

The IBIT Report

A Publication of the Institute for Business and Information Technology

Brad N Greenwood & Sunil Wattal

Fox School of Business

Temple University



Show Me The Way To Go Home

RIDE SHARING AND ALCOHOL-RELATED MOTOR VEHICLE HOMICIDE



Fox School of Business
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The IBIT Report

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Foreward

The introduction of ride-sharing platforms such as Uber and Lyft have dramatically transformed the traditional licensed livery industry.

However, their entry has not been without major controversy and debate on proper legal oversight, the impact on consumer safety, and overall benefit to the larger society. This *IBIT report* examines this tradeoff by first exploring the growth of the “sharing economy,” its benefits, and as its perceived threats to existing business models. It then focuses on an important social benefit that can come from this new service: the extent to which Uber has led to reductions in alcohol-related motor vehicle deaths.

To answer that question, the report uses an extensive data set from the California Highway Patrol’s Statewide Integrated Reporting System to reveal some fascinating insights into the impact of these services on public health. They find that alcohol-related motor vehicle deaths fell by up to 5.6% in California after the introduction of Uber X.

These effects are strongest in large cities, and are most likely immune to surge pricing during weekends and holidays. These results will interest public policy makes, regulators, the taxi industry, and others interested in the impact of the peer economy.

Bruce Fadem
Co-Editor-in-Chief
December 2015

David Schuff
Co-Editor-in-Chief
December 2015

Introduction

Ridesharing platforms such as Uber and Lyft have sparked multiple policy debates over the last half decade.

Detractors argue that these companies put the public and consumers at significant risk. However, both scholars and policy makers have argued that such firms provide customers with a much needed service that circumnavigates the bureaucratic process of licensed livery, like city taxis.

One social benefit much debated in the media is whether ridesharing has the potential for reducing one source of significant public welfare costs: **drunk driving**.

As the costs of drunk driving are often born by taxpayers, through the prosecution and incarceration of individuals convicted of DUI, the effective management of both the number and type of vehicle-for-hire services is an important challenge for policy makers with economic and social implications.

This report details a study that investigates the extent to which these services lead to reductions in alcohol-related motor vehicle deaths.

It contrasts two services offered by Uber in the State of California between 2009 and 2014. The first is **Uber Black, a town car service that offers transportation with a significant markup over taxicabs (~20% - ~30%). The second is Uber X, a personalized driving service that offers significant discounts over taxis (~20% - ~30%).**

Overall, Uber X implementation results in a **3.6% to 5.6% decrease in motor vehicle homicides per quarter** in the state of California. However, limited evidence exists to support previous claims that this also occurs with the more expensive Uber Black car service.

Further, results indicate that it can take 9 to 15 months for these effects to manifest-- and that no effect manifests during periods of likely "surge pricing."

Managerial and policy implications, and recommendations for maximizing the social benefit of these transportation services, are also discussed. **With more than 1000 deaths¹ occurring in California due to alcohol-related car crashes every year, it is clear there is substantial opportunity to improve public welfare and save lives.**



Homicide is defined as the act of a human being causing the death of another human being. These include both unintentional and intentional homicides.

Key Findings

IN THIS REPORT

Uber is an outgrowth of the **sharing economy**, whereby consumers put idle resources (cars, empty guesthouses, etc.) to mutually beneficial use.



When **Uber X**, a lower priced service, enters a market there is a **3.6%–5.6% decrease** in the rate of alcohol-related motor vehicle homicides.

VS



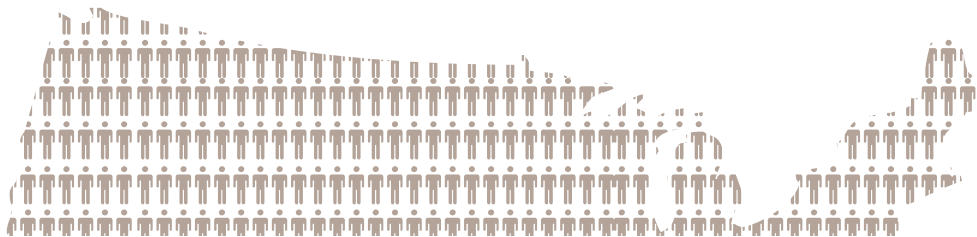
Uber Black, a higher priced premium service, **does not have a significant effect** on the number homicides due to drunk driving.



Alcohol-related vehicular **fatalities do not decrease** when “surge pricing” is likely in effect—weekends and holidays associated with increased drinking.



There is a **significantly stronger effect** when **Uber is in a larger city**.



A complete, national, implementation of UBER X would result in

500 FEWER DEATHS

due to alcohol-related car crashes



The Sharing Economy



The sharing economy, or peer to peer economy as it is often referred to, is a form of collaborative consumption where “participants share access to products or services rather than having individual ownership” (Hamari et al. 2013).

