**How traditional incumbents react to sharing economy entrants? Evidence from the car industry**

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**Abstract**

This paper studies the link between the diffusion of the sharing economy and traditional mature industries by providing additional empirical evidence of the economic impact associated with the sharing economy. This study adds to the ongoing debate over whether and how ride-hailing platforms influence new car sales in USA and China. The causal relationship between ride-hailing platforms and the automotive manufacturing industry is explored and verified.

**Keywords**

collaborative consumption models, Uber, Didi, ride-hailing services, sharing economy

**Introduction**

Over the last few years, the rapid proliferation of smartphones and associated applications has fueled the rapid growth of the online sharing economy, such as those of Uber, Airbnb, Lyft, Turo, and Peerby. These emerging online peer-to-peer platforms, collectively known as ‘collaborative consumption’, have made a great deal of money by enabling individuals to share their under-utilized resources and earn substantial income. Anecdotal evidence has noted that incumbent firms in the taxi, hotel and other industries are facing fierce competition from these sharing economy companies (e.g., Cramer and Krueger, 2016). For instance, eMarketer (2016) forecasts that nearly 15 million adults will use the ride-hailing services of Uber, Lyft or other companies at least once in 2016, an increase of 20.5% from 2015. Many studies have explored the impact of introducing ride-hailing apps on local regulations (e.g., Rauch and Schleicher, 2015), the market of ride-hailing (e.g., Zha et al. 2016), and the algorithm optimization of ride-hailing apps (e.g., Agatz et al. 2011). However, the causal impact of ride-hailing on shifting car demand has not been formally examined and understood. Passengers now have convenient and cost-efficient access to redundant car resources and avoid the financial, emotional, or social burdens of ownership (Bardhi and Eckhardt 2015). As the use of ride-hailing apps becomes more prevalent, an individual who plans to purchase a car in the coming few months (e.g. a fresh graduate) may change his or her purchase decision and think that buying and owning a new car is not immediately necessary, nor is it a priority. Recent reports show that many Uber users are holding off on car purchase because of the availability of ride-
hailing services (Deamicis, 2015). Such an effect on improving the utilization of the existing cars and delaying some individuals’ purchase plans could contribute to the decrease of new car sales in developed countries. On the other hand, using ride-hailing apps could lead to a positive impact on the automotive manufacturing industry in a developing country in which the number of cars per household is still low (e.g., China and India). Uber is creating 50,000 new ‘Driver Jobs’ globally each month and tens of thousands of people have joined ride-hailing platforms as full-time or part-time drivers (Fiegerman, 2014). In China and other developing countries, due to the low percentage of car ownership and lower income levels of households, such flexible job opportunities can attract people to purchase a car to participate in the labor market and thereby positively influence the automotive manufacturing industry. It is also noted that the negative effect of rail-hailing apps on new car sales may also exist in these developing countries because some passengers give up or delay their new car purchase plans by virtue of ride-hailing platforms possibly fulfilling an unserved demand of convenient, point-to-point urban travel (Wallsten, 2015). Consequently, the overall effect of ride-hailing apps on the automotive manufacturing industry and variation between developed and developing countries remain as empirical questions. The purpose of this paper is to quantify the economic impact of ride-hailing companies on the growth of car manufacturing firms using a unique dataset of vehicle registrations from the U.S.—the biggest developed country and China—the biggest developing country. We propose that ride-hailing platforms will significantly decrease new car sales in affected U.S states, but the negative effect of using ride-hailing apps on the automotive manufacturing industry will be slightly weakened because a few Uber drivers have to purchase new cars to meet the vehicle requirements of Uber. For instance, all Uber cars’ vehicle models must be from 2001 or later (2006 in some cities). As discussed above, we further suggest that ride-hailing platforms will significantly increase new car sales in affected Chinese provinces if the number of individuals who tend to purchase a new car and become a full-time ride-hailing driver is larger than the number of individuals who enjoy the benefits of rail-hailing apps and give up car ownership. Figure 1 (a) demonstrates the preliminary evidence on the topic and illustrates the pattern in new car sales and Uber’s presence in California. Figure 1 (b) demonstrates the trend of new car sales as a result of Didi Chuxing’s entry into the Jiangsu province of China.

