NOVEMBER 2021
IB: 21-08-A

ISSUE BRIEF

MOVING FORWARD:

THE ROLE OF TRANSPORTATION NETWORKING COMPANIES IN A SUSTAINABLE FUTURE

INTRODUCTION

The COVID-19 pandemic abruptly upended the way we live, work, and move around our cities. Working from home replaced commutes for many workers; cautious about public transportation, some urban residents bought cars for the first time; suddenly empty of traffic, some cities turned streets into thoroughfares for people walking and biking. But as vaccinations increase across the country, the restrictions and fears that guided our lives since March 2020 are lifting. Will we simply return to the old normal, or will we create a new one?

For more information, please contact:
Rabi Abonour
rabonour@nrdc.org

www.nrdc.org
www.facebook.com/NRDC.org
www.twitter.com/NRDC

When it comes to transportation, we cannot afford to go back to the way things were. Transportation is the leading source of greenhouse gas (GHG) emissions in the country, and despite advances in fuel economy and progress in vehicle electrification, transportation emissions are continuing to rise.[1] We cannot return to the old status quo if we are serious about fighting climate change.

Transportation network companies (TNCs) like Lyft and Uber were among the newest components of our pre-pandemic transportation system. The launch of Uber in 2010 was the beginning of a decade of rapid expansion for the TNC industry. By the end of the decade Uber operated in 700 cities across the United States and Lyft – launched in 2013 – operated in 300 cities.[2] These companies quickly became major players in the urban transportation landscape by offering consumers convenient, on-demand rides.

COVID-19 caused Lyft and Uber ridership to plummet.[3] However, ridership is beginning to climb once again as America emerges from the pandemic.[4] Now is the moment to think about what role these companies can and should play in a future that prioritizes clean energy and equitable transportation options.

Answering this question requires understanding the impact that TNCs had on GHG emissions during their pre-pandemic heyday. NRDC partnered with University of California, Berkeley Transportation Sustainability Research Center researchers Elliot Martin, Ph.D., Susan Shaheen, Ph.D., and Adam Stocker to present a snapshot of the net impacts of Lyft and Uber from mid 2015 to early 2017 in three major U.S. markets: San Francisco, Los Angeles, and Washington, D.C.[5] Using various original data sources, the report provides the most comprehensive, definitive, and data-rich assessment published to date of the impacts of these major TNC services on vehicle ownership, vehicle-miles traveled (VMT), travel behavior, and GHG emissions. In addition, the report assesses the impacts of pooled rides—in which multiple passengers share one vehicle en route to their respective destinations—on VMT and GHG emissions and contrasts these effects with those of private TNC rides.

The researchers found that:

1. TNCs appear to lead to an overall increase in VMT and GHG emissions.
2. TNCs reduce VMT the most when they enable people to avoid buying cars.
3. Inefficient matching of passengers limits the VMT and GHG emissions benefits of pooled rides.
4. TNCs replace public transit trips more than they facilitate them.

These results tell us that, without changes, companies like Lyft and Uber are likely to increase overall GHG emissions by encouraging additional driving. In the face of catastrophic climate change, we cannot let that happen. Instead, we must emerge from the pandemic with a more sustainable transportation system that prioritizes low-carbon mobility and uses TNCs to encourage travelers to drive less and reduce individual car ownership.

To realize this new normal, we recommend four policies: using equitable road pricing to manage congestion and encourage pooled rides, redesigning streets to prioritize low-carbon transportation, incentivizing or requiring the electrification of TNC vehicles, and mandating fair labor practices to protect TNC drivers. These policies will reduce GHG emissions, lessen health-harming pollution, and build a fairer transportation future.