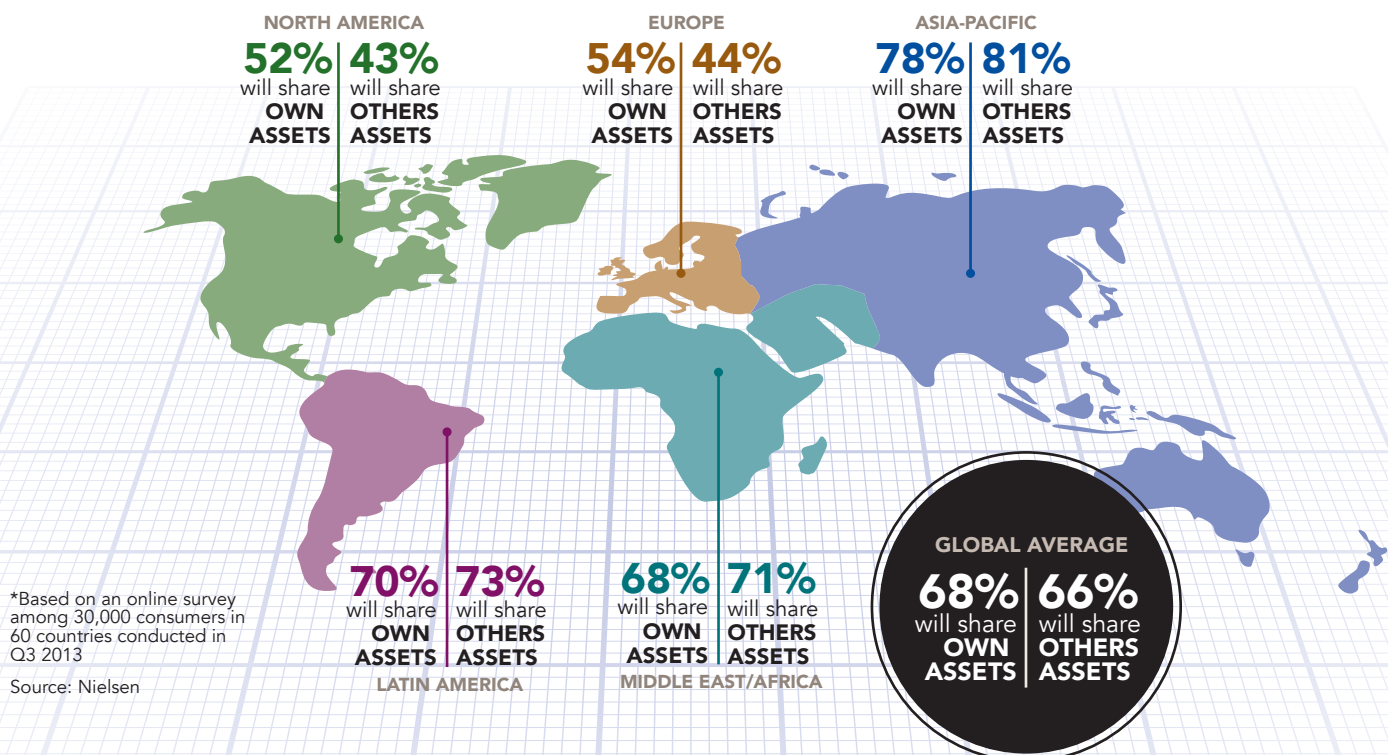
Originally conceived as a common means of production, e.g. the open source software movement, or means of microfinancing, the economy blossomed in 2013 into a \$15 billion a year sector with projections suggesting revenue will break \$335 billion by 2025².

One recent survey revealed that **more than 65% consumers worldwide are willing to share their assets or willing to partake of others’**.



The Rise of the Sharing Economy

% of online consumers willing to participate in sharing communities*



But what is most striking about the economy is the diversity of forms it has taken:

- **Crowdfunding platforms** – a large number of small contributions are pooled to fund projects or ventures
- **The open data movement** – the crowd can recombine and exploit the wealth of publicly available data to drive innovation
- **Real estate** – co-living and co-housing
- **Agriculture** – seed swapping and garden sharing have become vibrant economies

In each case the notion behind the economy is a simple one. By exploiting idle resources consumers can enter into mutually beneficial relationships, thereby capturing value from resources which would have otherwise gone unused or been wasted.

For example, the housing rental platform, AirBNB, allows homeowners to temporarily rent out their homes when they are not in use. By digitally connecting people with excess housing (the owner who is not occupying the dwelling for some period of time) with people in need of short term housing (vacationers or business travelers), the platform allows both parties to benefit.

In this scenario the owner, whose home would have been unused during the time they are not occupying it, can capture rents from the unused resource. The renter can occupy superior lodging for a discounted price.

Further, platforms like AirBNB have a host of advantages over traditional service providers, like hotels, because the owner does not need to carry excess inventory to meet demand when it spikes (the average occupancy rate for hotels in the US is roughly 65%³). As a result, hotels, as are all traditional vendors, are required to charge consumers a premium to subsidize their own unused resources, i.e. vacant rooms, when they are not in use.

Despite the benefits of the sharing economy its meteoric rise has not been without controversy. Advocates of the various aspects argue that it provides quality services to consumers at discounted prices; detractors increasingly question the legality of services. Because the services circumnavigate often costly professional licensing requirements, like those for taxi drivers, it has been argued that these drivers have an unfair advantage in a world where liability concerns for things gone wrong loom large⁴.

This controversy has come not only from supplanted competitors, like hotels and taxi drivers, but from members of the sharing economy as well. AirBNB, for example, was recently sued by the rival sharing service HomeAway, for uncompetitive practices in the city of San Francisco.

A key issue of interest of policy makers, industry, and consumers alike is **quantifying the social benefits of these peer-to-peer services**. For instance, the effect of Uber services (ride sharing) on drunk driving.

