Effects of Web-Based Taxi Services in the Reduction of Unemployment and Crime

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1 Introduction and Hypothesis

Uber and other web-based taxi services can be viewed as much more than a convenient way to get from point A to point B. This project aims to quantify the effects of Uber on unemployment and crime. For the same, the hypothesis to be studied in this project is as follows:

> **The introduction of web-based ride-sharing services such as Uber leads to the reduction of unemployment rates and reported crime rates in the metropolitan areas where it operates in.**

A detailed explanation of this project's hypothesis is as follows.

Falsifiability: Uber's relationship with both unemployment and crime rates is debatable. On one hand, Uber offers low-commitment, flexible job opportunities, but is also seen as merely a way to supplement income by many drivers. The effect of Uber on Crime is slightly more complicated. There have been many reports that Uber helps reduce crime by providing victims a way to get out of dangerous situations. But, there is also an alarming number of crimes (specifically, sexual assault) against Uber drivers themselves.

Interpretability: The motivation for this project stems from two major observations. First, we believe that the macroeconomic forces that govern unemployment can be addressed by the introduction of Uber. Uber is part of what is known as a "gig-economy', which allow for flexible employment, with very little commitment. Our hypothesis is motivated by this key benefit- that people with low skills who have lost their jobs can find a secure, well-paying alternative by becoming an Uber driver. This is easily tested in two ways. We can measure the positive effect of Uber on unemployment rates by studying the unemployment of metropolitan areas before and after Uber was introduced. Additionally, we posit that the introduction of Uber reduces the crime rate. This can be because of two reasons. First, Uber removes potential victims from potentially dangerous situations. Secondly, Uber may be able to remove the strenuous socio-economic conditions that lead people to commit crimes such as robbery. This ties in with our reasoning that Uber effectively gives employment options to those who need it. Again, this is easily tested by studying the rate of reported crime before and after the introduction of Uber.

2 Related Literature

The major findings of previous studies have been summarized in the following subsections.

Uber and Unemployment

A major contribution of Uber and other participants of the "gig economy" is their role in the creation of viable employment options. Services like Uber provide employment with three keen benefits: they provide low barriers to entry, flexible work schedules and have a low skill requirement [1, 2]. As Huang et al. [2] put it, these "digitally enabled" jobs also allow workers to work from wherever they like, whenever they like. More than just convenience, Li et al. [1] have found that the introduction of Uber significantly decreases unemployment rates and increases labour-force participation- and also tends to have a higher occupancy rate that traditional taxi-cabs.

Studies have shown that most drivers see Uber as a way of supplementing their incomes [3]. As David Walsh [3] puts it, it allows people to "show up and get paid". This policy is especially attractive to those who may be in-between jobs, as it is flexible and does not require long term commitment [1, 4, 3]. As observed by Fos et. al [4], Uber provides easily accessible, short term jobs, and does much more than simply provide employment- they found that laid off employees who have access to Uber are "less likely to rely on unemployment insurance and untapped credit."

Uber and Crime

Weber [5] found that the introduction of Uber in certain cities was associated to a reduction of "personal" crimes (such as assault) of about 5%. He posits that this reduction in crime rates may be due to three major reasons. First, app-based services largely rely on a cashless payment system. This reduces the cash a person has on hand, and therefore reduces the possibility of robbery and/or assault.

The second aspect that may have contributed to the reduction of personal crime is alcohol. Alcohol consumption is associated with increased crime, and given that a major use of Uber is to commute to and from bars and other alcohol-serving institutions, these services effectively remove potential criminals (specifically, an assaulter) from the public [6, 5]. Not only does this help in reducing assault, but as observed by Dills and Mulholland [7], the introduction of Uber led to a lower rate of Driving Under Influence (DUI) cases as well as fatal accidents.

Lastly, Weber [5] posits that Uber drivers may act as constant surveillance. Uber drivers are required to be spread out over the city in order to benefit from getting the most rides. This acts as a sort of pseudo-patrolling during high crime hours, where drivers can report suspicious activities to the police.

Another aspect of reducing crime is the effect of ride-sharing apps on sexual assault. Park et al. [6] have found that areas where Uber have more pickups tend to have a lesser likelihood of reported rape incidents. This may be because of Uber's ability to quickly match transportation supply with demand. This reduced wait-time and high availability may be essential to remove potential victims from dangerous situations as quickly as possible [6, 5].

While the introduction of these services have resulted in a reduction of personal crimes, Dills and Mulholland [7] and Weber [5] have found that the introduction of Uber has contributed to an increased rate of automobile thefts. Moreover, as reported in the Atlantic [8], there is a concerning amount of sexual harassment and assault cases against Uber drivers themselves- this may be because background checks may not be as thorough. But, it should be noted that Uber drivers face quicker and harder actions after a report of assault in the form of removing access to the app and blacklisting, as compared to the unfortunately slower response to assaults committed by regular taxicab drivers.