FINDINGS

To build an accurate picture of the impacts of TNCs before COVID-19, researchers coordinated with Lyft and Uber to aggregate key platform data from these providers and link that information to original survey data. To obtain a comprehensive picture of the net impacts of TNC services, they drew on five main data sources:

- Driver activity data from Lyft and Uber related to aggregate mileage and trips;[6]
- A passenger survey with 8,630 respondents, which captured self-reported changes in travel behavior and vehicle ownership since the introduction of TNC services;
- A control survey with 1,650 respondents, which compared sociodemographic and travel behavior trends among those who use TNC services and those who do not;
- A driver survey with 5,034 responses, which investigated driver behavior, home locations, primary passenger market locations, and vehicle characteristics across the three study markets; and
- San Francisco driver registration data, which provided additional insight into the home locations of licensed drivers in the city.

Based on these data, researchers came to several important conclusions about the impact of TNCs and their ability to reduce GHG emissions.

I. TNCs appear to lead to an overall increase in VMT and GHG emissions.

Several factors determine the effects of TNCs on VMT and GHG emissions. These include changes in travel behavior and vehicle ownership after the introduction of TNCs, projected vehicle ownership and travel patterns had TNCs not been introduced, and the number of miles that TNC drivers travel both with and without passengers. These factors differed among locations, and consequently the effects of TNCs varied by location as well. However, the results indicate an overall increase in VMT and GHG emissions in two of the three markets studied, and only a very slight decrease in the third.

In all three cities, TNC passengers drove their own cars less after the introduction of Lyft and Uber. However, this does not tell the whole story. To calculate the net impact of these services on VMT and GHG emissions, the researchers also had to consider the distances Lyft and Uber drivers traveled with passengers, the distances traveled without passengers

between trips, and the length of their commutes to and from the areas in which the drivers work. In the San Francisco and Los Angeles regions, TNC mileage outweighed the reduction in personal driving, leading to a net VMT increase (Table 1). The Washington, D.C. region saw a small net decrease in VMT.

TABLE 1: AVERAGE CHANGES IN VMT CAUSED BY LYFT AND UBER

	Change in passenger VMT per passenger per year	Change in operator VMT per passenger per year	Net change in VMT per passenger per year
San Francisco	−843	1,077	**+234**
Los Angeles	−931	1,173	**+242**
Washington, D.C.	−585	502	**−83**

The researchers translated the VMT findings into emission estimates by collecting survey data on the make, model, and year of personal vehicles owned by survey households and mapping the data to fuel economy factors as defined in the U.S. Environmental Protection Agency's fueleconomy.gov database. The data showed that, in general, Lyft and Uber vehicles were slightly more efficient than the cars they replaced (though our research revealed that the majority of Lyft and Uber drivers still owned gas-powered cars). However, this difference was small enough that Lyft and Uber still caused an increase in emissions in the San Francisco and Los Angeles regions and only a slight decrease in emissions in the Washington, D.C., region (Table 2).

TABLE 2: AVERAGE CHANGE IN GHG EMISSIONS (METRIC TONS) CAUSED BY LYFT AND UBER

	Change in passenger GHG per passenger per year	Change in operator GHG per passenger per year	Net change in GHG per passenger per year
San Francisco	−0.300	0.338	**0.038**
Los Angeles	−0.319	0.374	**0.055**
Washington, D.C.	−0.209	0.179	**−0.030**

© Felix Mizioznikov/iStock

2. TNCs reduce VMT when they enable people to avoid owning cars.

If TNC customers were making trips they would not have otherwise made or that they would have made without a car, then TNCs would clearly cause overall VMT to increase. However, to get a more complete picture of how TNCs affect VMT, this study addressed four mechanisms by which TNC services can *reduce* the VMT of their users:

- Reduced use of personal automobiles: Access to TNCs can change how much people use the vehicles they already own.
- Reduced use of other automobile modes: Access to TNCs can substitute for other shared modes, such as carpools, taxis, and car rentals.
- Vehicle shedding: Access to TNCs can motivate people to sell vehicles that they currently own.
- Vehicle suppression: Access to TNCs can discourage people from buying vehicles they otherwise would have acquired.