The Sharing Economy Landscape



Data Source: <http://blogs-images.forbes.com/deniselyohn/files/2015/03/sharing-economy-companies-1940x1362.jpg>

Ride Sharing Services



The Rise of Uber

Uber is an app based ridesharing service currently operating in more than 50 countries and 200 cities across the globe.

Founded in March of 2009 in San Francisco, California the service provides a platform for owner-operator drivers to find local fares electronically and provide them with transportation to their intended destination. As of **December 2014 the firm was valued at over \$40 billion with \$10 billion in projected 2015 revenues⁵.**

Originally designed as a “black car” service, where users would pay a premium to be taken to their destination by a fleet of high end vehicles (Lincoln Town cars, Cadillacs etc.), the service now offers a host of transportation options: car seat services for families, SUV services, and even helicopter services for super luxury passengers.

In 2012 the firm introduced the lower priced Uber X where drivers could use their personal vehicles to transport patrons.

QUICK FACTS

The Rise of Uber



Uber operates in
50 Countries
200 Cities
across the globe

Uber was founded

March 2009
San Francisco
California



\$40 billion
valuation in **2014**

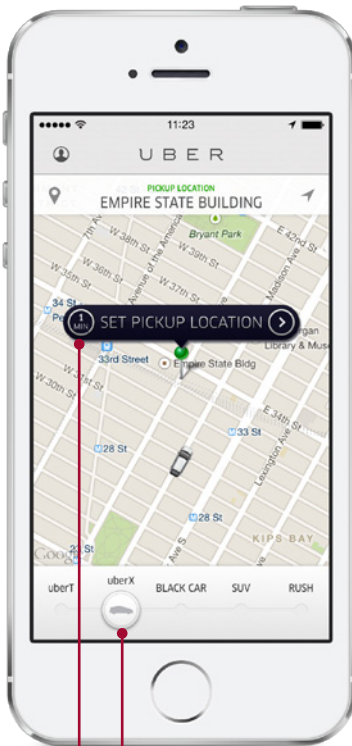
\$10 billion
projected revenues in **2015**

Using the Uber Application

3 Easy Steps to Getting A Ride

The app provides an estimated time for the patron to be picked up, as well as a sliding bar which allows the user to choose which service they wish to use. Once the vehicle has been requested, the fare is linked to the user's credit card (which is stored in the app) or PayPal account. After the transaction is complete, the user's account is electronically billed. The app also allows for ratings of both passengers and drivers through traditional online reviews using a 1-5 star rating.

1

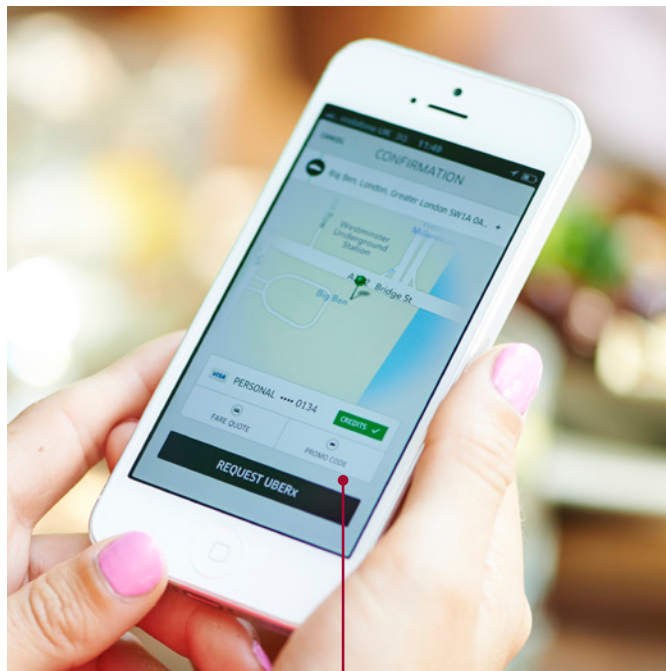


Pickup location is confirmed, and payment is made via a credit card on file.

Select your desired Uber service.

After setting a pickup location, the estimated pickup time is displayed.

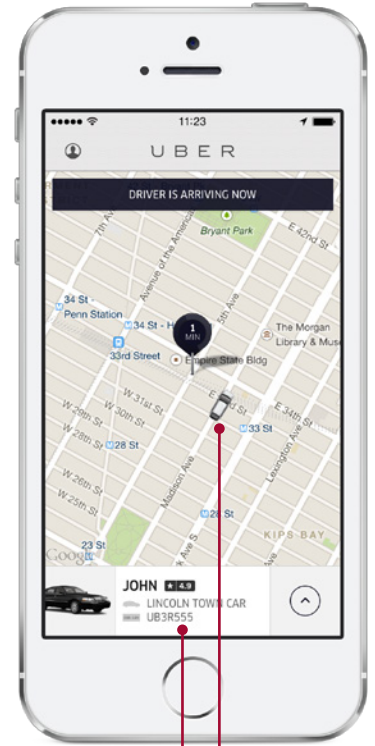
2



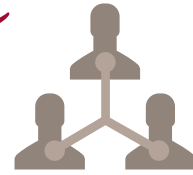
The name and rating of the driver is displayed as well as the car type and license plate number for easy identification of the vehicle.

GPS tracks the location of your driver and shows the time until arrival.

3



Measuring the Social Benefit of Ride Sharing



Why might the introduction of Uber influence the rate of alcohol-related motor vehicle fatalities? Two theories are described here.