3 Data Collection

There are three main datasets involved in our project:

1. **Introduction of App based taxi services:** In order to determine a line of comparison, our first dataset contained the date of introduction of app based taxis in every US state. This dataset was manually curated with two fields indicating the state and date of introduction of the first app-based taxi service of that particular state. For every state but Florida, Uber was introduced first and thus the date of introduction column was filled with the date Uber was introduced in these states. For Florida, we went with the date of introduction of Lyft.

2. **Unemployment Rate:** The National Conference of State Legislatures provides year wise datasets with unemployment rates per month in the form of CSV files [9]. The data is sourced by the Bureau of Labor and Statistics and used to identify the changes in the unemployment rate and whether they are influenced by the introduction of app based taxi services. For our project we have curated the state-wise unemployment rates from 2007-2016.

3. **Crime Rate:**The dataset covers 10 major crimes: violent crime, homicide, rape (legacy), rape revised, robbery, aggravated assault, property crime,burglary,larceny and motor vehicle theft spanning over the years from 1979 to 2019. The dataset is divided state-wise with the population of each state

4 Falsifiable Experiment

4.1 Unemployment Rates

First, we had to prepare our data. For the same, we collected the unemployment rates for each states for the following months:

- The month when Uber was introduced in that state. In the case when Lyft was introduced before Uber, we took that month's unemployment rate.
- 3, 6, and 12 months before Uber was introduced
- 3,6, and 12 months after Uber was introduced

Since we only has unemployment data from 2009-2017, we did not have all the above data for every state (specifically, Alaska, Hawaii and South Carolina). In order to include all 50 states into our analysis, we replaced missing values with the average unemployment rates beginning from a year before Uber was introduced.

In order to study the effects of introducing Uber on the State's unemployment rate, the following steps are taken:

1. We analyse the unemployment rate 3,6, and 12 months after Uber was introduced for every state. We count the number of states for which the unemployment rate has decreased.
2. In order to falsify that the decrease in unemployment has been caused by Uber, we also analyze the unemployment trend for the months leading up to the introduction of Uber. Specifically, we check whether the month in which Uber was introduced has a decreased unemployment rate compared to 3, 6, and 12 months prior.
3. We then calculate the "Adjusted Decrease in Unemployment", in which a state is counted to have a decrease in unemployment rates after Uber was introduced only if had not been on a decreasing trend before Uber was introduced. Specifically, the state has to have had a decrement in unemployment as per step 1, and an increase in unemployment as per step 2.

4.2 Crime Rates

Crime rates such as violent crime, homicide, rape legacy, rape revised, robbery, aggravated assault, property crime, burglary, larceny, motor vehicle theft and caveats were collected over the years 1979 to 2019. Decision was taken to only consider the following crimes: *Rape Legacy, Rape Revised, Robbery, Property crime, Burglary, Larceny, Motor vehicle theft.* This is because, we wanted to check if small crimes would be reduced due to the introduction of Web-Based Taxi Services.

For each state and each crime we have considered the crime rates during the following time:

- The year when Uber was introduced in that state. In the case when Lyft was introduced before Uber,we took that year's crime rates.
- A year before Uber/Lyft was introduced.
- A year after Uber/Lyft was introduced.

Since we only has unemployment data from 2009-2019, we did not have all the above data for every state(specifically, South Carolina). In order to include all 50 states into our analysis, we replaced missing values with the average crime rates beginning from a year before Uber was introduced.

In order to study the effects of introducing Uber on the State's crime rate, the following steps are taken:

1. We analyse the crime rates a year after Uber was introduced for every state. We count the number of states for which the crime rates have decreased.

2. In order to falsify that the decrease in crime has been caused by Uber, we also compare the crime trend for the year leading up to the introduction of Uber. Specifically, we check whether the year in which Uber has a decreased crime rate compared a year prior.

3. We then calculate the "Adjusted Decrease in Crime", in which a state is counted to have a decrease in crime rates after Uber was introduced only if had not been on a decreasing trend before Uber was introduced. Specifically, the state has to have had a decrement in crime as per step 1, and an increase in unemployment as per step 2.

5 Data Analysis and Observations

5.1 Unemployment Rates

As explained in the previous section, our results measure three metrics pertinent to the change in unemployment rate:

1. Whether the unemployment has decreased in a period of X months after Uber was introduced. We call this boolean "post-uber-decrement". Here, X takes a value of 3,6, and 12.

2. Whether the unemployment has decreased when Uber was introduced as compared to X months before it. The related boolean is called "pre-uber-decrement". Here, X takes a value of 3,6, and 12.

