Sharing Economy in Japan and the United States

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Abstract

The world is replete with underutilized assets and resources, which have motivated firms to create new and more efficient markets by exploiting digital platforms. The trend exhibits a fast growth of sharing economy in service industries across the globe. Additionally, the underutilized assets also motivate technology firms to aggressively invest in enabling technologies. For example, the ultimate goal of Google's driverless car project reportedly is to eventually rid the need for households to own cars by using rental services. That is, the sharing economy not only can increase the efficiency of underutilized assets but can also accelerate technological progress in the economy. Furthermore, unlike their traditional counterparts, sharing-economy companies have a much higher ratio of intangible assets. A prominent example is Airbnb, where the company has only 600 employees but the number of listed properties has surpassed that of the world's largest hotel chain.

In this study, using the firm-level data from Japan and the U.S. during the period of 2002 to 2015, we examine the impacts of the sharing economy on hotel and transportation industries in both the U.S. and Japan. There are several key findings from this research: First, firms incorporating and adopting sharing technology have a higher degree of organizational capital intensity and have accumulated a higher stock of organizational capital. Second, the creative destruction of the sharing technology have been shown on the estimated depreciation rates of organizational capital between the two groups. In general, the higher depreciation rate of organizational capital for existing incumbents implies that the value of their organizational capital are losing faster. Third, we show that the sharing technology shock caused a negative impact on the stock prices of existing incumbents but a positive impact on their counterparts adopting the new technology. Last but not least, by using the Uber case, we analyze welfare impacts of the new sharing technology and propose a new way to indirectly measure it. The analysis of the potential welfare impacts suggests the import measurement issues of the price index of the transportation service to the GDP growth and productivity growth.

[1] The views expressed are those of the author and do not necessarily reflect those of the U.S. Bureau of Economic Analysis.

1. Introduction

The world is replete with underutilized assets and resources. Given the underutilized assets and resources, several forces, such as new technology development and environmental concerns, have spurred the creation and accelerated the adoption of the sharing economy (Nadler, 2014). The trend exhibits a fast growth of sharing economy in service industries across the globe. For example, PricewaterhouseCoopers has estimated that the main sectors of the sharing economy could represent US $335 billion in revenue worldwide by 2025 (Matzler et al., 2015). *The Economist (2016)* reports that Uber dominates the chauffeured ride-sharing, which accounts for less than 4% of all kilometres driven globally and will rise to more than 25% by 2030 according to Morgan Stanley. Additionally, the underutilized assets also motivate technology firms to aggressively invest in enabling technologies. For example, the ultimate goal of Google's driverless car project reportedly is to eventually rid the need for households to own cars by using rental services. Google's goal is similar to the concept of Zipcar. A survey on Zipcar members finds that nearly 50% of its members, mostly in urban areas and college campuses, can avoid purchasing a car (Eha, 2013). An OECD study on the use of self-driving cars in Lisbon finds that share driverless car could reduce the number of cars needed by 80-90% (The Economist, 2016). That is, the sharing economy not only can increase the efficiency of underutilized assets but can also accelerate technological progress in the economy. Moreover, lower consumption costs offered by the sharing companies also allow consumers have more resources spent on other goods and services.

However, because sharing-economy firms are creating new business models which are challenging the existing ones in established industries, more affected firms in those industries are requesting more regulations. To provide important policy evaluation, we need to better measure the activities related to the sharing economy and examine the impacts on the economy are beyond the owners of the assets, the sharing service providers, and the consumers. For example, how does the rise of sharing economy negatively affect the incumbents? How does the rise of sharing economy affect the consumers? How does the rise of sharing economy affect the growth of the sharing-economy firms? Because the rise of sharing economy lowers down the transactions costs and average service costs, how does the cost saving affect the consumption of other economic activities? How does the enabling nature of sharing economy affect the economic growth within a nation?