Non-Monetary Costs Influence Consumers' Decisions

Extant research suggests many reasons why the introduction of electronic platforms may have an effect (Parker and Van Alstyne 2005). As it is often difficult to hire a cab based on the **time, location, or even race of the patron** (Meeks 2010), received research would suggest that the costs associated with finding transportation would decrease significantly when the app is used. The Uber app tells the driver where the patron is, and the patron how long it will take the driver to arrive. As a result, the app mitigates what economists call "information asymmetries," because the parties no longer rely on random discovery of each other. Moreover, consumers may be willing to pay a significant price premium for such a service by trading the costs of searching out a cab for the certainty of knowing when an Uber will arrive.

QUICK FACTS

Factors that May Make it Difficult to Hire a Cab



TIME



LOCATION



RACE

Financial Costs Influence Consumers' Decisions

It is also plausible that the cost of hiring a taxi is high enough to prevent people from hiring one in the first place, and research suggests that the price of cabs is often a component in a person's decision to drive under the influence (Nagin and Paternoster 1993). As a result, it is possible that premium services such as Uber Black will not decrease the drunk driving rate.

While **platform theory** suggests that drunk driving is the result of the individual being unable to find a cab, **rational choice theory** suggests that individuals may be able to find drivers-- but are electing to drive themselves based on the prices those taxis offer.

If a user's willingness to pay for cabs to avoid a DUI is sufficiently low, and the decreased cost associated with using the Uber app does not generate higher utility for the intoxicated person, then a premium service like Uber Black may not have an effect on the drunk driving rate--despite the increased access to transportation the app provides.

While the notion that drunk individuals make rational calculations about willingness to pay during the decision to drive under the influence may seem counterintuitive, research from psychology and criminology suggests that this may be the case (Clarke and Cornish 1985, Cornish and Clarke 2014). This research, called **Rational Choice Theory**, argues that individuals commit crimes out of a set of rational trade-offs which benefit them, as opposed to psychoses or a natural predilection to commit crimes (Clarke and Cornish 1985, Cornish and Clarke 2014).

In the context of Uber, the implications of this research are particularly notable.

The cost of hiring a taxi, versus the perceived cost and probability of being apprehended by the police, sets the individual up to make the rational trade-off to drive themselves while under the influence.

The rational decision to engage in drunk driving, even when controlling for self-control and other individual level factors, has seen support (Nagin and Paternoster 1993). This would suggest that services like Uber X, which offer a significant price reduction over taxi cabs, would have a greater negative effect on the drunk driving rate because it increases the accessibility of transportation, and **decreases the gap between the costs of being discovered driving under the influence and the cost of hiring a driver.**



UBER vs. Taxis

Comparing Uber Black, Uber X and Taxi Pricing



The two dominant services used, Uber Black (the traditional black car service) and Uber X (the discount service), offer significantly different price points for providing their services.

Uber Black charges a significant **premium over traditional taxi cab services (20%–30%)** while **Uber X** offers a significant price reduction – **20%–30% lower than taxis**. Both of these services offer the platform's advantages of increased

availability, but at significantly different price points. The setup, as well as the staggered rollout of the two services, permit the study of an effect on the alcohol-related vehicular homicide rate as well as the discovery of the mechanisms behind such an effect.

So, Does Uber Lower the Rate of Alcohol-Related Motor Vehicle Homicides?



To empirically estimate the effect of Uber entry on the motor vehicle homicide rate a unique dataset from several sources within the California Highway Patrol's Statewide Integrated Traffic Report System (SWITRS) was leveraged.

This dataset comprises **12,420 observations spanning 23 quarters (January 2009 – September of 2014) over 540 townships in the state of California.**

