Does Ride Sharing have Social Benefits?

Full Paper

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Abstract

The social impacts of the sharing economy facilitated through the advancements of information technology is the subject of intense policy debates. For instance, the deployment of ride as well as home sharing on a large scale using smartphones has supporters but also detractors who ask for new regulations. Research into the social effects of ride sharing are therefore an important contribution to better understand the cost and benefits to society as a whole. This study investigates the relationship between the implementation of the UberX service and drunk driving. Our findings reveal that there is an association between UberX deployment and a decline in the number of DWI fatalities among youth ages 17-34, while there is a much smaller non-significant effect for the population ages 35 and older which may be due to this new technology being more adopted among younger people than older people. City officials should take into consideration the positive effects of ride sharing when designing regulations.

Keywords

UberX deployment, Fatalities, Drunk Driving, Ride Sharing, Social Benefits.

Introduction

The sharing economy was largely made possible by the advances of the internet and handheld devices. It allows new entries into the market without holding inventory or major capital expenditures to leverage the connectivity of people for commerce. For instance, the largest commercial taxi company (Uber) does not own any taxis and the largest hotel company (Airbnb) does not own any hotels. Economists have principally embraced these new entries into the market place (IGM 2014). However, the new entries have also sparked calls for new regulations of the sharing economy because of some negative social consequences associated with the deployment of these sharing businesses. For instance, to curb Airbnb rentals homeowner associations and cities have started to change their rules on the minimum number of rental days. Cities have started to regulate ride sharing businesses with Austin being the first city in the United States where Uber has withdrawn its service because of regulations that require that drivers be fingerprinted. Since the new types of sharing enterprises are relatively new, not much research has been conducted with respect to the effects of these businesses on society. This paper offers insight into one aspect of the societal impact of ride sharing, namely the number of DUI crashes. This study was stimulated by Uber’s claim that the introduction of their service to the market has reduced drunk driving (Uber 2015) raising questions in the news media (Badger 2014) and by researchers (Rogers 2015). Specifically, in California the Uber website states that the “drunk driving crashes fell by 60 per month among drivers under 30 in the markets where Uber operates following the launch of UberX”, the low cost version of Uber. The rational for the decline in drunk driving crashes is that drive sharing companies offer a more convenient way of ordering transportation. Using an app to get Uber, the argument goes, is
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less burdensome than looking up a phone number for a taxi, calling a taxi company and waiting until it arrives without knowing how long it will take, whether it arrives at the correct place or if it arrives at all. Economics generally support the idea that the more options there are available, the more likely it is that people will decide on ordering a form of transportation other than using their own car, especially in cities where availability of parking is limited and costly.

The smartphone has become ubiquitous where making calls are just a minor feature. It has facilitated real-time ridesharing projects, which developed a user network and a convenient means of communication that help people to order rides from their smartphones. The smartphone application connects passengers with owner-operator drivers, calculates the costs, estimates the waiting time and provides the real-time tracking of drivers for the passengers (Fahey 2015). In addition, the navigation function in the smartphone application also offers star ratings for drivers and passengers to review before they accept a ride. In 2010, a survey at the University of California Berkeley determined that 20% of respondents used real-time ridesharing at least once a week and that real-time ridesharing was more popular among current drive-alone commuters (30%) than transit or non-motorized commuters (Deakin et al. 2010). Uber, which was founded in 2009 in the area of San Francisco, is currently the largest ridesharing company. Lyft, another ridesharing company also started its services in the San Francisco area in 2012 is the second largest ride sharing company. Uber is now available in more than 66 countries and 545 cities around the world (Uber Newsroom). Taking rides through Uber or Lyft is often a lower cost option compared to driving. This is especially the case in cities where parking is costly.