Each of these mechanisms caused a reduction in how much people drive themselves around (or use other shared modes). Table 3 presents these personal VMT reductions.

However, these numbers reflect only the reduction in personal driving. In the first two mechanisms—substitution for personal vehicles and other automobile modes—the personal decrease in VMT was more than outweighed by the additional mileage of the TNC drivers, leading to an increase in overall VMT. Passengers would have done the driving regardless of the availability of TNCs, and TNC drivers traveled additional miles commuting and between pickups.

Vehicle shedding and suppression, however, can decrease total VMT. Most of the costs of car ownership are fixed. Once someone pays for of the car, insurance, and registration fees, the cost of each incremental trip feels nearly free. TNC users, however, must pay for every trip. People who use TNCs instead of personal cars tend to respond to those marginal costs by traveling fewer vehicle miles than someone who owns a car, and by availing themselves of other modes, such as walking, biking, and transit.

The research shows that vehicle suppression had the largest effect on VMT. Between 6 and 9 percent of survey respondents in each city said that they would acquire a car if Lyft and Uber disappeared from their area. Respondents were asked to estimate how much they would drive these hypothetical cars, and the average mileage saved per suppressed vehicle was calculated at about 5,286 miles per year in the San Francisco region, 5,097 miles per year in the Los Angeles region, and 4,375 miles per year in Washington, D.C. region. When averaged across the entire sample, this translated to a VMT reduction of about 300 to 500 miles per year per person, significantly higher than the reductions associated with vehicle shedding, mode shift, and behavior change.

On the individual level, selling a car led to greater VMT savings than suppression (6,308 miles per year in San Francisco, 5,205 in Los Angeles, and 5,845 in Washington, D.C.). However, it is easier to not buy a car than it is to sell one, and shedding is relatively rare. Only 2.5 percent of respondents across the three cities shed a vehicle because of the availability of Lyft and Uber (compared with the 6–9 percent suppression rate).

These findings show that, while Lyft and Uber drivers generally increased overall VMT because they traveled so many miles without passengers, **it is possible for overall VMT to fall if the availability of TNCs means that more people choose not to own cars**. Policy solutions, then, should focus on maximizing these ownership effects by making it more attractive for people to live without personal cars.

TABLE 3: AVERAGE CHANGE IN PASSENGER VMT PER PASSENGER PER YEAR ATTRIBUTABLE TO DIFFERENT BEHAVIORS

	Change due to personal driving per year	Change due to use of other automobile modes per year	Change due to vehicle shedding per year	Change due to vehicle suppression per year	Change in weighted VMT per respondent per year
San Francisco CBSA	−164	−57	−197	−425	−843
Los Angeles CBSA	−194	−85	−141	−511	−931
Washington, D.C. CBSA	−100	−79	−103	−304	−585[22]

© iStock

3. Inefficient matching of passengers limits the VMT/GHG emissions benefits of pooled rides.

Before the pandemic, Lyft and Uber both offered pooled ride services, where multiple passengers going to different destinations would ride in the same vehicle. Lyft Shared and UberPool were intended to move more passengers per vehicle mile traveled, which could mean greater reductions in VMT overall. The researchers' findings confirm this hypothesis: Pooled services mitigated, to an extent, VMT and GHG emissions produced by TNCs. However, the benefits of pooling were partial and generally offset only a limited share of overall VMT and GHGs from TNCs.

The effectiveness of pooled services in mitigating VMT and GHG emissions depends on what portion of TNC passengers use these services and how efficiently they are matched. When a passenger requests a pooled ride, the operator tries to match them with other passengers along their route. In some cases there is no match, so the pooled ride effectively becomes a private one. The results of the study indicate that pooled services were more efficient at matching in places where they were more heavily used. This makes sense, because if more people are requesting pooled rides then there are more potential matches to make. San Francisco saw the highest demand for pooled services and the most efficiency gains from these services. With increased usage and better matching, Lyft Shared and UberPool would likely have greater impacts on efficiency.