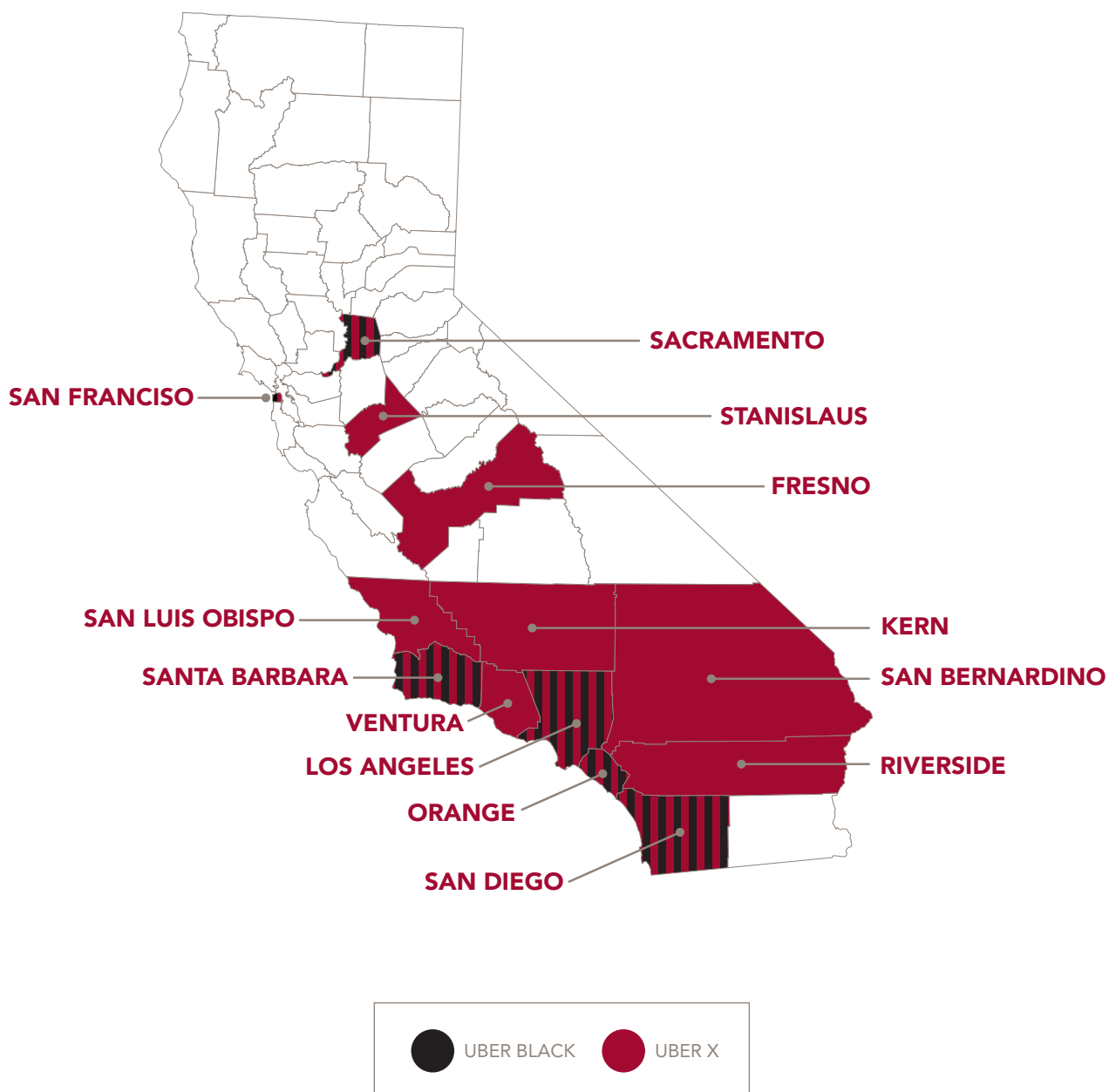
Then a natural experiment, the introduction of the Uber Service into California townships, was exploited. The difference in the differences in the DUI homicide rate between cities that receive the Uber services and those that do not was then estimated.

A Snapshot of Local Implementations of Uber Black and Uber X in the State of California

12,420
Observations

23
Quarters
(Jan. 2009 to Sept. 2014)

540
Townships
In the State of California



Results of the Empirical Estimation of Uber Entry on Alcohol Related Driving Fatalities

Introducing Uber X into a city has a significant, and negative, effect on the number of alcohol-related driving deaths, but Uber Black does not.

All else equal, this suggests several key pieces of information. First, previous within-city investigations of the effect of Uber entry may have overstated the effect (e.g. Badger 2014). Second, coupling cost and availability is key to decreasing DUI related deaths—patrons seem unwilling to pay a premium price for the Uber Black service, even in the short term.

Economically, these results suggest an average **decrease in DUI-related homicides of 3.6%** in locations treated by Uber X in the state of California.

The effect begins to manifest roughly 9 months after the entry of Uber X while no effect manifests for the entry of Uber Black.

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Uber Entry on Alcohol-related Driving Fatalities