Literature Review

Drunk driving remains a safety problem in the United States. Every day, 28 people die in alcohol-impaired driving crashes – one every 53 minutes according to NHTSA’s website. Alcohol-impaired motor vehicle crashes cost more than an estimated $52 billion annually (NHTSA). Research has shown that alcohol effects the brain function, hand eye coordination, reduces reaction times and the judgment of distances and speed leading to overconfidence and misjudgment in driving (Alcohol and Drug Foundation 2016). While the legal limit in the United States is 0.08, impairment occurs at much lower levels varying by age and other characteristics. Hence, European countries and Australia have a lower limit of 0.05. Youth drivers are especially affected when driving under the influence of alcohol because they are less experienced drivers than older adults (Zador et al. 2000). Thus, there is a zero tolerance level for drivers under the age of 21 in the United States.

There is an abundant literature on impaired driving and it is beyond the scope of this paper to provide a review of the extensive literature on drunk driving. We only provide the most relevant information about impaired driving obtained from NHTSA’s website which provides an extensive resource for research on the subject of impaired driving. Impaired driving has been found to be more common among young male drivers than female or older drivers. Impaired driving is also found more in rural areas than in urban areas. Socio economic factors also play a role. According to the Fatality Analysis Reporting System (FARS) the number of fatal crashes that involved drivers who had a blood alcohol concentration (BAC) above the legal limit of .08 has decreased dramatically from 53% in 1982 to 34% in 1997 and leveled off thereafter (Dang, 2008) In the same time period the proportion of 18 to 34 year-olds in the U.S. population declined from 30% to 23.5% and the percentage of males declined from 52.4% to 50.3%. The beer consumption per capita also declined by 12% in that time frame. There was an intensive effort by NHTSA to encourage states to pass stronger drunk driving laws. Specifically, all states in the U.S. passed no tolerance laws for drivers age 20 years and younger and lowered the legal limit from 0.1 to 0.08. Still, alcohol-related deaths in traffic crashes have declined only slightly over the last decade to 29% in 2015.

There is only limited research on the benefits of countermeasures other than DWI enforcement which is still considered the primary method of reducing impaired driving. Greenwood and Wattal (2015), using rational choice theory arguments, analyzed data from 2009 to 2013 for selected urban areas in California to study how Uber might affect impaired driving. They found that in California there was about a 5% decline in drunk driving fatalities after UberX was introduced. However, another study using data from the FARS, the fatality analysis reporting system, between 2005 and 2014 found no such decline due to Uber introduction (Brazil and Kirk 2016). The authors explaining their negative findings argue that drunk drivers are not rational and that the “average inebriated individual contemplating drunk driving may not be sufficiently rational to substitute drinking and driving for a presumably safer Uber ride.”
However, this argument simplifies the interaction between alcohol use and crashes. It may be true that alcoholics who drive frequently above the legal limit may not be persuaded to use Uber unless their licenses are revoked. Still, Uber and Lyft provide alternative transportation that did not exist a couple of years ago for those whose licenses were revoked and hence one might expect lower violations for driving without a license. The main argument, however, for an Uber effect on impaired driving is that over 90% of impaired driver fatalities have no prior DWI arrests. For those people who plan their evening out that might involve drinking, taking Uber or Lyft is a rational choice before they consumed alcohol, and many drunk driving crashes may be avoided by planning before consuming alcohol. A central component of the Theory of Planned Behavior indicates the “individual's intention to perform a given behavior” (Ajzen 1991). In the case of using Uber rather than driving, there has to be an intention to avoid problems such as driving drunk beforehand, not after the individual has consumed alcohol and might be too impaired to make rational choices. Greenwood and Wattal (2015) use the Rational Choice Theory to explain why an individual who is drunk would make a rational choice of using Uber instead of driving her car. They argue that individuals who commit crimes respond to particular situations selectively based on cost and benefits. In the case of drunk driving, an individual would weigh the risk of being stopped, being arrested or being in an accident, against the benefit of driving home with his or her own car. However, drivers who have already consumed a significant amount of alcohol and are severely drunk are unlikely to make such a rational choice. In addition, drivers who used their car to go out to drink are less likely to order a ride to their home. The vast majority of drivers driving under the influence of alcohol are not aware of their impairment. Nevertheless, rational choices come into play at the time an individual makes a decision about how to get to the destination and back. Individuals make the decision to use Uber instead of driving for a variety of reasons, one of which may be to avoid driving home impaired. The more people decide to use a ride share, the larger will be the effect on drunk driving unless Uber drivers are driving drunk themselves. Hence, regardless of the reasons for using Uber rather than one’s own car, there will be fewer impaired drivers on the road on average because Uber and Lyft have increased the number of people using hired rides rather than driving their own vehicle.