3. The Adjusted Unemployment Decrement: here a state's "adjusted-decrement" is true if it has a post-uber-decrement, but not a pre-uber-decrement.

The number of states having a post-uber-decrement, pre-uber-decrement, and adjusted-decrement with respect to 3,6, and 12 months are summarized in Table 5.1. Please not that there are a total of 51 "states", as the data for unemployment consists of that of the 50 states and a seperate entry for the District of Columbia.

Table 1: Number of States with Decrease in Unemployment Rates

Time Period(Months)	Pre-Uber-Decrement	Post-Uber-Decrement	Adjusted-Decrement
3	24	31	17
6	30	36	16
12	35	37	11

From the table, it is evident that 61%, 71% and 73% of states had a decrease in unemployment rates 3, 6, and 12 months respectively after Uber was introduced. To have a strictly pessimistic analysis, we analyse the Adjusted Decrement and mark that 33%, 31%, and 22% of states had a decrease in unemployment 3,6, and 12 months after Uber was introduced, while having a non-decreasing unemployment trend before Uber was introduced.

5.2 Crime Rates

Similar to change in unemployment rate, our results measure three metrics pertinent to the crime rates:

1. Whether the crime rates have decreased in a period of 1 year after Uber was introduced. We call this boolean "post-uber-decrement".

2. Whether the crime rates have decreased when Uber was introduced as compared to 1 year before it. The related boolean is called "pre-uber-decrement".

3. The Adjusted Unemployment Decrement: here a state's "adjusted-decrement" is true if it has a post-uber-decrement, but not a pre-uber-decrement.

Table 2: Number of States with Decrease in Unemployment Rates

Crime	Adjusted Decreament	Post-Uber Decrement	Pre-Uber Decrement
Rape Legacy	6	13	23
Rape revised	5	12	27
Robbery	9	25	30
Property Crime	6	37	42
Burglary	6	44	43
Larceny	6	38	42
Motor Vehicle Theft	6	18	25

The number of states having a post-uber-decrement, pre-uber-decrement, and adjusted-decrement with respect to 1 year are summarized in Table 5.2.

From the table, it is evident that 26%, 24%, 50%, 74%, 88%, 76% and 36% of states had a decrease in crime rates in Rape Legacy, Rape Revised, Robbery, Property Crime, Burglary, Larceny and Motor Vehicle Theft respectively after Uber was introduced. To have a strictly pessimistic analysis, we analyse the Adjusted Decrement and mark that 12%, 10%, 18%, 12%, 12% and 12% of states had a decrease in crime rates in Rape Legacy, Rape Revised, Robbery, Property Crime, Burglary, Larceny and Motor Vehicle Theft after Uber was introduced, while having a non-decreasing crime rate trend before Uber was introduced.