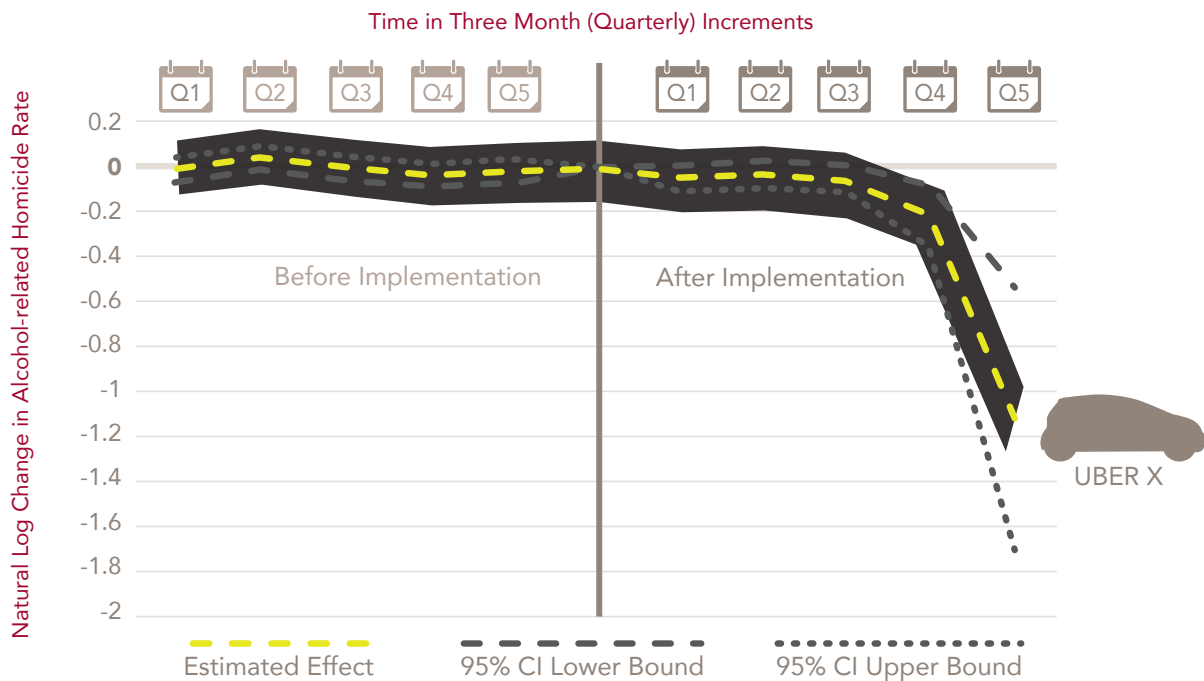
Difference in Difference Estimations

Dependant Variable	(1) ln (Num Deaths)	(2) ln (Num Deaths)	(3) ln (Num Deaths)
 UBER X	-0.0369** (0.0180)		-0.0362** (0.0179)
 UBER BLACK		-0.0142 (0.0153)	-0.00156 (0.0151)

*** p<0.01, ** p<0.05, * p<0.1

Effects of Uber X Implementation

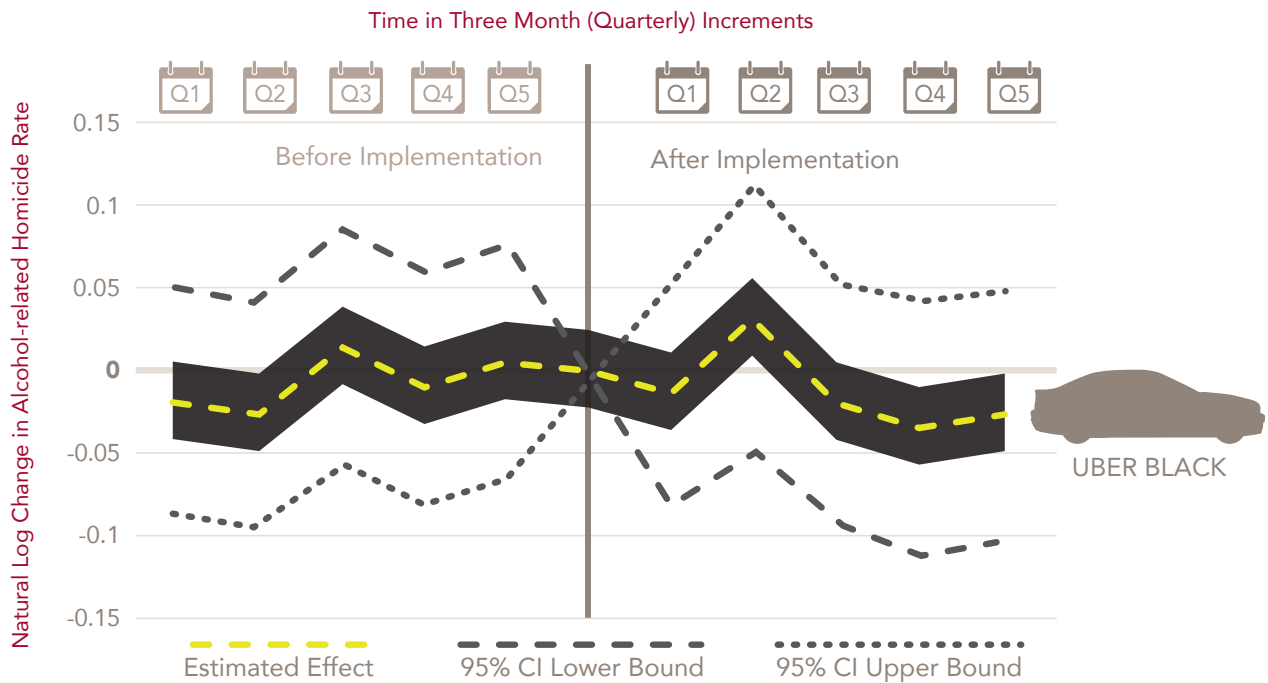
of Alcohol-related Homicide Rate



Results of the estimations are corroborated by the Figures (where the percent change in the DUI rate is displayed graphically). As can be seen in these two figures, there is no significant, unaccounted for, difference between cities receiving Uber and cities not receiving Uber before Uber entry⁶.

Effects of Uber Black Implementation

of Alcohol-related Homicide Rate



What Else Affects Uber's Effect?

While cost considerations are of the utmost importance when patrons make decisions about operating motor vehicles under the influence, factors that intensify or attenuate the strength of the effect need to be considered.

Two potential moderators of the demand for driving services were explored: days of the year when demand is likely to spike, thereby causing **Uber's surge pricing** to be put into effect, and the **size of the local population**, which should correlate with the steady state demand in the local market.

QUICK FACTS

Other Factors that Affect Ubers Effect



SURGE PRICING



POPULATION

It is important to note that this work is subject to several limitations.

- First, analysis was only in the State of California due to data availability. While California is a large and economically diverse state, which offers the ability to study Uber over a protracted period of time, further research will be necessary to ensure the robustness of the results.
- Second, it is important to note that the entry of the service is not random. As a result, further work is necessary to ensure that there are not confounding factors which also influence the results.
- Limited information is available about the drivers of vehicles that are involved in the crashes—which populations and sub-populations are influenced to the greatest degree based on race, gender, age, or socio-economic status.