However, while pooled rides may be more efficient than private rides in terms of VMT per passenger, the lower fares associated with pooled rides could divert trips from even more efficient modes—like public transit, biking, and walking—and could be more likely to induce trips that otherwise would not be taken. The research supports this hypothesis, finding that pooled services both replaced public transit trips at a greater rate than private services did and induced travel at a greater rate. Additional research is necessary to determine if improved matching would be enough to outweigh the additional vehicle trips that these services incentivize.

4. TNCs replace public transit trips more than they facilitate them.

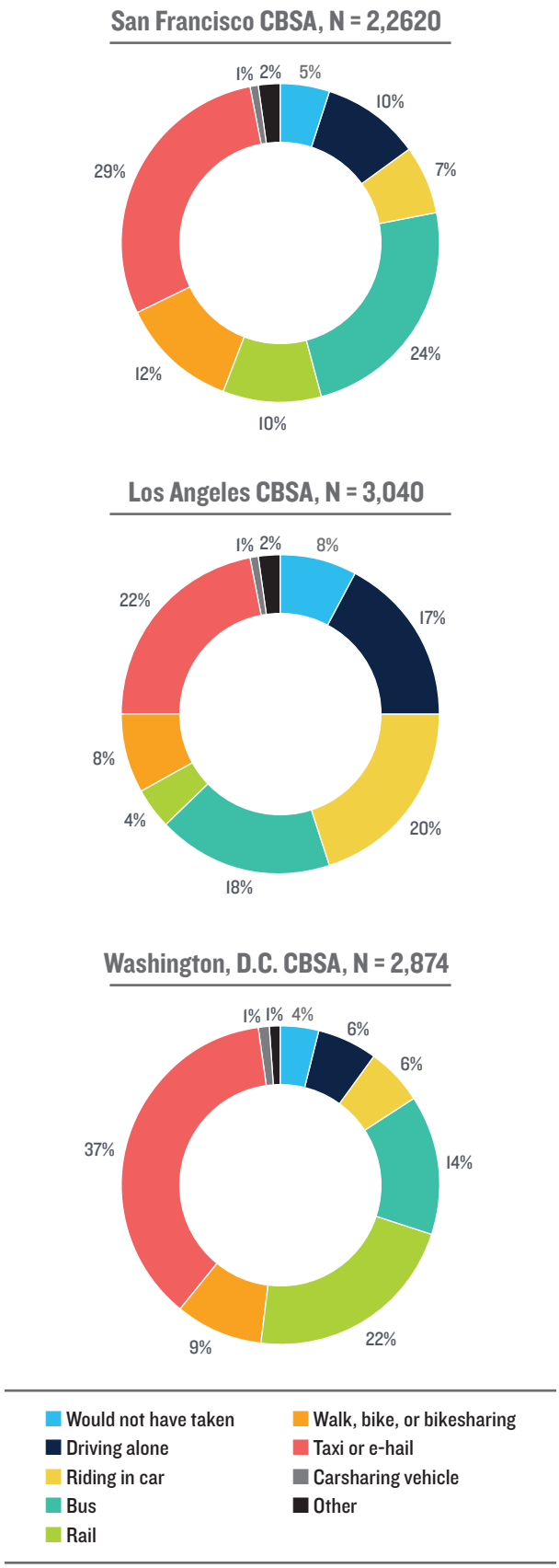
Aside from zero-emissions travel options such as walking and biking, public transportation is the most climate-friendly way to get around. In considering the VMT and GHG emissions impacts of TNCs, it is important to understand how TNCs impacted local public transportation ridership. Did TNCs, as Lyft and Uber have suggested, facilitate more public transit use by providing a first/last-mile connection to transit stations? Or did TNCs pull riders away from public transit?

