Policy Brief Series on

Uber and Lyft in U.S. Cities

Findings and Recommendations from Carnegie Mellon University Research on Transportation Network Companies (TNCs)

Dr. Jeremy Michalek, Dr. Daniel Armanios, Dr. Corey Harper,
Dr. Destenie Nock, Dr. Kate Whitefoot, Dr. Matthew Bruchon,
Dr. Mahtot Gebresselassie, Connor Forsythe, Lily Hanig, Adam Koling

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Carnegie Mellon University
Engineering and Public Policy

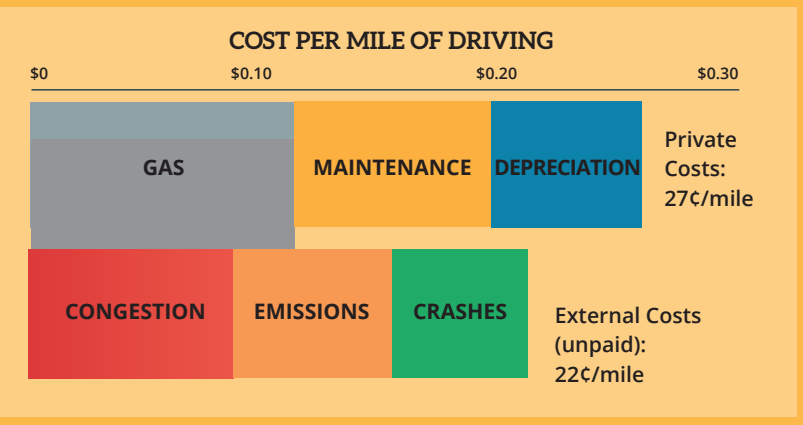
Contents

Key Terms

Equity — The level of fairness in how benefits and burdens are shared and allocated across society (distributional equity).[1]

Equality — The degree to which people with similar needs and abilities are treated equally.[2]

External cost — An indirect cost or benefit to an uninvolved third party that arises as an effect of another party's actions. For example, the cost of air pollution from driving is paid by people who breathe the particles and suffer elevated risk of respiratory and cardiovascular disease. Example estimates of private costs and external costs of driving are shown in the figure.



Ridehailing — In some contexts, the term ridehailing is synonymous with ridesourcing (see ridesourcing).[3] In other contexts the term ridehailing implies that the ride can be hailed from the street, like a taxi, rather than from a smartphone.

Ride pooling — See ride-splitting

Ridesharing — Ridesharing involves adding passengers to a private trip in which driver and passengers share a destination. Such an arrangement provides additional transportation options for riders while allowing drivers to fill otherwise empty seats in their vehicles. Traditional forms of ridesharing include carpooling and vanpooling. This term is sometimes used to refer to ridesourcing.[4]

Ride-splitting — A type of ridesourcing that allows customers requesting a ride for one or two passengers to be paired in real time with others traveling along a similar route.

Ridesourcing — Use of online platforms to connect passengers with drivers and automate reservations, payments, and customer feedback. Riders can choose from a variety of service classes, including drivers who use personal, noncommercial vehicles, traditional taxicabs dispatched via the providers' apps, and premium services with professional livery drivers and vehicles. Ridesourcing has become one of the most ubiquitous forms of shared mobility.