Surge Pricing

To the extent that spikes in demand cause Uber's surge pricing⁷ to be put into effect, raising the price of hiring either an Uber X or Uber Black car, it is important to understand how this may affect the alcohol-related homicide rate. If, for example, the effect of Uber intensified or stayed constant during periods of high demand, this would suggest that a lack of taxis causes the drop in alcohol-related motor vehicle homicides. Alternatively, if the effect diminishes during spikes in demand, when costs rise due to the surge pricing, this would suggest that cost is the driving force-- because neither Uber service is being used.

To determine the effect of Uber entry during these times the dependent variable was changed to reflect the total number of alcohol-related motor vehicle deaths during weekends (when drinking is more prevalent) and US major holidays which involve drinking.⁸ Weekends and holidays result in an increased load on the vehicles for hire in the local area.

• • • • •

Uber Entry on Alcohol-related Driving Deaths on High Demand Days[†]

Difference in Difference Estimations

Dependant Variable	(1) In (Num Deaths)	(2) In (Num Deaths)	(3) In (Num Deaths)
 UBER X	-0.00240 (0.0110)		-0.00628 (0.0120)
 UBER BLACK		0.00640 (0.00893)	0.00859 (0.00973)

*** p<0.01, ** p<0.05, * p<0.1 †High demand days defined as weekends and drinking holidays



The finding? No significant effect of Uber entry on the number of persons killed during these times. This underscores that costs are the most significant factor in understanding the negative effect of Uber entry on the decrease in the alcohol-related motor vehicle homicide rate.

Population

To the extent that the size of local population will affect the size of steady state demand, and by extension the supply of Ubers in the local area, it is reasonable to assume that the number of Uber drivers will exist in a steady state equilibrium (i.e. a consistent number of drivers servicing the local population).

While this would suggest that there would be no difference of the per capita effect of Uber, by city size, the opposite may also be true. On one hand, it is plausible that the size of the effect in larger cities may be smaller because larger cities often have more established transportation options like public transportation. Alternatively, it is also possible that the effect would be greater in large cities because smaller cities have too small a population to garner significant attention from Uber drivers.

To investigate where Uber has a stronger and weaker effect, the data from the SWITRS dataset was divided into three groups: small cities, medium sized cities (those with populations greater than 50,000 people and less than 250,000 people), and large cities (those with populations greater than 250,000 people). These new categories were applied to the original estimates. Several interesting differences appeared. First, as the population of local cities increase, there is also a rise in the effect of Uber entry. A significant effect also manifests for Uber Black car services (although the size of the effect declines in the presence of Uber X).

It appears there is a significantly stronger negative effect on the alcohol-related motor vehicle death rate in large cities, when compared with smaller cities.

• • • • •

Uber Entry Interacted with Population

Difference in Difference Estimations

Dependant Variable	(1) ln (Num Deaths)	(2) ln (Num Deaths)	(3) ln (Num Deaths)
 UBER X	0.00745 (0.0166)		0.00404% (0.0174%)
 UBER X in MEDIUM CITY [^]	-0.164*** (0.0534)		-0.166%*** (0.0552%)
 UBER X in LARGE CITY ^{^^}	-0.523*** (0.111)		-0.426%*** (0.115%)
 UBER BLACK		0.0128 (0.0145)	0.00709% (0.0151%)
 UBER BLACK in MEDIUM CITY [^]		-0.0745* (0.0427%)	0.00401% (0.0412%)
 UBER BLACK in LARGE CITY ^{^^}		-0.411%*** (0.0953%)	-0.196%* (0.104%)

*** p<0.01, ** p<0.05, * p<0.1 ^Medium city indicates population of 50,000–250,000 ^^Large city indicates population >= 250,000

Key Takeaways About Uber's Ridesharing Services



And the Effect on Alcohol-Related Motor Vehicle Homicides

Intuition suggests that the rate of alcohol-related crashes should decrease after Uber enters a local market.

And, yes, analysis of California specific information indicates that there is a **significant effect of the entry—of lower priced Uber options, specifically Uber X.**

There is a significantly stronger effect in larger cities.

But, findings also suggest that there is **no effect when surge pricing is likely to be in effect** (during weekends and drinking holidays), thereby underscoring the importance of how cost consideration in affect the number of deaths that occur in alcohol-related crashes.

Why are these conclusions important?

The entrance of Uber X results in a 3.6%–5.6% decrease in the rate of motor vehicle homicides per quarter in the state of California.

13,000
Deaths at a cost of
\$37 Billion

13,000 deaths occur nationally each year due to alcohol-related car crashes at a cost of 37 billion dollars.⁹

It is possible that a complete implementation of Uber X would create a public welfare net of over \$1.3 billion to American taxpayers and save roughly 500 lives annually.

Save Tax Payers
\$1.3 Billion
Annually and
500 Lives

Saves individuals DUI
expenses between
\$5,000
and
\$12,000

Costs to the individual (e.g. court costs, insurance rate increases, loss of income) usually total between \$5,000k and \$12,000 dollars for the first DUI offence¹⁰ so significant benefits can accrue for customers who use these services.

Besides Drunk Uber Users, Who Else Can Benefit?



Restaurateurs, Event Planners, and Nightlife Managers

Significant potential benefit exists for restaurateurs, event planners, and nightlife managers—individuals whose livelihood often depends on the sale of alcohol. In particular, by partnering with services like Uber.