To explore this issue, respondents were asked about their most recent TNC trip and whether they used it as first/last-mile connection. Between 7 and 13 percent of respondents in each region used their last TNC trip to get to or from public transit. Most of these respondents would still have used transit even if Lyft and Uber were not available. When TNCs were used for first/last-mile connections, they were more often replacing bus, walking, biking, and taxi connections than they were encouraging new public transit trips.

Respondents were also asked what mode they would have used for their most recent trip had TNCs not been available. The results indicate that TNCs drew passengers away from all other modes, including public transit. Taxis were the single most common mode to be replaced by TNCs, but between 24 and 36 percent of respondents said they would have used bus or rail for their last trip had TNCs not been available. Lyft and Uber's lower-cost pooled services were especially competitive with public transit. Figure 1 presents the distribution of modes replaced by respondents' last Lyft or Uber trip.

© Gabrielle Lurie/San Francisco Chronicle via Getty Images

FIGURE 1: DISTRIBUTION OF TRAVEL MODES REPLACED BY LYFT AND UBER IN THE SAN FRANCISCO, LOS ANGELES, AND WASHINGTON, D.C. CORE-BASED STATISTICAL AREAS



Based on this research, Lyft and Uber appeared to replace public transit trips more than facilitate them. Some 2 to 3 percent of respondents reported using public transit more often because of Lyft and Uber, but 24 to 53 percent of respondents said they used it less. Despite claims that its service complements transit, Uber seems to be aware of its negative effect on transit ridership. The company stated in its 2019 IPO filings that it sees itself "as an alternative to personal vehicle ownership and usage of public transportation."[7]

RECOMMENDATIONS

While TNCs can reduce VMT in certain situations, during the 2015–17 study period Lyft and Uber usage increased overall VMT and GHG emissions in two of the three cities we studied. As the country recovers from the pandemic and TNC ridership begins to climb, policymakers should seize the opportunity for change and act to maximize the potential benefits of TNC use while also ensuring that our streets work for all travelers, regardless of how they choose to get around.

TNC ridership is increasing, but it is unclear whether the industry will ever look exactly like it did before the pandemic. As the economy reopens, demand for TNCs is outstripping supply. Fewer people are driving for Lyft and Uber than before the pandemic, and as a result fares are up as much as 40 percent.[8] While fares may fall if more drivers join the TNC workforce, it's also possible that TNCs will keep prices high in an effort to become profitable after years of operating at a loss.[9]

If TNC fares remain at these higher levels, it is likely that people will take fewer trips. This could reduce the negative effect of TNCs by leading to less additional driving, but it could also reduce the *positive* effect of TNCs by making regular use of the services too expensive to compete with car ownership. Our recommendations, then, focus both on maximizing the potential of TNC use to discourage car ownership and ensuring that people have convenient ways to travel without driving. Additionally, we want to push TNCs toward business practices that protect labor rights and prioritize vehicle electrification.

1. Use equitable road pricing to manage congestion and encourage pooled rides.

Driving is often the most convenient way to travel through a city, but that convenience comes with costs like traffic fatalities—more than 35,000 Americans die in car crashes every year—and increased pollution.[10] Instead of making drivers and their passengers pay for the full impact of their vehicle use, these costs are passed on to society. In the case of TNCs, this kept fees artificially low, which encouraged increased ridership and led to greater traffic congestion.

Even before the pandemic, cities had begun to use pricing to manage TNCs. For example, Washington, D.C., levies a 6 percent TNC tax, and New York City adds $2.75 to every TNC trip in most of Manhattan.[11] As experiences in cities

implementing congestion pricing have shown, charging even a relatively modest fee to cars to enter downtown areas during peak periods can alleviate congestion.[12] However, adding fees to Lyft and Uber rides but not to private automobile trips could simply cause people to drive their own cars rather than using TNC services, which would greatly limit any potential reductions in VMT, emissions, and congestion. Given this possibility, TNC taxes should be pursued alongside broader congestion pricing programs.