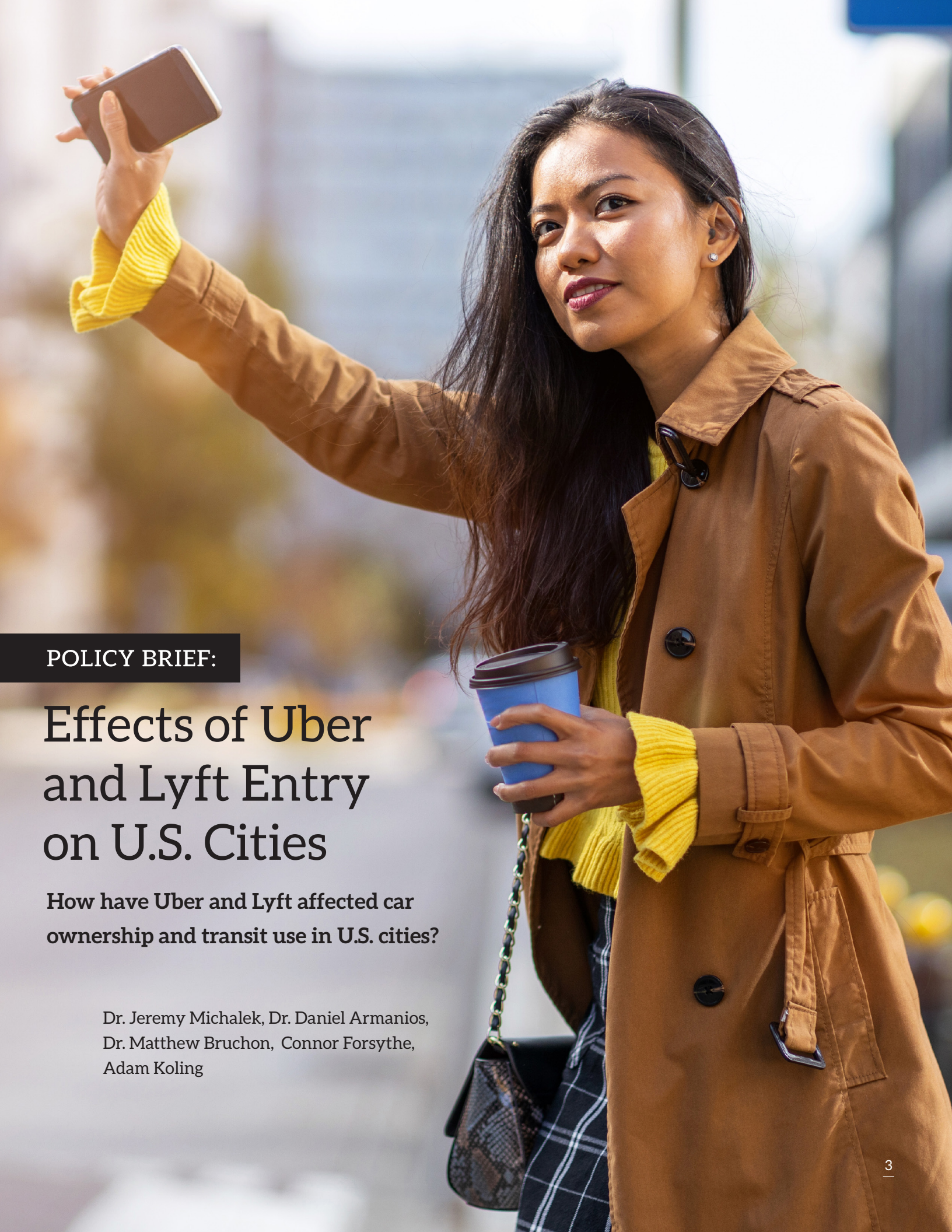
Transportation Network Company (TNC) — A company that provides ridesourcing services.

[1] *Karner, A., London, J., Rowangould, D., & Manaugh, K. (2020). From transportation equity to transportation justice: Within, through, and beyond the state. journal of planning literature, 35(4), 440-459.*

[2] *Litman, T. (2021). Evaluating Transportation Equity: Guidance for Incorporating Distributional Impacts in Transport Planning. Victoria Transport Policy Institute.*

[3] *Tirachini, Alejandro. "Ride-hailing, travel behaviour and sustainable mobility: an international review." Transportation 47.4 (2020): 2011-2047.*

[4] *https://www.transit.dot.gov/regulations-and-guidance/shared-mobility-definitions.*



POLICY BRIEF:

Effects of Uber and Lyft Entry on U.S. Cities

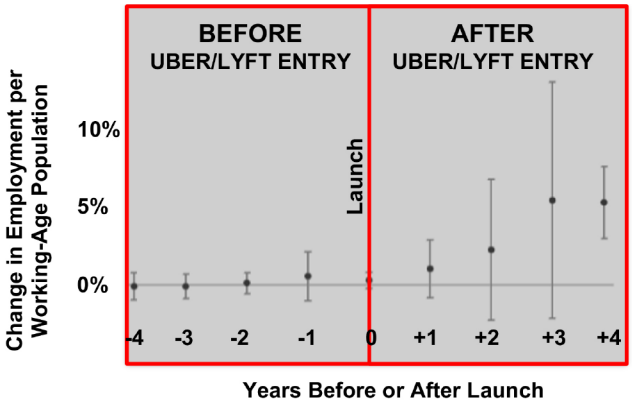
How have Uber and Lyft affected car ownership and transit use in U.S. cities?

Dr. Jeremy Michalek, Dr. Daniel Armanios, Dr. Matthew Bruchon, Connor Forsythe, Adam Koling

How Have Uber and Lyft Affected U.S. Cities?

WHAT HAPPENS WHEN UBER AND LYFT ENTER U.S. CITIES?

- Vehicle ownership increases by 0.7% on average
- This increase is larger in car-dependent and slow-growth cities
- Displacement of transit ridership is larger in cities with higher income or fewer children
- Economic growth, employment, and wages for unstable jobs increase



We conducted two statistical analysis studies leveraging the staggered timing of Uber and Lyft entry across U.S. cities as a natural experiment to isolate the effects caused by Uber and Lyft.

FINDINGS: Uber/Lyft entry has increased vehicle ownership on average across cities, especially in car-dependent and slow-growth cities.[5]

Uber/Lyft entry has displaced transit most in cities with high income and high childless household rates.[5]

Uber and Lyft entry has increased economic growth, employment, and wages of unstable jobs.[6]

RECOMMENDATION: Municipalities should consider the different effects that Uber and Lyft have on different kinds of cities when determining city policy. Ridesourcing does not look like a reliable way to reduce car ownership, and it displaces transit most in cities where people have more disposable income and fewer children, but overall, it has contributed economic benefits in cities, especially for seasonal, temporary, or otherwise intermittent jobs.