Vendors can be held culpable for over-serving patrons, but return business is vital for these firms. Integrating Uber during the dining or event experience helps all parties. The vendor is able to eschew a significant liability risk, while still ensuring that their patrons do not endanger themselves. Also, a chauffeured service is often seen as a sign of prestige so there may be additional social externalities which accrue to both the patron and the vendor.



Policy Makers

There are direct implications for policy makers and regulators who need to stay informed during the ongoing debate regarding the legality of services like Uber.

Although the results of this investigation cannot speak to public welfare losses which may result from improper vehicle handling or safety on the part of consumers, they provide important insights into the potential benefits of the sharing economy. For policy makers, as much of the debate surrounding Uber is speculative and lacking hard data, this report supplies substantive evidence of the benefits fostering the service economy can have.

By allowing Uber to operate, a very real effect—decreased mortality—is realized by constituents.



Managers and Regulators of the Taxi Industry

Finally, for the managers and regulators of the taxi industry, two notable implications exist as well. First, these results underscore the punitive effects of barriers to entry. If limited pools of medallions, onerous insurance and licensing procedures, and other forms of regulation are in fact making it impossible for existing livery services to compete with Uber, then there are serious implications which need to be balanced against these regulations. Second, these results highlight what cab companies need to do in order to compete with firms like Uber, i.e. integrate the hailing process into ubiquitous mobile technology and decrease price.

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Footnotes

1. http://apps.dmv.ca.gov/about/profile/rd/r_d_report/Section_5/S5-243.pdf
2. <http://www.pwc.co.uk/issues/megatrends/collisions/sharingeconomy/the-sharing-economy-sizing-the-revenue-opportunity.jhtml>
3. <http://www.statista.com/statistics/200161/us-annual-accomodation-and-lodging-occupancy-rate/>
4. <http://time.com/3625556/uber-manslaughter-charge-san-francisco/>
5. <http://www.businessinsider.com/uber-revenue-projection-in-2015-2014-11>
6. This is referred to as the pre-treatment trend (Angrist and Pischke, 2008). Ensuring no difference in the trend provides an important check of the assumptions of the difference in difference model.
7. A full explanation of surge pricing from Uber can be found here: <https://support.uber.com/hc/en-us/articles/201836656-What-is-surge-pricing-and-how-does-it-work->
8. The full list of holidays includes: Fourth of July, Memorial Day, Labor Day, Cinco de Mayo, Thanksgiving, the day before Thanksgiving, Christmas, Christmas Eve, Halloween, Easter, New Years Eve, and Superbowl Sunday. The source of these data is: http://content.time.com/time/specials/packages/article/0,28804,1986906_1986905_1986891,00.html
9. http://www.rita.dot.gov/bts/sites/rita.dot.gov/bts/files/publications/by_the_numbers/drunk_driving/index.html
10. <http://dui.drivinglaws.org/resources/how-much-does-a-first-offense-dui-cost.htm>

About the Authors



Brad N. Greenwood

Dr. Brad N. Greenwood is an Assistant Professor of Management Information Systems in the Fox School of Business. He joined the faculty at Temple from the University of Maryland, College Park where he served as a visiting assistant professor. Dr. Greenwood's research centers around information availability and decision making in ambiguous environments, notably in the contexts of healthcare and entrepreneurship and has been published in such leading outlets as Management Science, Information Systems Research, Productions and Operations Management, and MIS Quarterly.

His corporate experience includes nearly eight years as a deputy program manager and analyst for CACI International, a mid-sized consulting firm in the greater Washington DC Metro Area. He received his Bachelor's degree in Information Technology and Management Information Systems from Rensselaer Polytechnic Institute. Dr. Greenwood also received: a Master's of Business Administration in IT Consulting from the University of Notre Dame; a Master's of Informational Technology from Virginia Polytechnic Institute; and a PhD in Decision, Operations and Information Technology, with a minor in Strategic Management, from the University of Maryland, College Park.



Sunil Wattal

Sunil Wattal is an Associate Professor of Management Information Systems at the Fox School of Business, Temple University, Philadelphia, USA. Dr. Wattal's expertise focuses on social computing and innovation in technology industries, as well as applying advanced econometric models and integrating multiple data sources to quantify the value of social media and crowd-funded marketplaces. His work has been published in top academic journals such as MIS Quarterly, Information Systems Research, Management Science, Journal of Management Information Systems, IEEE Transactions on Software Engineering, and in international conference proceedings. He has also received several best paper awards and

nominations from prestigious academic conferences such as Hawaii International Conference on System Sciences (HICSS), Conference on Information Systems and Technology (CIST), and International Conference on Information Systems (ICIS). He serves as an Associate Editor for MIS Quarterly and an Associate Editor for the International Conference on Information Systems (ICIS). His research has been funded by grants from organizations such as the National Science Foundation, and the Kauffman Foundation.

Dr. Wattal has worked as a design engineer, business development executive, and analyst. Most recently, he worked as a senior analyst to analyze sales and pricing data in the healthcare industry. His teaching interests include data analytics, information technology management, and internet enabled supply chains. He holds a Bachelor's in Engineering from Birla Institute of Technology and Science Pilani (India), an MBA from Indian Institute of Management Calcutta (India), an MS (Industrial Administration) from Carnegie Mellon University, and a PhD from the Tepper School of Business, Carnegie Mellon University.