As discussed, pooled rides have the potential to create additional VMT reductions. Lyft and Uber suspended their pooled ride programs at the start of the pandemic. While the future of Lyft Shared is unclear, *Business Insider* reports that UberPool will likely return in a limited format lacking the deep discounts that previously characterized the service. Previously, Lyft and Uber greatly subsidized their pool services.[13] Levying lower per-passenger fees on pooled rides than on private ones could make pooling more cost-effective both for TNCs and for their consumers. In New York City, the $2.75 TNC fee is reduced to $0.75 per passenger for pooled rides.[14] This concept can be extended to private vehicles. An occupancy-based fee would encourage people to share both TNC and private vehicle trips.

An ideal road pricing system would incentivize people to use the most efficient modes of travel. Single-passenger automobile trips (either private or provided by a TNC) should be more expensive than multi-passenger automobile trips, and the price of both should be high enough to encourage people to ride public transit, bike, or walk instead.

Many low-income Americans rely on cars to live their daily lives, so we must consider the equity implications of road pricing. Road pricing programs should be designed in collaboration with traditionally underrepresented communities and include strategies to maximize equity. For example, cities can create exemptions or discounts for low-income drivers and use road pricing revenues to fund transit services that disproportionately serve low-income travelers. For a deeper dive into equitable road pricing, please review the report *Pricing Roads, Advancing Equity*, published by the transportation advocacy organization TransForm with support from NRDC.[15]

© John Chacon/CDWR

© Adam Coppola Photography

2. Redesign streets to prioritize low-carbon transportation.

The research shows that more than half of TNC trips in the San Francisco and Washington, D.C. regions and nearly half of trips in the Los Angeles region were four miles or shorter. These trips could be well served by buses, bicycles, and walking, but most streets in American cities have traditionally given priority to personal automobiles. Transit, walking, and bicycling are often slow, dangerous, or otherwise unpleasant as a result. While automobiles can make traveling easier, especially for people with disabilities, driving should not be the default mode of transportation for all road users.

During the pandemic, cities took bold steps to reclaim street space for people to travel safely without cars. Rather than walk back these programs, cities should double down, continuing to redesign their streets to give dedicated space to travelers who choose to travel by lower-emissions modes. Bus lanes, protected bicycle lanes and slow streets, and wider sidewalks with safer intersection crossings are all important pieces of a low-carbon future.

3. Incentivize or require electrification of TNC vehicles.

The study shows that while a notable portion of Lyft and Uber drivers owned hybrid vehicles, very few owned plug-in hybrid electric vehicles (PHEVs) or electric vehicles (EVs). This presents an opportunity to reduce the carbon footprint of TNCs. In 2018, California took a major step toward TNC electrification with the passage of SB 1014, the California Clean Miles Standard and Incentive Program.[16] The program requires that TNCs create GHG reduction plans and work to transition their drivers to zero-emissions vehicles. To their credit, Lyft and Uber recently made commitments to go 100 percent electric by 2030 and 2040, respectively.[17]

The need for charging is one barrier to meeting the ambitious electrification goals set by Lyft and Uber. There is a clear correlation between the availability of charging infrastructure and EV adoption in the consumer market.[18] TNC drivers face the additional challenge of not knowing their destination before accepting a ride. This puts them at risk of accepting a ride out of range of their vehicle. Funding strategically placed charging infrastructure, especially Level 3 DC fast chargers, could help combat this problem.

© Andrew Spear for NRDC

© Seth Wenig/AP

Cities could require that TNCs fund the installation of publicly accessible charging infrastructure, which would help alleviate range anxiety for both TNC drivers and other electric vehicle drivers. Public charging infrastructure would be especially useful to drivers (TNC and otherwise) who live in apartments or other buildings without on-site charging.