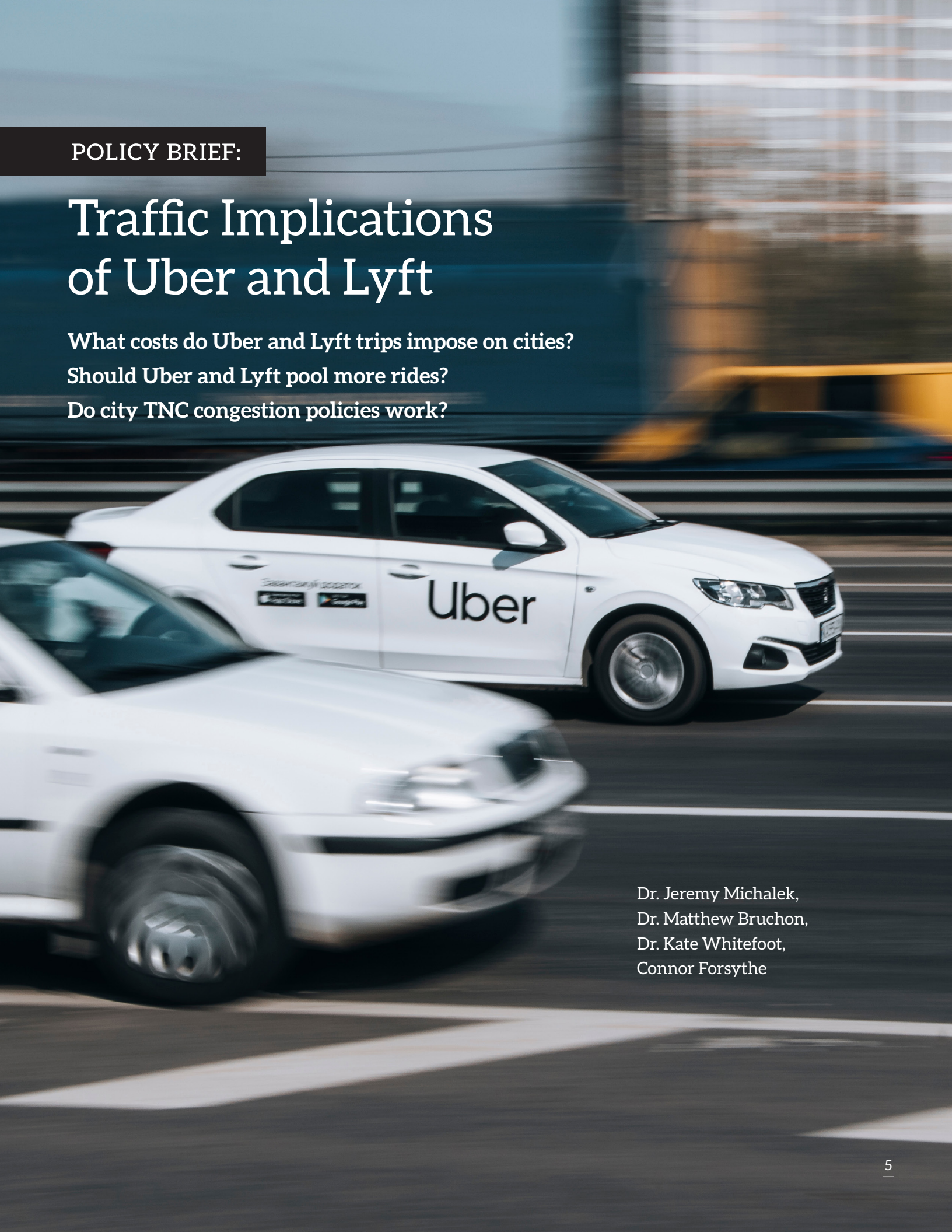
[5] *Ward, J., J.J. Michalek, C. Samaras, I. Azevedo, A. Henao, C. Rames, T. Wenzel (2021) "The impact of Uber and Lyft on vehicle ownership, fuel economy & transit across U.S. cities," iScience v21 n1 p101933.*

[6] *Koling, A., D. Armanios, A. Jha, and J. Michalek (2022) "Ride-sharing the wealth: effects of Uber and Lyft on jobs, wages and economic growth" Working Paper, Carnegie Mellon University.*

POLICY BRIEF:

Traffic Implications of Uber and Lyft

What costs do Uber and Lyft trips impose on cities?
Should Uber and Lyft pool more rides?
Do city TNC congestion policies work?



Dr. Jeremy Michalek,
Dr. Matthew Bruchon,
Dr. Kate Whitefoot,
Connor Forsythe

What Costs do Uber and Lyft Trips Impose on Cities?