Research Model and Hypothesis

Smartphone usage is more prevalent among young drivers than older drivers, hence it can be expected that any effect in the reduction of alcohol-related crashes is stronger among young adults than among older people. We propose the following hypotheses.

H1: Introduction of UberX into cities will be associated with a reduction of DWI fatalities among 17 to 34 year-old drivers.

H2: The introduction of UberX into cities will be associated with a reduction of DWI fatalities among occupants ages 35 and older that is smaller than the reduction for young drivers ages 17 to 34.

We used an observational panel study design to examine within-city changes in quarterly motor vehicle fatalities after the launching of UberX services for the period from 2007 to 2015. We obtained quarterly observations for the 100 largest population metropolitan city areas in the United States from the U.S. Census website. There is an indication that “urbanites are the biggest users of Uber – with just 5% living outside of an urban or suburban area”, so the 100 largest population metropolitan areas cover most urban areas across the U.S. (McGrath 2015). Furthermore, age is associated with drunk driving risk (i.e., young drivers ages 17-34 are more likely to be involved in alcohol-related crashes (Zador et al. 2000)). Moreover, age is also associated with the use of smartphones and Uber (i.e., younger people ages 17 to 34 years are more likely to use a smart phone and are the most enthusiastic Uber adopters making up almost three quarters of Uber’s US users (McGrath, 2015)). Thus, we controlled for age by analyzing young drivers and older drivers separately as spelled out in the hypotheses. We excluded four cities in the data because those four cities did not obtain UberX service by the end of 2015 while all the other 96 cities had launched UberX service before the end of 2015.

Dependent Variable

The dependent variable in this analysis is the number of fatalities that involve a driver with a blood alcohol level above the legal limit of 0.08. Although there is a zero tolerance for drivers under the age of 21, we use the same limit of 0.08 for these ages as well. The fatal data was obtained from the Fatality
Analysis Reporting System database (FARS). We created two age groups of 17-34 and 35-65 with the latter age group not containing any of the first age group, i.e., if there was a DWI crash with two drunk drivers we counted this crash only for the younger driver.

While there are many different services that have been launched from Uber Company, such as Uberpool, UberXL and Uberblack, only UberX is the widely used and the most economically favored option among these service options. In addition, UberX is available for all the cities in the sample data, and UberX is the only service that is offered for all the cities in the sample data. The observational panel study examined the quarterly data by city from 2007 to 2015 with 96 cities resulting in 3,456 observations. Table 1 shows the statistics summary for two different age groups. The ‘number of fatalities ≠ 0’ indicates the total number of observations that have at least one fatality in a quarter, and the ‘number of fatalities =0’ indicates the total number of observations that have zero fatalities in a quarter.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>17-34s</th>
<th>35-65s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total observations</td>
<td>3456</td>
<td>3456</td>
</tr>
<tr>
<td># of fatalities ≠ 0</td>
<td>2027</td>
<td>1608</td>
</tr>
<tr>
<td># of fatalities=0</td>
<td>1429</td>
<td>1848</td>
</tr>
</tbody>
</table>

Table 1. Statistics Summary for Dependent Variable

**Independent Variable: Treatment**

The average effect of UberX deployment is the primary effect. The UberX launch information for each city was obtained from the Uber Newsrooms. We created an indicator variable for UberX presence, 0 indicating UberX was not present in this city in the whole quarter and 1 indicating its presence during the whole quarter.