4. Mandate fair labor practices to protect TNC drivers.

This research examined the effects of Lyft and Uber given the prices that prevailed from 2015 to 2017. Keeping the cost of TNC services low helped the services compete with car ownership, but those low prices were made possible by exploitative labor practices. A 2018 study by the Economic Policy Institute calculated the average wage of an Uber driver to be just $9.21 per hour after accounting for gas, vehicle depreciation, and other expenses.[19]

Lyft and Uber circumvent minimum wage laws and other worker protections by classifying drivers as independent contractors rather than employees. Proposition 22, passed by California voters in November 2020, codified this practice.[20] While Proposition 22 was ruled unconstitutional in August 2021, Uber plans to appeal and TNCs are likely to pursue similar laws in other states.[21]

As discussed, the VMT effects found in this study relied on TNC fares being low enough that people could afford to use Lyft and Uber for all their car trips and forgo owning their own automobile. It is possible that improving driver compensation would result in increased fares and that this would undercut some of the potential environmental benefits of TNC use. However, VMT reductions cannot come at the expense of workers' rights. If TNCs cannot be allies in the fight against climate change while fairly compensating drivers, they cannot be allies at all.

CONCLUSION

Since their introduction a decade ago, TNCs have become ubiquitous players in America's urban transportation landscape—a landscape that has contributed to the climate crisis. In 2020, the COVID-19 pandemic upended our transportation system. As the country reopens, we risk returning to an environmentally catastrophic status quo.

Looking ahead, governments are deciding what role to play in the TNC industry, but they cannot make informed decisions without comprehensive data about TNCs. Using operator data and survey responses, this research provides crucial information about how Lyft and Uber were affecting VMT and GHG emissions in our cities. We see from the results that while TNCs have the potential to reduce VMT by reducing car ownership, Uber and Lyft compete with transit and can lead to an overall increase in VMT and GHG emissions. By enacting policies that prioritize clean transportation and enhance the potential of TNCs to reduce overall car use, we can chart a new path toward a more sustainable future.

ENDNOTES

1 U.S. Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," last updated April 14, 2021. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#transportation.

2 David Meyer, "Ford CEO Hackett Sets Aside 2021 Autonomous Vehicle Deadline," *Fortune*, August 18, 2017, http://fortune.com/2017/08/18/ford-hackett-2021-autonomous-vehicles/. Chris Zook, "Uber's New CEO Will Have to Win on Two Fronts Simultaneously," *Harvard Business Review*, August 30, 2017, https://hbr.org/2017/08/ubers-new-ceo-will-have-to-win-on-two-fronts-simultaneously.

3 Michael Goldstein, "What Is the Future for Uber and Lyft After the Pandemic?," *Forbes*, July 27, 2020, https://www.forbes.com/sites/michaelgoldstein/2020/07/27/what-is-the-future-for-uber-and-lyft--after-the-pandemic/?sh=6cf142a83bc8.

4 Tony Owusu, "Lyft Sees a Smooth Ride for Passenger Volume in 2021," *TheStreet*, March 18, 2021, https://www.thestreet.com/investing/lyft-rises-on-improved-ridership-expectations.

5 While this brief refers to these three cities, the researchers conducted their analysis at the level of the core-based statistical area (CBSA), a census-defined unit consisting of the city and its surrounding metropolitan region.

6 Lyft and Uber provided per-passenger mileage data but not total mileage data. As a result, the study cannot calculate total VMT effects.

7 Brian Addison, "What It Means When Uber Finally Admits It Is in Direct Competition with Public Transit," *Long Beach Post,* April 15, 2019, https://lbpost.com/longbeachize/addison-uber-competition-public-transit/.

8 Winnie Hu, Patrick McGeehan, and Sean Piccoli, "You Can't Find a Cab. Uber Prices Are Soaring. Here's Why," *New York Times*, June 15, 2021, https://www.nytimes.com/2021/06/15/nyregion/uber-prices-rise-yellow-taxis.html.

9 Andrew J. Hawkins, "Uber and Lyft Are Getting Less Unprofitable, but COVID-19 Is Still a Drag on Their Business," *The* Verge, February 11, 2021, https://www.theverge.com/2021/2/11/22277043/uber-lyft-earnings-q4-2020-profit-loss-covid.