![Figure 1(a). The Relationship between New Car Sales and Uber’s Entry into California](image1)

![Figure 1(b). The Relationship between New Car Sales and Didi Chuxing’s Entry into Jiangsu Province](image2)

Our paper aims to make a few key contributions to the literature. We are among the first to research the link between the diffusion of the sharing economy and traditional mature industries by providing additional empirical evidence of the economic impact associated with the sharing economy. The results of our study can inform academics, policy makers, environmental health practitioners, and other relevant stakeholders regarding the impacts of online collaborative consumption on traditional firms. The rich nature of our dataset allows us to examine the effect of the entry of ride-hailing platforms on new car sales in different developed and developing countries.
Prior Literature

Digital Two-Sided Platforms

Internet-enabled two-sided platforms have profoundly changed business practices, social and economic activities by serving as digital intermediaries between suppliers and consumers (Constantinides and Barrett 2014). One major stream of research on two-sided platforms examines their impacts on social and public issues. Instances of such work include: Chan and Ghose (2013) and Greenwood and Agarwal (2015), who investigate whether the entry of Craigslist increased the prevalence of HIV; Alexander and Gonzalez (2015) and Li et al. (2016), who explore how ride-hailing platforms affect traffic congestion; and Chasin and Scholta (2015), who summarize possible opportunities and challenges for e-Government to implement an online two-side platform between citizens and government. Investigating the antecedents and consequences related to individuals’ participation in different online two-side platforms is another topic that has received extensive attention in platform research (Kim et al. 2015, Burtch et al. (2013). Other recent studies on individuals’ participation and decision mechanisms of crowdfunding platforms. Another stream of research on online two-side platforms examines their substitution and complementarities effects on incumbent firms offering similar goods or services (Cusumano, 2015). Our work also contributes to the growing literature on multi-platform competition. Several extant studies have particularly examined the economic theory of two-sided markets (Rochet and Tirole, 2003), multi-homing and choice (Landsman and Stremersch, 2011), and the behavior of firms and individuals in two-sided markets (Jin and Rysman, 2015). Little is known about the economic impact of digital two-side platforms on traditional manufacturing industries. Our paper aims to fill this gap by examining the impact of ride-hailing platforms on new car sales in the U.S. and China.

Car Sharing

Focusing specifically on the car-sharing literature, a significant amount of research has investigated the effects of car-sharing adoption, including studies from economic, environmental and social perspectives, such as examining the alleviation of air and noise pollution, improving traffic congestion, and reducing the costs of vehicle travel (e.g., Jacobson and King, 2009). Findings of this stream of research have important managerial implications for the question of whether a car sharing approach can effectively solve the environmental and transportation problems typically faced by metropolitan areas, such as New York, London and Paris (Fellows and Pitfield, 2000). Ride-hailing platforms (e.g., Uber) have similarities with traditional car sharing, but they act as peer-to-peer, two-sided platforms that connect demand and supply via technology innovations. Although this stream of work has investigated various benefits accrued by introducing car-sharing policies, it is imperative to understand the intrinsic relationships that emerging car-sharing mobile applications would hold regarding car manufacturing firms.

Data

Our study attempts to explore the relationship between the use of ride-hailing apps and the revenue of car manufacturers in the US and China by estimating annual new car sales as a function of ride-hailing entry into the market. To identify the entry effects of Uber, we rely on a natural experiment design inherent in Uber’s expansion in the US. During its expansion, the ride-hailing service offered by Uber was available in certain locations at each time period, thereby providing variation in ride-hailing entry across states and years. We design to consolidate the annual number of new car registration and licensing records for each state from the US Department of Transportation. To examine the entry timing of ride-hailing platforms into a location, we collected data on the year in which Uber was launched. With this data, we can construct a binary entry indicator for a state for a given year. There may be a time lag between Uber entry and its impact on new car sales. In order to alleviate this concern, we only chose 22 US states where Uber entered between 2010 and 2013 as our treated groups and constitute a national panel data set across a period of 10 years (2006-2015). The (at least) 4-year pre-treatment period and the (at least) two-year post-treatment period allow us to examine the lagged effect of Uber on new car sales and the parallel trends assumption, as discussed below. Another natural experiment operating in parallel to examine the relationship between Didi Chuxing’s entry and new car sales in China can also be conducted. We can construct a national panel data set for 31 Chinese provinces across a period from 2006 to 2015 (i.e. ten
years). Similarly, Didi Chuxing’s entered into 31 provinces between 2009 and 2013, and thus we can examine the lagged effect of Didi Chuxing and parallel new car sales trends between treated and untreated groups. We can run panel regressions of new car sales on Uber and Didi Chuxing’s entry with state (or province) and year fixed effects, and include multiple controls to account for demographic features, socioeconomic factors, and traffic intensity, which may affect new car sales. These control variables for the US and China are collected from the Chinese annual statistical books and United States Census Bureau and Bureau of Economic Analysis respectively. Per capita income, GDP growth rate and population size are included as three covariates to account for the level of urbanization of each location. We also collect the geographic coverage of public transportation (i.e. the total number of registered public buses) and the intensity of paved roads to serve as two control variables, which can influence the use of ride-hailing apps.