We simulate Uber/Lyft rides and personal vehicle trips, estimating the external cost to society of congestion, crash risk, air pollution, and greenhouse gas emissions.[7]

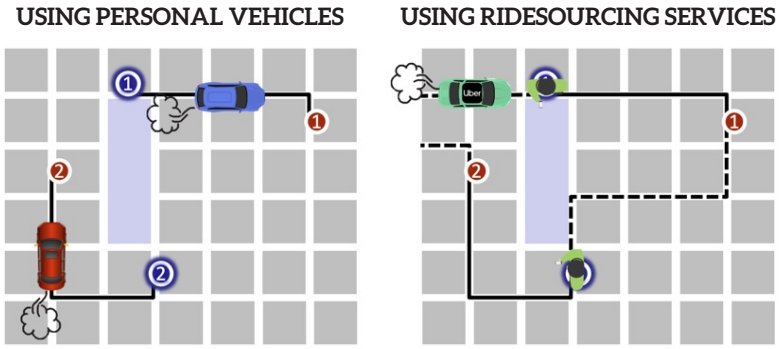
FINDINGS: Compared to driving a personal vehicle, Uber and Lyft clean the air but clog the streets.

An Uber or Lyft ride can reduce air pollution damages by 9-13¢ per trip by avoiding the number of times vehicles produce bursts of pollution when starting up. But the extra TNC driving to and from passengers increases costs from congestion, crash risk, climate change, and noise by 45¢.

Overall, an average Uber/Lyft ride creates more external costs to society than a personal vehicle trip.

RECOMMENDATION: Policies that encourage ridesourcing over personal vehicle use are not likely to increase net benefits to society.

To reduce the external costs of ridesourcing for society, cities **can encourage pooled rides over solo rides, encourage enhanced safety** in TNC vehicles, and **discourage transit displacement**.



Compared to personal vehicle travel, ridesourcing services may reduce emissions from vehicle startups but increase vehicle distance traveled displacement.

SHIFTING A PRIVATE VEHICLE TRIP TO UBER OR LYFT INCREASES AVERAGE EXTERNAL COSTS BY 32-37¢ PER TRIP

Taking an Uber or Lyft can drop air pollution costs by 9-13¢ per trip.

But the extra driving creates additional external costs of 45¢ per trip from crashes, congestion, climate change, and noise.

To reduce external costs, encourage pooled rides and reduce transit displacement.

[7] *Ward, J., J.J. Michalek and C. Samaras (2021) "Air pollution, greenhouse gas, and traffic externality benefits and costs of shifting private vehicle travel to ridesourcing services," Environmental Science & Technology, 55 19 13174-13185.*

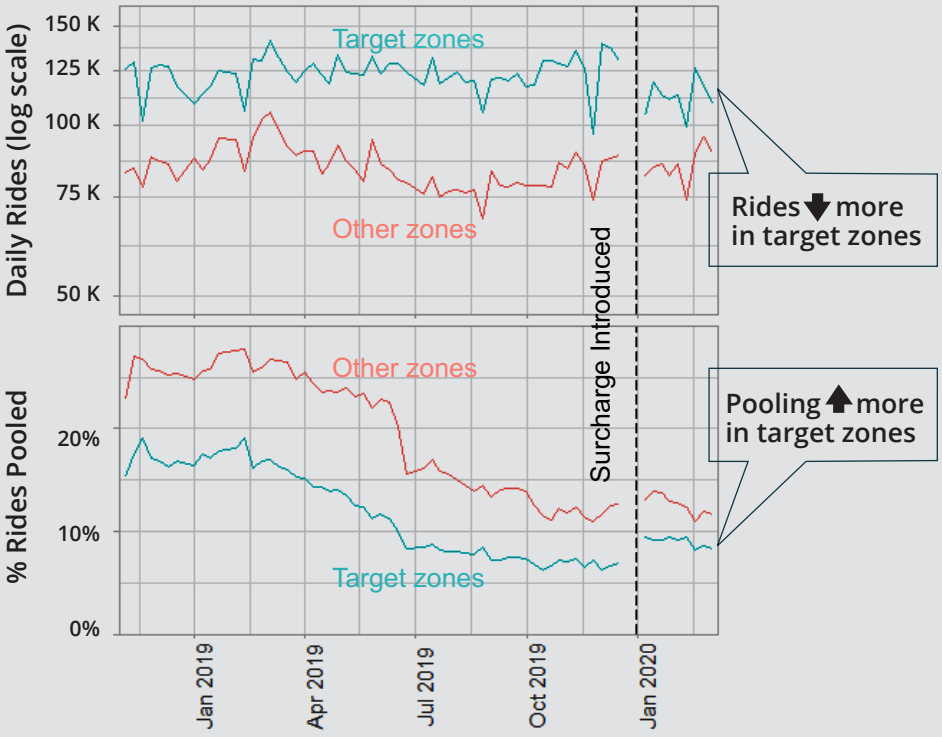
Do City TNC Congestion Policies Work?

In January 2020, the City of Chicago implemented a tax to encourage Uber and Lyft riders to pool rides and discourage travel to and from downtown and special zones during peak hours.

We conducted a causal statistical analysis to identify the effect of Chicago's policy on peak downtown rides relative to other rides.[8]

FINDINGS: Chicago's policy had its intended effect, resulting in an estimated 3% increase in pooling rates and an 8% reduction in total rides to and from downtown during peak hours, relative to trends with non-downtown rides.

RECOMMENDATION: City tax policies can successfully and meaningfully influence TNC ridership behavior. Municipalities should consider economic efficiency and equity factors as well as relationships with other modes when setting TNC policy.



