How do ride sharing services drive traffic congestion?

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Introduction

Sharing economy, which uses information technology to re-distribute unused or underutilized assets to people who are willing to pay for the services, has received tremendous attention in the last few years. Its new, creative business model has disrupted many traditional industries (e.g., transportation, hotel) by fundamentally changing supply and demand in the marketplace. In this research-in-progress, we plan to investigate how Uber, a peer-to-peer platform providing ride-sharing services, influence traffic congestions and CO2 emissions.

Combining data from Uber and the T&A Urban Mobility Report released by Texas A&M Transportation Institute, we will empirically examine whether and how the entry of Uber car services will drive traffic congestions as well as the emissions of carbon dioxide in the metropolitan areas of the United States. We will further explore how ride-sharing services can change the driving behaviors of individuals, thus shifting demand and supply in the market.

Findings from this research will provide empirical evidence on the impact of rideshare to traffic congestion, add new insights to public understanding of the sharing economy and potentially contribute to government policy decisions.

Background

There has been heated debate around this topic:


Blame Uber for Congestion in Manhattan? Not So Fast — The New York Times

These reports and articles are pre-mature and did not provide conclusive evidence. So there are opportunities for rigorous research.

Literature Foundation

I. Digital Infrastructure and Platforms
Digital infrastructure that facilitates our daily activities by increasing the effectiveness, efficiency, and quality of life.

II. Traffic Congestion
• Fundamental Law of Highway Congestion
• Induced Traffic
• Latent Demand

III. Sharing Economy

IV. CO2 emissions
Evidence of debates is illustrated in the Figure. A robust estimate of any social impact that these services provide could factor heavily in legislative debates.

Data

We combine the Uber entry time data, which is retrieved directly from the Uber website, with congestions data from T&A Urban Mobility Report, which was done by A&M Transportation Institute. The T&A Urban Mobility Report provides data from different facets of traffic mobility of 101 urban areas in US from 1982 to 2014.

Dependent Variables:

Travel Time Index = Delay time + Free = Flow Travel Time

Excess CO2 due to congestion (million Pounds), Annual Hours of Delay (thousand), Annual Congestion Cost Total Dollars (million).

Control Variables:

Population, GDP in current dollars, Dissimilarity Index, Education Quality Index, Median Income, Number of college graduates, Population living in poverty, People who are over 65, Number of individuals within the city working in law enforcement, Freeway Lane-miles, Arterial Lane-miles, Commuter (thousands), Elevation Rage (meters), Ruggedness, Heating degree days, Cooling degree days.

Independent Variables:

Uber entry time data. We distinguish different car services at different cities and different time.

Expected Results

We will get the definite results of how Uber entry influence traffic congestion and CO2 emissions.

We expect that the entry of Uber will increase urban area traffic congestion and CO2 emissions. Because Uber will cause "Induced traffic". First, due to the lower price, availability, and convenience, Uber substitutes Taxi to some extent.

Second, due to the lower price, availability, and convenience, Uber boosts travel. Uber X will have more significant effect due to its more friendly price.

Methodology

We employ a natural experiment to investigate the cause effect relationship: the entry of Uber service to major urban areas in United States between 2011 and 2015. This allows us to set up appropriate econometric models to capture the effect of temporal, geographical, service, and price differences at varying time sand orders:

We will identify which mechanism helps explain the phenomenon. Besides, we will conduct granular level analysis to see how these effects differ.

Difference-in-Difference

We use a difference in difference method to investigate the effect of Uber entry on traffic congestions and CO2 emissions.

We estimate the effect using the following equations:

\[
\gamma_1 = S'Y_2 + N'Y_2 + P'Y_2 + \epsilon
\]

\[\gamma_2 \times \text{Travel Time Index } S \text{ represents Uber entry, N and P represent time fixed effect and urban area fixed effect, } \epsilon \text{ is the error term.} \]

We check the parallel trend assumption by conducting The Relative Time Model.

\[y_2 = \tau \left[ (\psi_1 \cdot \phi) + N \cdot \psi_2 + P \cdot \psi_3 + \epsilon \right]

N is the vector of time fixed effects, and P is the vector of urban area fixed effects. \(\epsilon\) indicates the error term. \(\psi_1\) indicates whether or not Uber will ever affect city j during the study. 

\{\tau\} contains the relative time parameters to be estimated.

Then we will use Propensity Score Matching to limit the ex-ante differences between the treatment and control samples.

Conclusion

These findings could add conclusive empirical evidence to the debate around “Uber and its ink”. It will contribute to the platform literature, help people gain better understanding of sharing economy and inform policy makers and governors.

To conclude, our research have great academic contributions as well as practical implications.
Reference:


Downs, A. “THE LAW OF PEAK-HOUR EXPRESSWAY CONGESTION.” *Traffic Quarterly* 16, no. 3 (July 1962).