10 Luz Lazo, "Traffic Fatalities Are Down in the U.S., but More Pedestrians and Bicyclists Are Being Killed, Officials Say," *Washington* Post, October 22, 2019, https://www.washingtonpost.com/transportation/2019/10/22/traffic-fatalities-are-down-us-more-pedestrians-bicyclists-are-being-killed-officials-say/.

11 Martin Austermuhle, "Taxes on Booze and Uber Set to Go Up in D.C. to Help Pay for Metro," WAMU, May 18, 2018, https://wamu.org/story/18/05/15/taxes-booze-uber-set-go-d-c-help-pay-metro/. Winnie Hu, "Your Taxi or Uber Ride in Manhattan Will Soon Cost More," *New York Times,* January 31, 2019, https://www.nytimes.com/2019/01/31/nyregion/uber-taxi-lyft-fee.html.

12 John Rennie Short, "Should U.S. Cities Use Congestion Pricing to Ease Traffic?," *Smithsonian Magazine*, February 8, 2018, https://www.smithsonianmag.com/innovation/should-us-cities-use-congestion-pricing-to-ease-traffic-180968107/.

13 Tom Dotan, "The Pandemic Almost Killed UberPool, One of Uber's Cheapest Ride Services, and It Will Never Be the Same," *Business Insider,* May 26, 2021, https://news.yahoo.com/pandemic-almost-killed-uberpool-one-130000941.html.

14 New York State Office of the Governor, "Governor Cuomo Announces Highlights of the FY 2019 Budget," press release, March 30, 2018, https://www.governor.ny.gov/news/governor-cuomo-announces-highlights-fy-2019-budget.

15 Stuart Cohen and Alan Hoffman, "Pricing Roads, Advancing Equity," *TransForm*, January 2019, https://www.transformca.org/transform-report/pricing-roads-advancing-equity.

16 Office of State Senator Nancy Skinner, "Governor Signs Senator Skinner's Electrify California Ride-Hailing (E-CAr) Bill," press release, September 13, 2018, https://sd09.senate.ca.gov/news/20180913-governor-signs-senator-skinner%E2%80%99s-electrify-california-ride-hailing-e-car-bill.

17 Dara Khosrowshahi, "Driving a Green Recovery," Uber Newsroom, September 8, 2020, https://www.uber.com/newsroom/driving-a-green-recovery/. "Leading the Transition to Zero Emissions: Our Commitment to 100% Electric Vehicles by 2030," Lyft Blog, June 17, 2020, https://www.lyft.com/blog/posts/leading-the-transition-to-zero-emissions.

18 "Electric Vehicles Increasing in Popularity in U.S., with Bay Area Leading Charge in EV Purchases," KTVU, May 8, 2018, http://www.ktvu.com/news/ktvu-local-news/electric-vehicles-increasing-in-popularity-in-us-with-bay-area-leading-charge-in-ev-purchases.

19 Lawrence Mishel, "Uber and the Labor Market," Economic Policy Institute, May 15, 2018, https://www.epi.org/publication/uber-and-the-labor-market-uber-drivers-compensation-wages-and-the-scale-of-uber-and-the-gig-economy/.

20 Eric Rosenbaum, "What Uber, Lyft Prop 22 Win Could Mean for the Future of All Freelance Work," *CNBC Small Business Playbook,* November 4, 2020, https://www.cnbc.com/2020/11/04/what-uber-lyft-prop-22-win-means-for-future-of-all-freelance-work.html.

21 Margot Roosevelt and Suhauna Hussain, "Prop. 22 is Ruled Unconstitutional, a Blow to California Gig Economy Law," *Los Angeles Times*, August 20, 2021, https://www.latimes.com/business/story/2021-08-20/prop-22-unconstitutional.

22 The sum of the figures in this row differ from the total due to rounding.