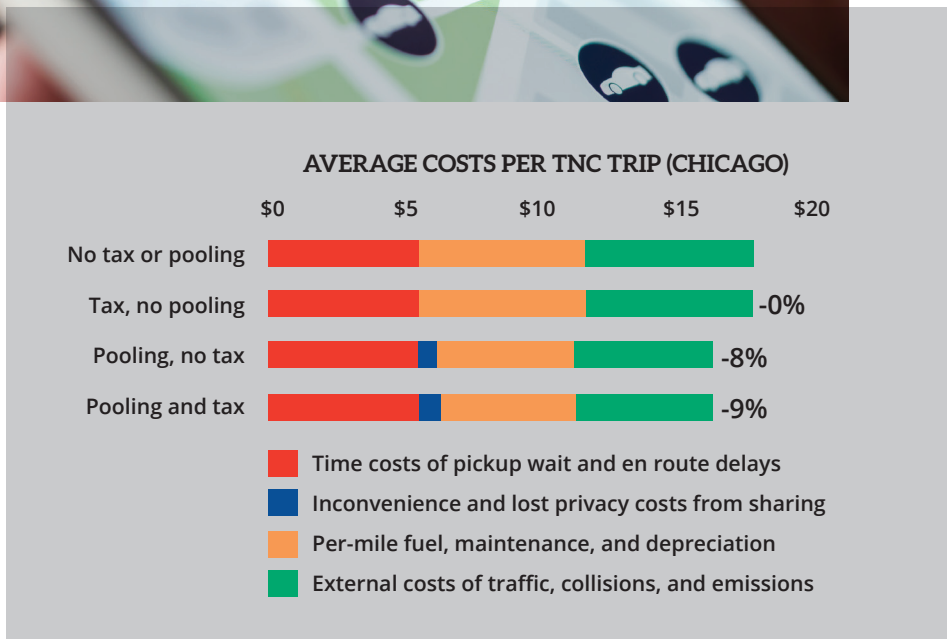
[8] *Bruchon, M., C. Forsythe, C. Andreasen, K. Whitefoot and J. Michalek (2022) "Does congestion pricing for Uber and Lyft work? Effects of Chicago's downtown zone surcharge," Working Paper, Carnegie Mellon University.*

Should Uber and Lyft Pool More Rides?

We optimize a fleet of TNC vehicles to satisfy ride demand in Chicago, using public TNC travel data, and we compare results when optimizing the fleet for (1) minimum private costs and (2) minimum private costs plus a tax reflecting costs to society of congestion, collisions, and emissions.[9]

FINDINGS: Ride pooling (sharing rides) reduces external costs of congestion, collisions, and emissions by 18% and reduces overall social costs by 8%.

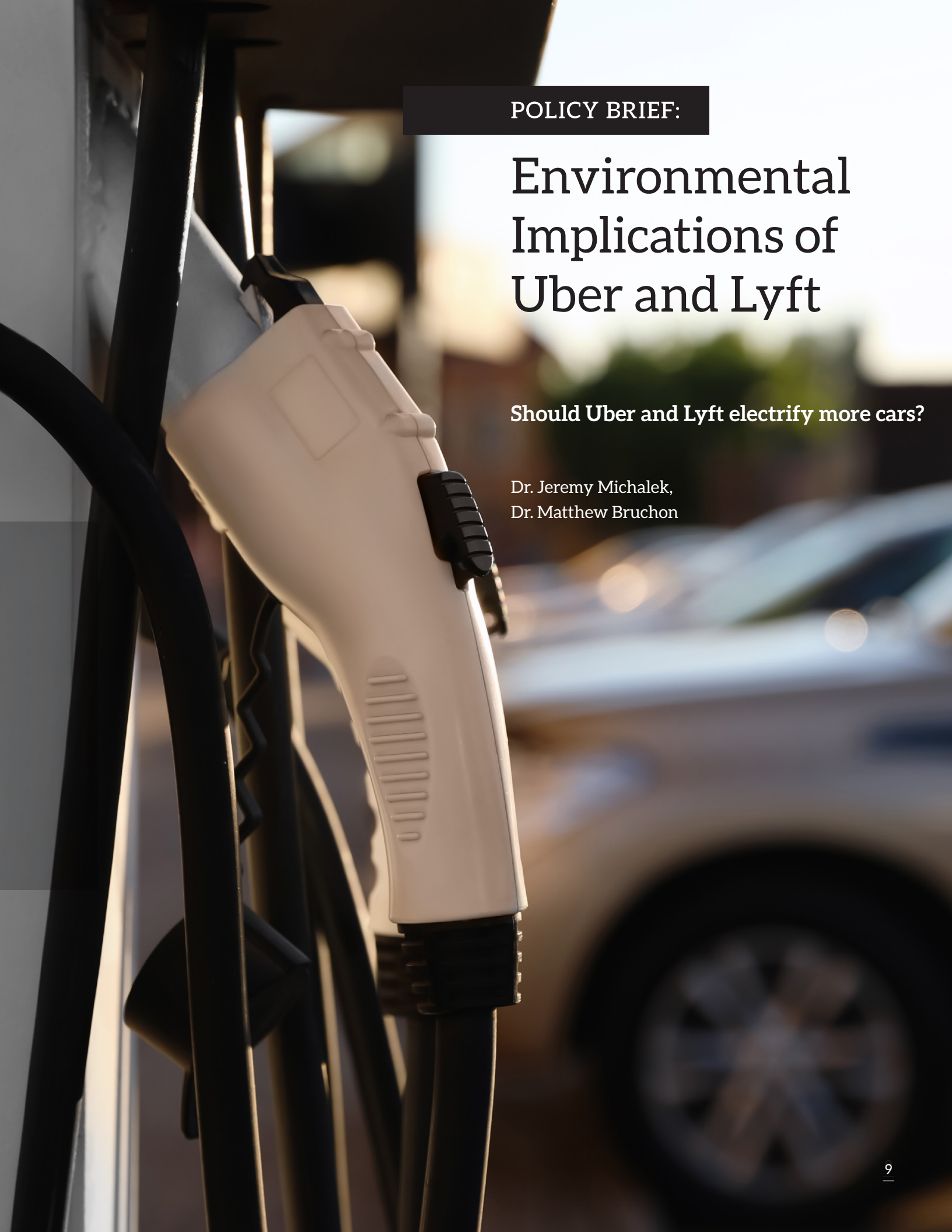
Private costs alone appear to provide most of the needed incentive for TNCs to pool rides: When charged for the costs of congestion, collisions, and emissions imposed on others, our TNC fleet increased pooling rates by only 3% and reduced social costs by 1% (~$5M per year in Chicago).