Economists have been trying to explain the fast growth of various sharing business models and estimate their impacts on different economic players and the economy. However, due to the data constraints, the current literature is limited to the conceptual studies, regional studies, and the welfare impact of a single firm, such as the conceptual studies of the phenomenon (Nadler, 2014), the regional studies of Airbnb's impacts on local hotel revenues (Zervas et al., 2014), the quality impacts of Uber on the taxi industry (Wallsten, 2015), and the measurement of consumer welfare by Uber (Cohen et al., 2016). Methodologies are needed to measure the related activities, capital involved, corporate gains and/or losses, consumer welfare, GDP growth, and productivity growth.

To contribute to the understanding of the sharing economy, we focus on examining the impacts of the rise of sharing economy on market valuation and intangibles, proposing a new way to indirectly measure the impacts on social welfare, and discussing the implied measurement issues. Specifically, after the introduction of new sharing business model, except the negative impacts on the revenues of some existing incumbents, what happens to their intangibles? Does the new business model act as a creative destruction which makes the old business model of existing incumbents outdated or deteriorated faster? That is, the resource based theory indicates that the depreciation of their intangibles is expected to be higher than those of their new counterparts. How does the incumbents react to cope with the entrants with new business model? Unlike their traditional counterparts, sharing-economy companies are in general low physical asset intensive but have superior business models to generate rapid growth. A prominent example is Airbnb, where the company has only 600 employees but the number of listed properties has surpassed that of the world's largest hotel chain, Marriot International, Inc. Another example is Uber, with a latest estimated market valuation, US $68 million and around 11% of Apple's market valuation on September 16, 2016, does not have its own fleet. To explain the high market valuation, intangible assets are the key candidate to examine. That is, we need to examine whether those new sharing-economy companies have a much higher intensity of intangible assets. Eisfeldt and Papanikolaou (2013) find that firms with a higher degree of organizational capital intensity also are more productive and their average market returns are 4.6% higher. So, we examine how the entry of sharing-economy companies affects the stock performances of existing incumbents? Lastly, what happens to the consumers?

Before conducting the analysis to answer those research questions, we need to measure the intangibles, mainly organizational capital, of interested companies in the hospitality and transportation industries. To measure intangibles, economists generally encounter the problems that there is no arms-length market for most intangibles and that the majority of them are developed for a firm's own use. Following earlier research, we use the sales, general, and administrative (SG&A) expense as a proxy for a firm's investment in organizational capital (Lev and Radhakrishnan, 2005; Eisfeldt and Papanikolaou, 2013). Firms report this expense in their annual income statements. It includes most of the expenditures that generate organizational capital, such as employee training costs, brand enhancement activities, consulting fees, and the installation and management costs of supply chains. Because SG&A expenditures may include some items that are unrelated to improving a firm's organizational efficiency, people might question whether it is a valid measure of a firm's investment in organizational capital. Eisfeldt and Papanikolaou (2013) use five ways to validate their measure, and the results show that four out of five ways clearly support this approach. Moreover, the inefficiency of the investment in organizational capital by definition should show in the depreciation rate of organizational capital. That is, if a firm's investment in organizational capital has a lot of inefficiency, the value of its organizational capital cannot be maintained well, which implies that it will have a higher depreciation rate of organizational capital. As shown in Li (2015), across U.S. high-tech industries, market leaders in general have a smaller depreciation rate than their followers. In this research, we adopt the R&D depreciation model that Li and Hall (2016) developed to estimate the depreciation rates of the organizational capital for the hospitality and transportation industries of Japan and the U.S. separately. Following Hall (1998), we use the perpetual inventory method to construct the stock of organizational capital for key firms in those two industries in both Japan and the U.S.

In this paper, we use the key firm-level data in the hospitality and transportation industries from Japan and the U.S. during the period of 2002 to 2015. The U.S. data source is the Compustat dataset and the Japan's data source is Nikkei Financial Quest Database.