**Independent Variables: Covariates**

In order to reduce the bias in the effect estimates, we select six control variables for UberX deployment across the U.S. In the previous studies, the unemployment rate and number has been identified as affecting the number of fatalities (Evans W 1988), (Partyka 1991). Vehicle miles traveled (VMT) has been shown to relate to fatal crashes (Hauer 1997); in fact, it is used in all highway safety studies. To convert state VMT to city VMT we allocated state VMT proportionally to population. We obtained the monthly state VMT information from the website of the Federal Highway Administration (FHA). Population size was also identified as having an effect on the number of motor vehicle deaths (IIHSHLDI 2016). In addition, we also controlled for some sociodemographic dimensions such as poverty and the percentage of bachelor degrees based on state level because the poverty rates and education have been shown to contribute to young drivers' fatal crash risks (Males 2009). For the city-level income, we obtained the data from the section of household income from the website of the U.S. Census Bureau. In summary, the six control variables are the state-level unemployment rate, the state-level poverty rate, the state-level percentage of bachelor degrees, the city-level population, the city-level household income and the city-level VMT. As a 7th control variable we included for any linear time trend in the number of fatalities not accounted for by the other control variables.

**Analysis**

The Negative Binomial Model is the most commonly used model in highway safety analysis (Hauer 1997). It is often derived as a Poisson-Gamma mixture model, which overcomes the restriction of equi-dispersion that is imposed in Poisson models. With count data from multiple periods the Negative Binomial Model is usually a better choice than Poisson models (Allison 2009). Therefore, the total number of fatalities for each city in each quarter can be presented as:

\[
\text{Num of Fatalities} = \text{Exp}[\beta_0 + \beta_1 \ast \text{UberX} + \beta_2 \ast \text{income} + \beta_3 \ast \text{poverty} + \beta_4 \ast \text{Unempl.rate} + \beta_5 \ast \text{Popul}.]
\]
A fixed city effect was added because of the non-linear behavior caused by a few large cities such as New York, Los Angeles, Chicago... as shown in Figure 1.

![Figure 1: Quarterly Number of alcohol-related Fatalities versus city Population](image)

The scatter plot shows the quarterly number of alcohol-related fatalities vs. the population of each city. For example, the largest city New York has a much lower number of fatalities than other cities. This is likely due to the fact that large cities have a very different transportation infrastructure than smaller cities. In addition, Los Angeles also has a large population but it has a higher number of fatalities than other cities because of more drivers on the road. To account for these differences between large cities and small cities, we included a dummy variable for the cities with a population greater than one million to eliminate the variation that was caused by large cities. We completed the same analysis for both 17 to 34 year-old drivers and 35 to 65 year-old drivers. The negative binomial package (nbreg) in STATA was used for all the models in this study.

### Results

Results from the Negative Binomial Models of Uber’s association with total fatalities for 17 to 34-year-old drivers are shown in Table 2. The average effect of UberX deployment is -0.31; this implies that there is an average decrease of 27% in the number of fatalities for cities across the U.S. involving drivers ages 17 to 34 who have a blood alcohol content of 0.08 or more. The 95% confidence interval ranges from 17.1% to 34.9%. This indicates that there is strong association between UberX entry into the market and the number of alcohol-related fatalities involving DWI drivers in this age group. Corresponding to H1, the introduction of UberX into cities does associate with a reduction of DWI fatalities among 17 to 34 year-old drivers. The effect is statistically significant at p=0.001.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Coefficients</th>
<th>STD.Err</th>
<th>Significance</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>UberX Deployment</td>
<td>-0.31</td>
<td>0.062</td>
<td>***</td>
<td>(-0.43, -0.19)</td>
</tr>
<tr>
<td>Income/$10,000</td>
<td>-0.56</td>
<td>0.042</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Poverty</td>
<td>-0.24</td>
<td>0.008</td>
<td>***</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Table 2: Model for fatalities involving 17-34 year-old drivers with BAC &gt;=0.08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>UberX Deployment</td>
</tr>
<tr>
<td>Covariates</td>
</tr>
<tr>
<td>Poverty</td>
</tr>
<tr>
<td>Unemployment Rate</td>
</tr>
<tr>
<td>City Population/100,000</td>
</tr>
<tr>
<td>With bachelor Degree</td>
</tr>
<tr>
<td>VMT Quarter/1000</td>
</tr>
<tr>
<td>***p&lt;=0.001</td>
</tr>
<tr>
<td>**p&lt;=0.05</td>
</tr>
<tr>
<td>*p&lt;0.1</td>
</tr>
</tbody>
</table>