RECOMMENDATION: Ride pooling is an important mechanism for reducing social costs of ridesourcing services, but private costs alone appear to provide most of the incentives needed for TNCs to pool rides at nearly the socially optimal level. **There is limited room for policy intervention to increase net benefits to society by encouraging ride pooling** beyond that which TNCs already have incentives to provide.

However, disincentives beyond costs modeled here (such as forecasting and operational challenges) may discourage pooling, and **other policy justifications (such as equitable service coverage) may still warrant policies** to encourage pooling.

[9] *Bruchon, M., C. Forsythe and J.J. Michalek (2022) "Should ridesourcing services pool more?" Working Paper, Carnegie Mellon University.*



POLICY BRIEF:

Environmental Implications of Uber and Lyft

Should Uber and Lyft electrify more cars?

Dr. Jeremy Michalek,
Dr. Matthew Bruchon

Should Uber and Lyft Electrify More Cars?

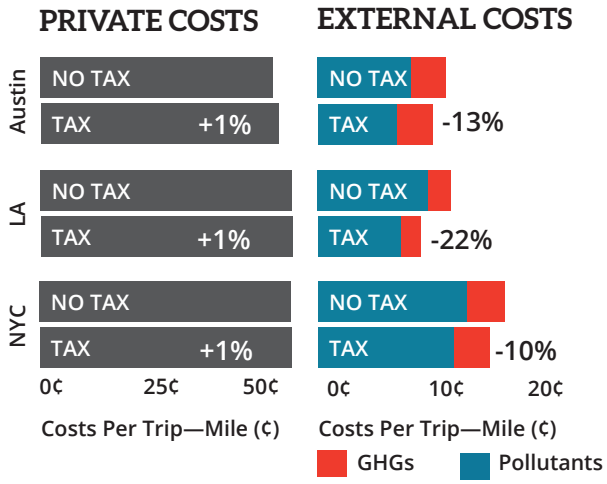
We optimize a fleet of TNC vehicles to serve demand in Chicago with a mix of conventional gasoline vehicles, hybrid electric vehicles, and plug-in electric vehicles. We compare results when (1) minimizing the private costs and (2) minimizing private costs plus a tax reflecting cost to society of air pollution and greenhouse gas emissions.[10]

FINDINGS: When faced with the costs that air pollution and greenhouse gas emissions impose on others, cost-minimizing **TNCs electrify more of their fleet, reducing air emission costs** by amounts that range from 10% (in New York) to 22% (in Los Angeles ~$29M per year).

RECOMMENDATION: Policy interventions to encourage electrification of TNC fleets, such as California's Clean Miles Standard, may be **warranted on social welfare grounds**.

However, in most cases **the socially optimal fleet involves a mix of vehicle powertrain technologies**—not 100% electric vehicles—so policies should avoid overly blunt instruments and allow flexibility for gasoline vehicles to be used in portions of the fleet, such as for infrequently used vehicles that serve only peak demand.

Even gasoline Uber/Lyft vehicles can reduce air pollution compared to personal cars, but most of the costs to society from TNCs come from congestion and crash risk, so **electrifying Uber and Lyft will not alone solve the TNC externality problem.**[11]



[10] *Bruchon, M., I. Azevedo and J.J. Michalek (2021) "Effects of air emission externalities on optimal ridesourcing fleet electrification and operations," Environmental Science & Technology, v55 n5 p3188-3200.*

[11] *Ward, J., J.J. Michalek and C. Samaras (2021) "Air pollution, greenhouse gas, and traffic externality benefits and costs of shifting private vehicle travel to ridesourcing services," Environmental Science & Technology, 55 19 13174-13185.*

POLICY BRIEF:

Equity Implications of Uber and Lyft

What is the role for TNCs in a pandemic?

