



AUTONOMOUS VEHICLES: DIRECTIONS FOR RESEARCH

ELAINE BUCKBERG
CHIEF ECONOMIST
GENERAL MOTORS

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94%
OF ALL
TRAFFIC ACCIDENTS
ARE CAUSED BY
HUMAN ERROR

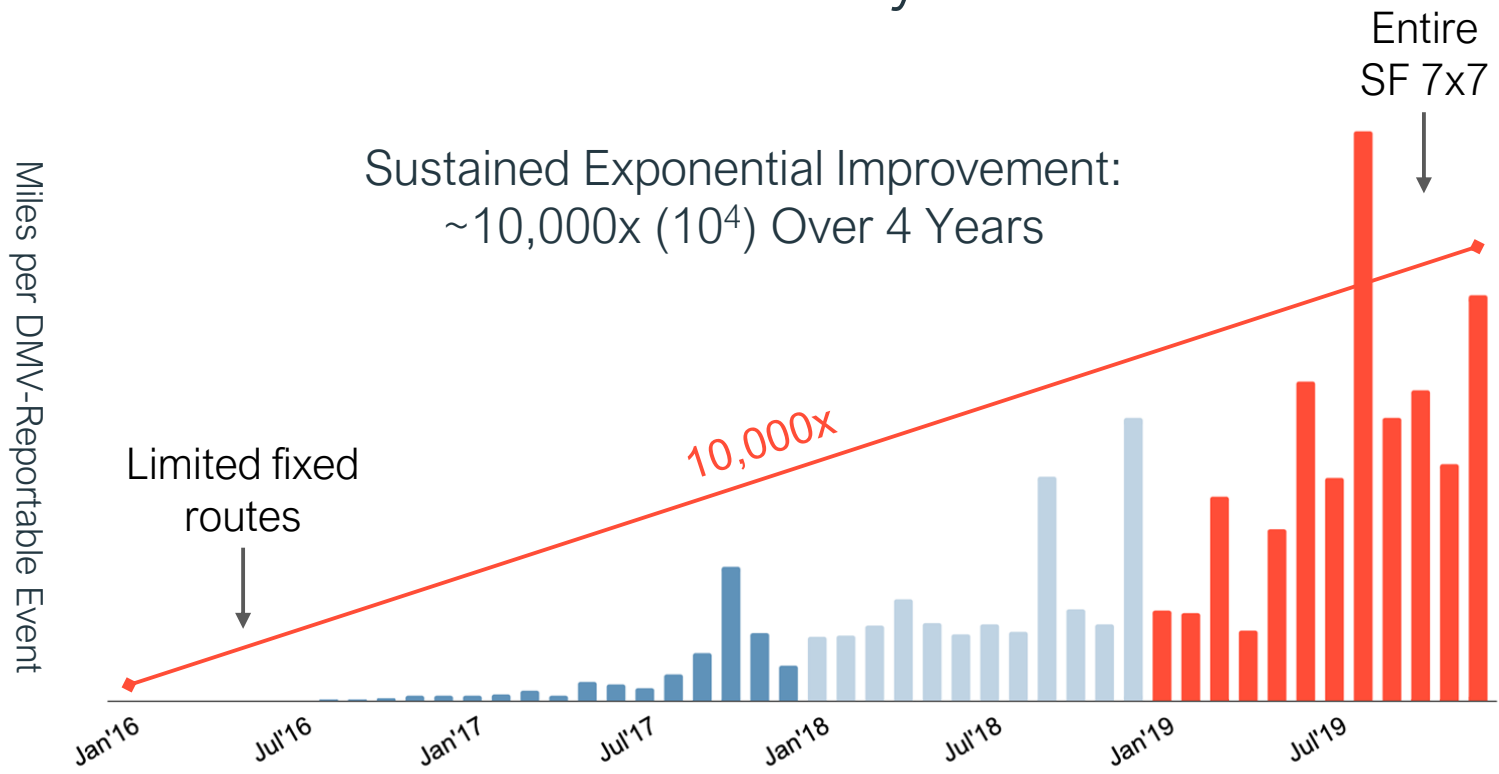
COMMUTERS
WASTE A FULL WEEK
OF THEIR LIVES IN TRAFFIC EACH YEAR

THE U.S. HAS
3 NON-RESIDENTIAL PARKING SPACES
FOR EVERY CAR
ON THE ROAD

Source: Auto Insurance Center
GENERAL MOTORS



How Close Are We To AVs On City Streets?



SOME KEY THEMES IN AV LITERATURE

- The impact of ride hailing (much of AV lit really rests on ride hailing)
- Environmental effects
- Labor market effects
- Distribution and welfare implications / overall costs and benefits

WHAT IS MISSING IN THE RIDE HAILING LITERATURE?

False assumption of homogeneity in many studies, which focus on most likely users.

Non-urban users: Studies look at dense urban areas. Suburban and rural settings are also important—represent most of current parc and VMT.

