional societies. Dr. Hoel is a fellow of the American Society of Civil Engineers and a fellow of the Institute of Transportation Engineers. He is a former member of the TRB Executive Committee and served as its chairman in 1986. He also served as TRB's division chair for Nuclear Regulatory Commission (NRC) oversight from 1995 to 2004. Dr. Hoel was appointed a member of the National Academy of Engineering in 1989. He holds a Ph.D. in civil engineering from the University of California at Berkeley.

**Michael Manville** is a professor in Cornell University's Department of City and Regional Planning. He has two primary areas of interest: the relationship between transportation and land use, and local public finance. He studies the willingness of people and communities to finance different government services, and also studies the tendency of local governments to hide the costs of transportation in the property market. He is particularly interested in how land use restrictions intended to fight traffic congestion can influence the supply and price of housing. His research has been published in a variety of transportation and planning journals, including the *Journal of the American Planning Association*, the *Journal of Planning Education and Research*, *Urban Studies*, and *Transport Policy*. In addition, Dr. Manville has advised local, state, and federal officials about transportation policy and has consulted with both developers and environmental organizations about land use regulation. He holds a Ph.D. in urban planning from UCLA.

**Steven Polzin** is director of mobility policy research at the Center for Urban Transportation Research at the University of South Florida and is responsible for coordinating the center's involvement in the university's educational program. Dr. Polzin carries out research in mobility analysis, public transportation, travel behavior, planning process development, and transportation decision making. He is on the editorial board of the *Journal of Public Transportation* and serves on several TRB and American Public Transportation Association committees. He recently completed several years of service on the board of directors of the Hillsborough Area Regional Transit Authority (Tampa, Florida) and on the Hillsborough County Metropolitan Planning Organization board of directors. Dr. Polzin worked for transit agencies in Chicago (RTA), Cleveland (GCRTA), and Dallas (DART) before joining the University of South Florida in 1988. He holds a B.S. in civil engineering from the University of Wisconsin-Madison and an M.S. and Ph.D. in civil engineering from Northwestern University.

**Bruce Schaller** is principal at Schaller Consulting. He previously served as deputy commissioner for traffic and planning for the New York City Department of Transportation from 2012 through 2014. In this capacity, Mr. Schaller was responsible for the safe, efficient, and environmentally responsible movement of people and goods on the city's streets. He was responsible for the development and implementation of programs and projects designed to enhance the city's bus, bike, pedestrian, and truck networks, including implementation of the transportation elements in Mayor Bloomberg's PlaNYC and key initiatives in the department of transportation's (DOT) Sustainable Streets Strategic Plan. He also oversaw DOT's art and urban design initiatives, including serving as liaison with the Public Design Commission, and clean fuel initiatives focused primarily on trucks, other commercial fleets, ferries, and taxis/for-hire vehicles. From June 2007 through 2011, Mr. Schaller served as DOT's first deputy commissioner for planning and sustainability, spearheading the implementation of key PlaNYC initiatives including Select Bus Service (SBS); innovative parking pricing policies; public space planning, including DOT's Plaza Program; neighborhood planning studies; and publication of the department's annual Sustainable Streets Index. Prior to his tenure at DOT, Mr. Schaller was principal of Schaller Consulting. He consulted extensively for local governments, transit and airport authorities, university and nonprofit organizations, for-profit companies, and federal agencies on the identification of transportation needs, the development of effective transit programs, taxicab regulation, transit fare policy, road pricing, transportation finance, customer communications, and bus rapid transit. Mr. Schaller also has served as deputy director for marketing research and analysis at New York City Transit, where his work was instrumental in fare policy initiatives, expansion of the paratransit program, the development of customer communications, and the design of new subway cars and buses. He has served as well as director of policy development and evaluation at the New York City Taxi and Limousine Commission. He holds an M.A. in public policy from the University of California at Berkeley and a B.A. from Oberlin College.