**Empirical Methodology**

Our empirical strategy exploits this variability to identify the impact of ride-hailing's entry on new car sale revenue using a difference in differences (DID) identification strategy (e.g., Zervas et al., 2015). To test for site entry effects, we estimate regressions in the form

\[
\ln(Y_{ct}) = A_c + B_t + g \cdot Z_{ct} + p \cdot R_{ct} + e_{ct}
\]  

(1)

where \(c\) indexes states/provinces and \(t\) indexes time (\(t = 2006\) to \(2015\)); \(Y_{ct}\) is the number of new car registration plates for state/province \(c\) in year \(t\); \(A_c\) is a vector of 22 states’ (and 31 provinces’) fixed effects; and \(B_t\) is a vector of time fixed effects. Further, \(Z_{ct}\) is a vector of state/province demographics features and socioeconomic indicators, which includes a logarithm of population size, GDP growth rate, per capita income, per capita bus transportation, and per capita road kilometres. Moreover, \(R_{ct}\) is the binary indicator for ride-hailing app entry, that is, \(R_{ct} = 1\) if the state/province has Uber/Didi Chuxing in a particular year, zero otherwise, and \(e_{ct}\) is an error term. The coefficient \(p\) is the difference-in-difference estimate of the effect of Uber’s and Didi Chuxing’s entry on the number of new car sales. If \(p > 0\), then ride-hailing app entry has caused an increase in the number of new car sales. The fixed effects framework together with covariates may not be able to account for potential time-varying effects that influence new car sales trends. To assess the robustness of our results, following prior studies (e.g., Athey and Stern, 2002), we further run regression models with time-varying controls. We execute this check by including interaction terms of the state/province covariates with the linear time trend as follows:

\[
\ln(Y_{ct}) = A_c + B_t + g \cdot Z_{ct} + p \cdot R_{ct} + v \cdot Z_{ct} \cdot T_t + e_{ct}
\]  

(2)

To check the DID parallel trend assumption, and to understand how long it takes for significant effects to manifest, following Baesens et al. (2016), Chan and Ghose (2013), Greenwood and Wattal (2015), and Li et al. (2016), we include a series of time dummies \((j = t - 2, ..., t+2)\) that represent the chronological distance between an observation period, \(t\), and the timing of treatment in affected state(province) \(i\):

\[
\ln(Y_{ct}) = A_c + B_t + g \cdot Z_{ct} + \sum_{j=t+2}^{t+2} P_j \times (R_{ci} \times \varphi) + v \cdot Z_{ct} \cdot T_t + e_{ct}
\]  

(3)

**Expected Contributions**

Our work contributes to the small, but growing, literature in information systems about the impacts of online two-sided platforms on social issues, incumbent firms and traditional manufacturing industries. Our study will provide empirical evidence of a causal relationship between ride-hailing platforms and the automotive manufacturing industry. This study adds to the ongoing debate over whether and how ride-hailing platforms influence new car sales. Our rigorous empirical analysis will provide additional evidence that the effect of ride-hailing platforms on new car sales could vary with the percentage of car ownership per household and income levels. It may be the case that Didi Chuxing is simultaneously increasing the total number of cars on the road by creating new job opportunities and the demand for private car services because of its convenience and low price. Alternatively, Uber may be increasing the utilization of existing cars and delaying households’ new car purchase plans. Moreover, this research serves as an open call to extend similar research into other aspects of the sharing economy, such as the effect of Airbnb on the dry-cleaning industry, the effect of TaskRabbit on the unemployment rate, and the effect of Wework on the survival ability of start-up firms.
REFERENCES