Representative samples: Based on samples of ride-hailing users, not representative samples of the population.

Heterogenous consumers: Do not give attention to the heterogeneity of consumer lifestyle, preferences, importance of time use, vehicle depreciation, and other factors.

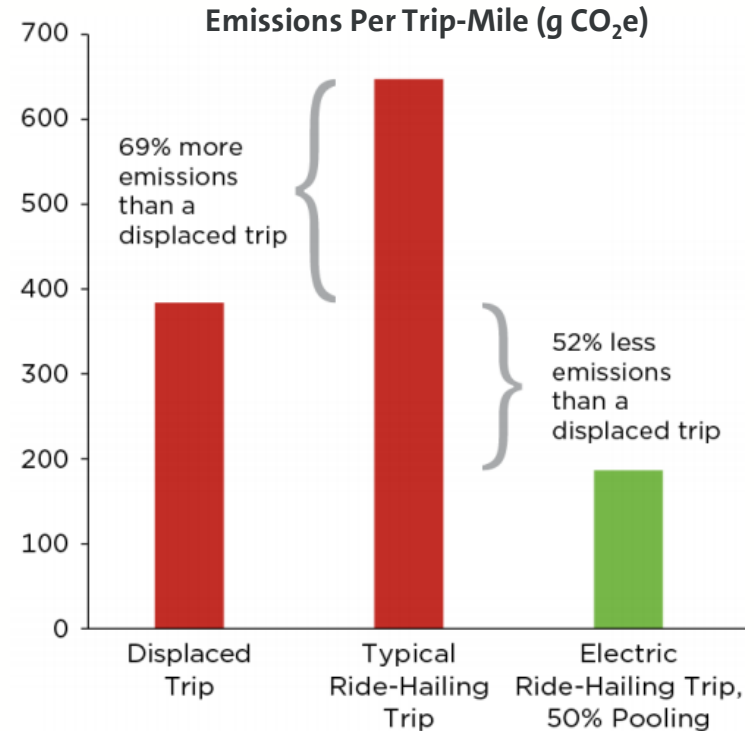
Vehicles are not *merely* a means of transportation: Adoption of shared AVs must consider other needs—customer/vehicle matching (e.g., baby seat, groups, cargo, wheelchairs).

RIDE HAILING POSES CLIMATE RISKS THROUGH INCREASED GREENHOUSE GAS EMISSIONS

Ride hailing is 69% more polluting than the rides being replaced.

- Deadheading—empty miles to pick up passengers
- Displacement of various low carbon intensive modes of transportation

Findings signal value in deploying EVs for ride hailing.