**Susan Shaheen** is an adjunct professor in civil and environmental engineering at the University of California at Berkeley. She is also co-director of the university's Institute of Transportation Studies' Transportation Sustainability Research Center (TSRC). She served as policy and behavioral research program leader at California Partners for Advanced Transit and Highways from 2003 to 2007, and as a special assistant to the Director's Office of the California Department of Transportation from 2001 to 2004. She has worked as a consultant to the U.S. Department of Energy and the EPA in Washington, DC, and as a postdoctoral researcher at the University of

California at Berkeley. She has authored 55 journal articles, more than 100 reports and proceedings articles, and four book chapters and co-edited one book. She has also served as a guest editor for *Transport Policy,* the *International Journal of Sustainable Transportation,* and *Energies*. Dr. Shaheen's research projects on carsharing, smart parking, and older mobility have received national awards, and she was the chair of TRB's Emerging and Innovative Public Transport and Technologies Committee from 2004 to 2011. In addition, she is a member of the National Academies' Transit Research Analysis Committee, a member of the Intelligent Transportation Systems (ITS) Program Advisory Committee to the USDOT secretary, chair of the TRB subcommittee on Shared-Use Vehicle Public Transport Systems, and a member of two TRB standing committee focused on advanced public transportation systems. She holds an M.S. in public policy analysis from the University of Rochester and a Ph.D. in ecology, with a focus on the energy and environmental aspects of transportation, from the University of California at Davis.

**Daniel Sperling** is distinguished professor at the University of California at Davis in the Departments of Civil Engineering and Environmental Science and Policy. He is also founding director of the university's Institute of Transportation Studies (ITS-Davis). He was appointed by Governor Schwarzenegger to the California Air Resources Board in February 2007 and was co-director of California's Low Carbon Fuel Study. Dr. Sperling is recognized as a leading international expert on transportation technology assessment, energy and environmental aspects of transportation, and transportation policy, and he was recently honored as a lifetime national associate of the National Academies. He has served on 15 National Research Council committees, has chaired TRB standing committees on alternative fuel vehicles and sustainable transportation, and is chair of the TRB Executive Committee in 2015. He is author or editor of more than 200 technical articles and 12 books, and has testified many times to the U.S. Congress and the California Legislature on alternative fuels and advanced vehicle technology. Dr. Sperling holds a B.S. in environmental engineering from Cornell University and a Ph.D. in transportation engineering from the University of California at Berkeley.

**Marzia Zafar** is currently director of the Policy & Planning Division (PPD) in the California Public Utilities Commission (CPUC). PPD consists of a small group of policy analysts charged with identifying and analyzing utility industry issues, internal and external procedures, and interagency relationships that would not ordinarily be addressed by the CPUC's industry divisions in the course of their operations. PPD provides commissioners, the executive director, and the management team with independent analysis and advice focused on CPUC practices, procedures, issues, and policies. Ms. Marzia joined the CPUC in June 2007 as chief of staff to Commissioner Simon. Most recently, she managed the commission's Business & Community Outreach Branch. Ms. Marzia has been in the regulatory and energy industries for more than 16 years. She started her career with Southern California Gas Company as a cost accountant, then moved to regulatory case management, where she focused on cases related to the energy crisis of 2000-2001, affiliate transactions, general rate cases, and gas industry restructuring. Ms. Marzia is one of the Smart Grid team members at the CPUC and wrote the first draft of the Smart Grid Rulemaking. She has been working with the Smart Grid team since its inception in 2008. She holds a B.A. in business from California State University, San Bernardino.

**Susan Zielinski** is managing director of Sustainable Mobility & Accessibility Research & Transformation (SMART), a cross-disciplinary initiative at the University of Michigan that

advances sustainable transportation systems in an urbanizing world. Previously, she spent a year as a Harvard Loeb fellow focusing on new mobility innovation and leadership. Prior to 2004, she co-founded and directed Moving the Economy (MTE), a Canada-wide "link tank" that works to catalyze and support sustainable urban transportation innovation as well as new mobility industry development, an integrated industry approach developed at MTE. As a transportation planner for the City of Toronto, Ms. Zielinski worked for more than 15 years developing and leading transportation and livability policies and initiatives. She has advised on a range of local, national, and international initiatives, including the National Advisory Committee on Energy Efficiency, Transport Canada's Sustainable Development Advisory Committee, the Gridlock Panel of the Ontario Smart Growth Initiative, the OECD's Environmentally Sustainable Transport Project, the King of Sweden's jury of the Stockholm Partnerships for Sustainable Cities, and the European Conference of Ministers of Transport. She was also a long-time board member of Canada's Center for Sustainable Transportation and founding board member of the Green Tourism Association. She holds an M.S. in environmental studies from York University.

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