How did COVID-19 affect TNC ridership in high- and low-income neighborhoods?

How did heat waves affect TNC ridership in high- and low-income neighborhoods?

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Dr. Mahtot Gebresselassie,
Lily Hanig

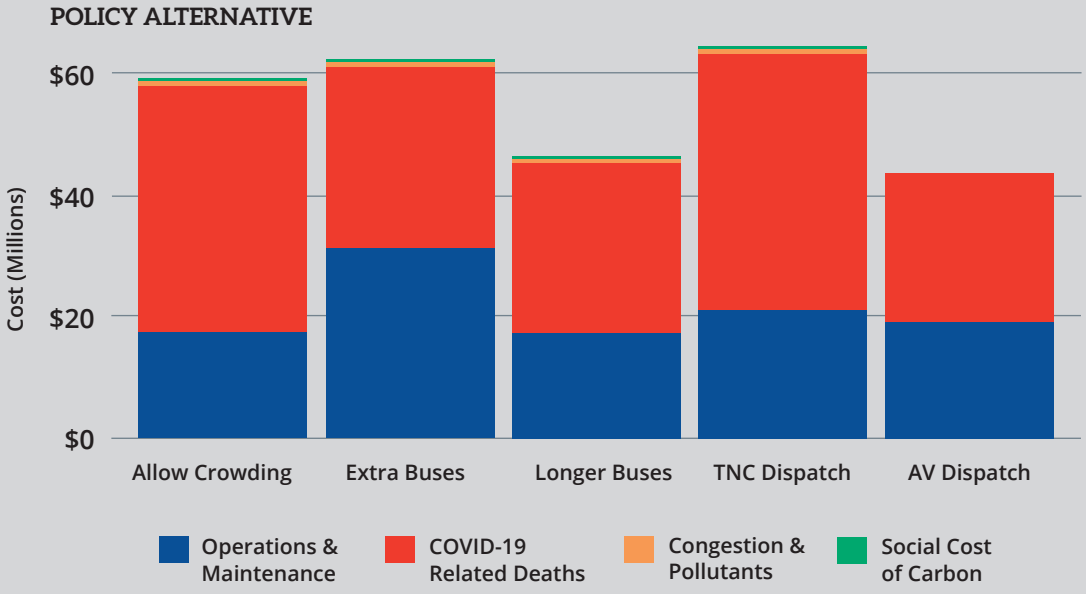
What is the Role for TNCs in a Pandemic?

We estimate the risk of contracting COVID-19 on the Pittsburgh bus system during the pandemic and compare options for mitigating risk.[12]

FINDINGS: We estimate that **4% of COVID-19** cases in the early months of the pandemic could have been **contracted on the bus** or from a bus rider. The **most cost-effective mitigation approaches** with estimated benefits that outweigh costs include (1) **dispatching longer buses** to maintain reduced passenger density and (2) **dispatching on-demand autonomous TNC** vehicles for overcapacity riders.

RECOMMENDATION: Implementing **longer buses** on high demand routes is a strategy that can be implemented today by transit agencies to increase bus capacity and reduce viral spread. **Autonomous TNC vehicles can be dispatched in future scenarios to supplement overcapacity bus routes in pandemic scenarios.** This type of policy can benefit essential workers who are often from low-income or minority groups.

[12] *Hanig, L., C. Harper and D. Nock (2022) "COVID-19 public transit precautions: trade-offs between risk reduction and costs," Working Paper, Carnegie Mellon University.*



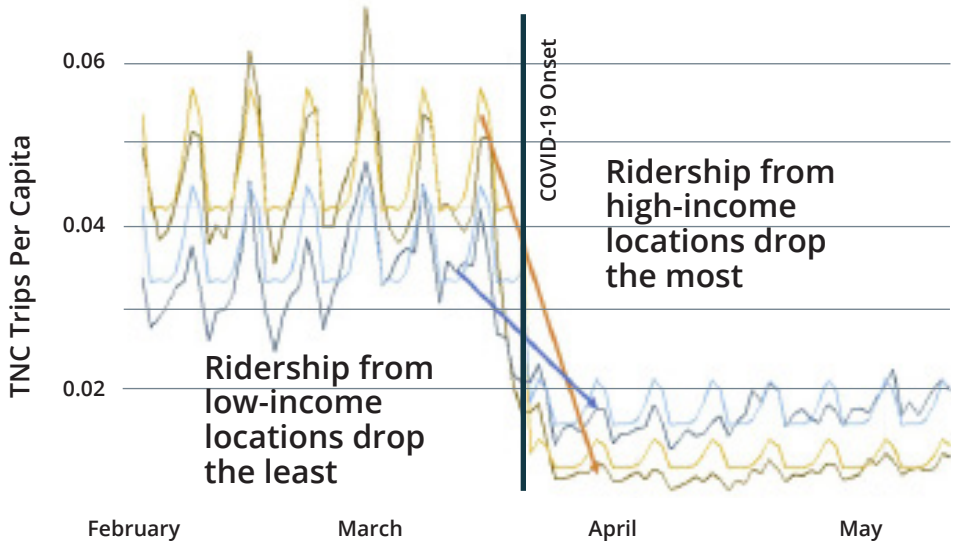
How Did COVID-19 Affect TNC Ridership in High- and Low-Income Neighborhoods?