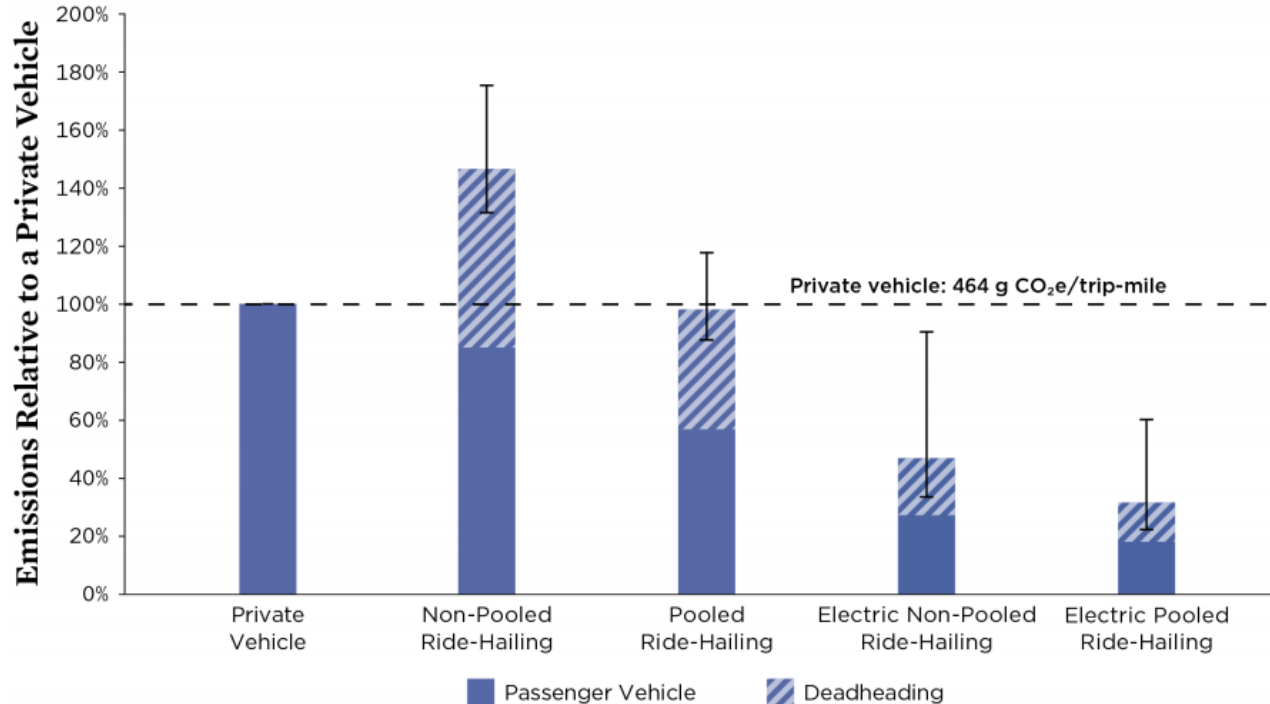


Source: Anair, D., J. Martin, M.C.P. de Moura, and J. Goldman. Feb 2020. "Ride-Hailing's Climate Risks: Steering a Growing Industry toward a Clean Transportation Future." Cambridge, MA: Union of Concerned Scientists.

USE OF EVS AND POOLING LEADS TO LOWER EMISSIONS

EVS REDUCE EMISSIONS MORE THAN POOLING

When is ride hailing better for the climate than using a private vehicle?



Source: Anair, D., J. Martin, M.C.P. de Moura, and J. Goldman. Feb 2020. "Ride-Hailing's Climate Risks: Steering a Growing Industry toward a Clean Transportation Future." Cambridge, MA: Union of Concerned Scientists.

CONSUMERS' TRANSPORTATION NEEDS VARY

Research thus far doesn't address the heterogeneity of consumers and their needs. Poses matching issues.

Almost any vehicle works if

- Commuting solo
- Few people out to shop/evening out

May need car seat/assistance/specific height/space

- Adult with young children
- Senior citizens
- Persons with disabilities

Need cargo space

- Family / tourist groups with baggage
- Transporting Large business/sport/music equipment

Low density and longer distances traveled

- Rural communities, outer ring suburban



INTRODUCTION OF AVS WILL BE BENEFICIAL TO MOST AMERICANS, BUT COSTLY TO SOME

Groshen et al. finds:

- Fewer pure driving jobs. Taking driving out of jobs could lower skill level and compensation.
- New jobs created may not match the location or skills of the jobs at risk.
- Job loss is likely slow to 2030 (<50K/year), creating opportunity to put in place policies to mitigate effects on most affected workers and communities.

Opportunity to pilot programs—rigorous evaluation/expand most successful:

- Place-based programs to address affected communities vs. only affected workers?
- Worker training accounts or other flexible benefits?

Source: Groshen, E., S. Helper, J.P. MacDuffie, and C. Carson. June 2018. "Preparing U.S. Workers and Employers for an Autonomous Vehicle Future." Upjohn Institute Technical Report No. 19-036. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

GROWING LITERATURE ON DISTRIBUTION, WELFARE, AND EFFICIENCY ISSUES RELATED TO AV ADOPTION

Recent research, including Ostrovsky and Schwarz (2018), Martin and Fairweather (2019), Seo and Shapiro (2019), and Holland et al. (2020), has examined:

- Optimal subsidy and taxation
- Road pricing and congestion
- Distributional consequences
- Public finance
- Social efficiency and welfare

This is a rich area for more work.

Sources:

Holland, S.P., E.T. Mansur, and A.J. Yates. Feb 2020. "The Electric Vehicle Transition and the Economics of Banning Gasoline Vehicles." NBER Working Paper 26804.

Martin, L.A. and Z. Fairweather. June 2019. "The Potential Distributional Impacts of Automated Vehicle Technologies." Unpublished Paper. NBER Conference on the Economics of Autonomous and Electric Vehicles.

Ostrovsky, M. and M. Schwarz. Feb 2018. "Carpooling and the Economics of Self-Driving Cars." NBER Working Paper No. 24349.

Seo, B., and M.H. Shapiro. June 2019. "Minimizing Fleet Emission Through Optimal EV Subsidy Design and Vehicle Replacement." Unpublished Paper. NBER Conference on the Economics of Autonomous and Electric Vehicles.

DIRECTIONS FOR FUTURE RESEARCH

What does data-based trip modeling show? Assessing vehicle trips and transportation, incorporating choices of U.S. households based on population density and demographics; detailed micro level studies using, e.g. National Household Travel Survey.

How do consumers value their time? Critical to estimating adoption at different prices per mile.

Will AVs increase pooled ride sharing? Assessing customers' perceived value of price, number of additional passengers, time, trust, security, and privacy. (Perhaps assuming COVID-19 risks abate.)

What is the impact of utilization rate on the environment and congestion? EVs vs. ICE AVs? Variation in utilization by geography/demography; effects of emissions and congestion.

More work on employment effects.

Alternative city/state revenue sources if drivers license and parking revenues fall.



THANK YOU