6 Conclusion

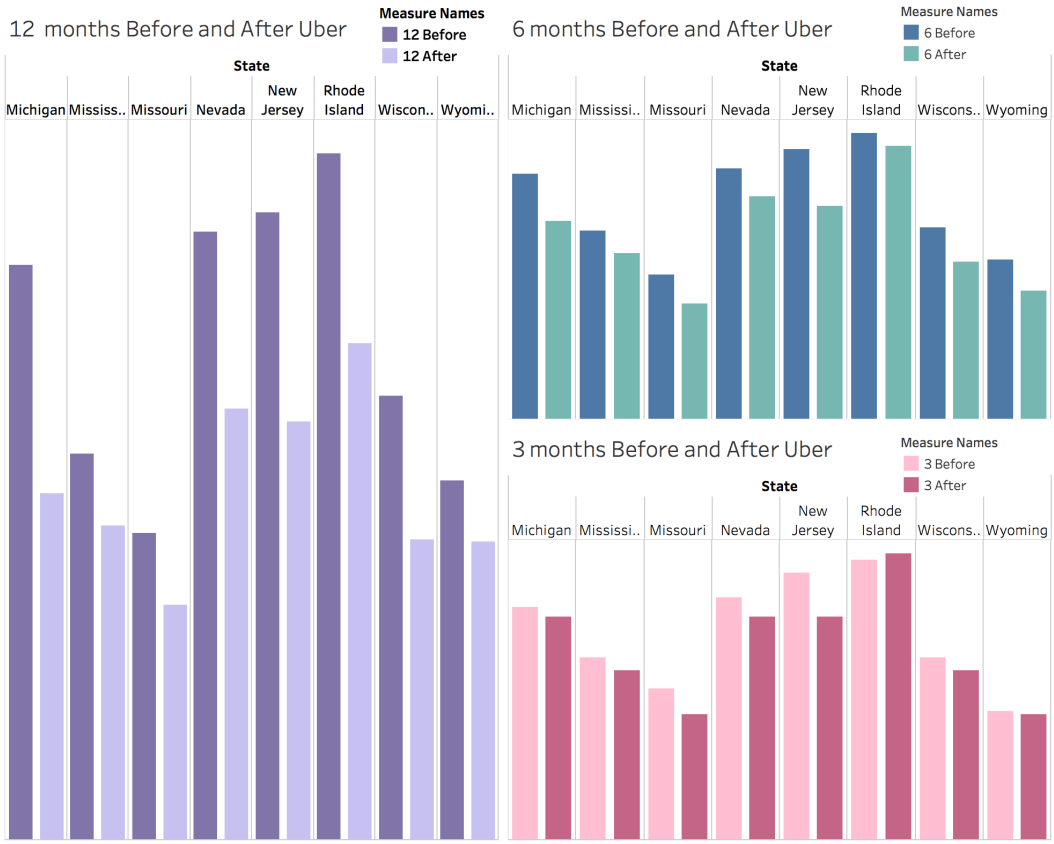

Figure 1: Changes in Unemployment Rate Before and After Uber Introduction

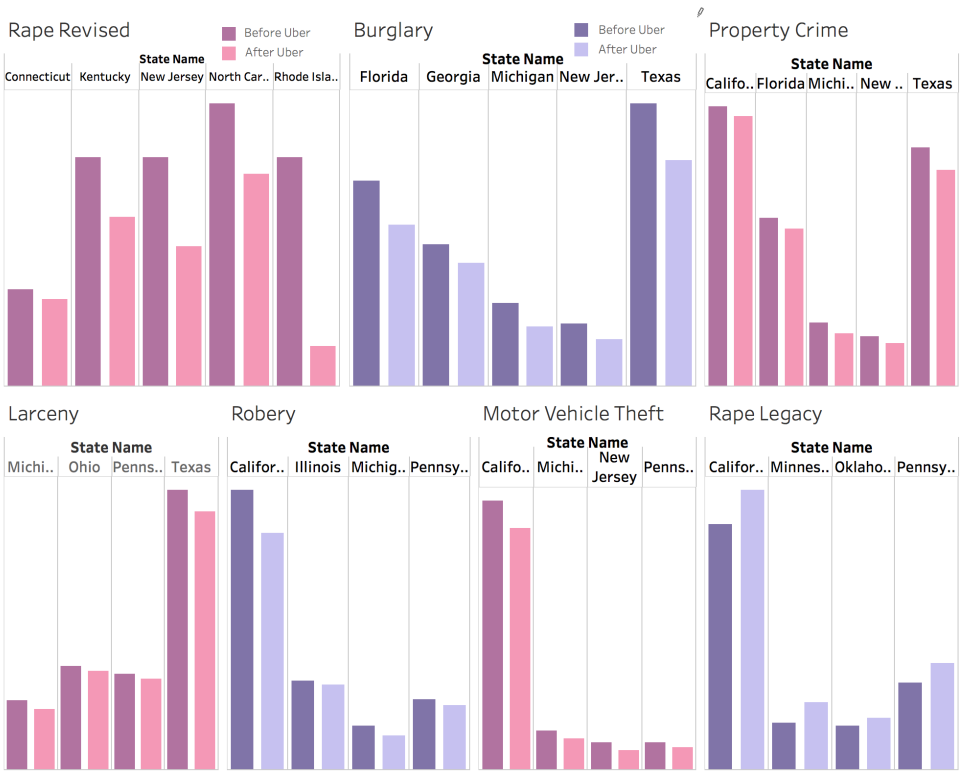

Figure 2: Changes in Crime Rate Before and After Uber Introduction

As seen in Figures 1 and 2, we observe that there is a high reduction in both unemployment and crime after Uber was introduced in states that have a large urban population, such as California, New Jersey, etc. This may be because Uber is more assimilated in these populations, thereby bringing around a greater effect. An interesting observation is that urban states such as New York and the District of Columbia do not have too much of a decrease. This may be because of the robust public transportation systems in place in these states- meaning that people don't use Uber enough for it to be so widely assimilated. Further study including the analysis of state-wise population, public transportation facilities, and external social factors may be able to determine the exact cause of why there is such a substantial decrease in unemployment/crime after the introduction of Uber. Another avenue for further study would be to analyse the proportion of Uber drivers who are female, and study the crime rates in states with a higher percentage of female Uber drivers.

The scalability of this hypothesis may be slightly complicated. We posit that similar results may be found for other first world countries that have a similar social and economic structure as that of the United States. This may not be the case for developing countries, which are limited by the affordability and accessibility of web-app based platforms such as Uber. Moreover, social restriction such as who is allowed (or eligible) to drive an Uber may also play a role in how widely it is available. Moreover, in countries that strongly support the local taxi-services, the introduction of private web-app based taxi services may not be as easy, thereby preventing such an analysis.

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