We study the change in TNC ridership after the 2020 onset of the COVID-19 pandemic in both low- and high-income neighborhoods in Chicago.[13]

FINDINGS: We find a **larger drop in ridership** among riders traveling from **high-income neighborhoods** than among riders traveling from low-income neighborhoods.

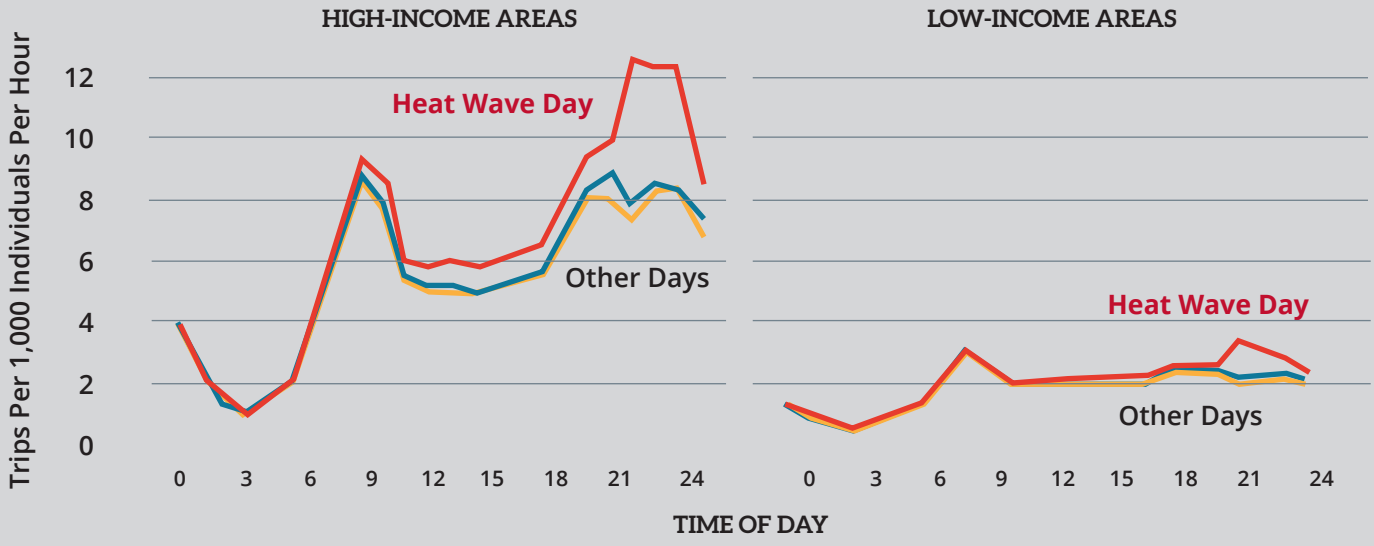
IMPLICATION: Low-income travelers appear more likely to be essential workers or otherwise be **dependent on TNC rides** and unable to adjust travel behavior in response to the pandemic, highlighting inequities. Some essential riders may perceive the health risk during the COVID pandemic on TNCs as lower than other public transit modes.

RECOMMENDATION: Conduct surveys to better understand why travelers from low-income neighborhoods use Uber and Lyft over alternatives and whether **changes in transit** may be warranted to support these travelers. Evaluate perception of the relative safety of different transportation modes.



[13] *Hanig, L. D. Nock, C. Harper (2022) "How did COVID-19 affect TNC ridership in high- and low-income neighborhoods?" Working Paper, Carnegie Mellon University.*

How Did Heat Waves Affect TNC Ridership in High- and Low-Income Neighborhoods?



We study the change in TNC ridership during heat waves in both low- and high-income neighborhoods in New York City in July 2019.[14]

FINDINGS: We find that the **increase** in trips per capita during heat waves is higher in **high-income neighborhoods than in low-income neighborhoods**.

IMPLICATION: High-income travelers appear to have a greater ability to switch to more comfortable modes during heat waves, while **low-income riders are more likely to endure extreme temperatures and humidity** while waiting at and walking to/from public transit stops.

RECOMMENDATION: Transportation planners should consider the possibility and viability of **extending special service offerings in low-income neighborhoods** and those with less transit access during heat waves to alleviate transit disparity exacerbated by extreme weather.

[14] *Gebresselassie, M., J.J. Michalek, D. Nock, C. Harper (2022) "Impact of heat waves on TNC-usage rates in low- and high income neighborhoods in New York City" Working Paper, Carnegie Mellon University.*

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Carnegie Mellon University

Heinz College
Carnegie Mellon University
5000 Forbes Ave.
Pittsburgh, PA 15213
412-268-9505
mobility21.cmu.edu

Carnegie Mellon University
5000 Forbes Ave.
Pittsburgh, PA 15213

412-268-2000
cmu.edu