Table 3: Model for fatalities involving 35-65 year-old drivers with BAC &gt;=0.08

Discussion and Implications

**Strengths**

This study contributes to an understanding of the important social benefits of ride sharing, namely the decline in alcohol-related fatalities. The findings of this study indicate that there is a positive social benefit associated with UberX deployment in American cities, namely reducing the number of DWI fatalities involving 17 to 34 year-old drivers. There is a smaller, although not statistically significant, reduction in the number of fatalities for 35 to 65 year-old drivers. As Taxi organizations and other detractors of ride sharing pressure public officials to introduce regulation to curtail Uber and Lyft, it is important to identify the positive side effects of the deployment of ride sharing made possible through the spread of smartphones. The study also shows that there is a larger benefit among young adults compared to the older generation, which is less likely to use smart phone apps.

**Limitations**

This paper contains several limitations that influence the potential generalization of its findings. First, we cannot conclude that the average effect in the model is the causal effect from UberX deployment.
Although we have made attempts to control for known confounders, there may be other unknown confounders that could explain the decline in alcohol-related fatalities.

**Conclusion**

The sharing economy has reformed some industries such as taxi businesses and hotel businesses, and both bring more choice for the consumer. However, the lack of regulation has been continuously criticized. For instance, Uber and Lyft withdrew their services for Austin, Texas, because of the requirement that taxi drivers are finger printed. Some cities and homeowner associations have begun to limit how Airbnb can be used. With the controversy over social benefits and negative effects of the sharing economy, it is important to assess all benefits as well as negative effects. With the launch of the UberX service in recent years, this study provides evidence that UberX service is associated with a positive effect on reducing the number of DWI fatalities, especially for the drunk drivers with ages between 17 to 34. More research needs to be done to confirm the actual causal effect of UberX when more years of data are available and comparisons can be drawn to cities such as Austin that lost the UberX service. However, if these reductions in DWI fatalities continue then city officials should encourage ride sharing services and not curtail them.

There are several theories that can be used to explain the finding. Rational choice theory has been suggested to argue that drivers make a rational decision of choosing UberX over driving because of the costs and benefits. Using UberX in a city is often less costly than driving when cost for parking is included. It is important to note that we do not assume that a driver decides on using UberX after he has been drinking, but rather before he decides to go out. Once a driver has decided to use her own car to go out there is little incentive to not drive back home. There has to be an intention to use UberX beforehand, not after drinking, for people to choose ride services over driving. The technology adoption model provides an explanation for why there is an increase in ride users compared to the use of taxis. Because of the ubiquity of smartphones, the ease of use for UberX is by far superior to ordering a taxi. This may explain the rapid adoption of UberX. While some people may have switched from using taxis to using Uber or Lyft, the large number of UberX and Lyft users point toward an adoption of ridesharing among car owners that would have driven themselves without the availability of ride sharing. Hence, there is a large number of new customers that would drive if ride sharing were not available, a certain percentage of which may be impaired after the end of their evening out. This habit will subsequently lead to a decline in impaired driving.

**REFERENCES**