This paper has several key findings. First, we measure the intangible assets of sharing-economy companies and their counterparts in both Japanese and the U.S. hospitality and transportation industries. Second, firms incorporating and adopting sharing technology have a higher degree of organizational capital intensity and have accumulated a higher stock of organizational capital. Third, the creative destruction of the sharing technology have been shown on the estimated depreciation rates of organizational capital between the two groups. In general, the higher depreciation rate of organizational capital for existing incumbents implies that the value of their organizational capital are losing faster. Fourth, we show that the sharing technology shock caused a negative impact on the stock prices of existing incumbents but a positive impact on their counterparts adopting the new technology. Last but not least, using the Uber case, we analyze welfare impacts of the new sharing technology and propose a new way to indirectly measure it. The analysis of the potential welfare impacts suggests the importance of the measurement of the price index of the transportation service to the GDP growth and productivity growth.

The rest of paper proceeds as follows. Section 2 describes the methodology. Section 3 describes the data, the estimation of the depreciation rates of organizational capital, and the construction of organizational capital stock for firms. Section 4 shows the empirical analysis results for sharing-company firms and incumbents. Section 5 concludes.

2. Response of Stock Markets on the Introduction of Sharing Technology

2.1 Methodology – Extended Difference-in-Differences

In this section, we use the stock prices of existing incumbents to estimate the causal effect of the introduction of sharing technology on their future profitability. To conduct the causal inference, econometricians have developed tools such as randomized controlled trial (RCT), difference-in-differences (DD), and structural estimation. Because we cannot perform laboratory experiments in the study of sharing economy, RCT, though the best approach, is infeasible. In addition, because currently most sharing economy firms are not public and their financial data are not available, the approach of structural estimation is also infeasible. Therefore, DD is the most promising and feasible approach to infer the causal impact of sharing economy.

Based on the DD approach, one can infer the causal impact by estimating the difference between the pre-post difference of the treatment group, T, and that of the controlled group, C. Since the pre-post difference C can be considered as a proxy of the pre-post difference T without intervention, we can estimate the causal treatment effect by taking the difference of them.[2]

In this paper, by using state-space models, we apply an extended procedure of DD (Brodersen et al., 2015). The method overcomes two limitations of DD. The first limitation is

[2] See Angrist and Krueger (1999) for general discussion on difference-in-differences.

that DD generally assumes a static regression model. If data are serially correlated in practice, the specification error deteriorates the estimation outcome. And, the other limitation is that analyses based on the DD approach study the difference between two time points: before and after the intervention. However, in general, it is uncertain when the intervention is over. Moreover, we may want to know the temporal causal impact of the ongoing event or phenomenon, such as the sharing economy. These effects usually evolve over time; therefore, it is not preferable to identify the causality only by the difference between two time points.

By using the extended DD procedure, our study addresses the above limitations (Varian, 2014; Scott and Varian, 2014; Brodersen et al., 2015). In this procedure, we first separate the time-series data into pre-intervention period and post-intervention period. Second, we specify the state space model, or the so-called Bayesian structural time-series model in machine learning literature, and use pre-intervention data to estimate the reduced-form parameters. Third, from the posterior predictive distribution, we simulate the counter-factual post-intervention time series. Finally, we compute the pointwise impact by taking a difference between the real post-intervention time series, the treatment group, and the simulated post-intervention time series, the control group. Since the simulated time series can be considered as a proxy of the real time series without intervention, we can use the difference between the simulated and the real time series to estimate the causal treatment effect.

2.2 State Space Model (or Bayesian Structural Time-Series Model)

A state space model for time-series data is generally defined as an observation equation and a state equation:

$$y_t = Z_t^T \alpha_t + \epsilon_t, \quad \epsilon_t \sim \mathrm{N}(0, H_t)$$

$$\alpha_{t+1} = T_t \alpha_t + R_t \eta_t, \quad \eta_t \sim \mathrm{N}(0, Q_t),$$

where Z_t is a vector of independent variables and α_t represents a state vector. This study uses the following specification of the state space model:

$$y_t = x_t^T \beta_t + \mu_t + \epsilon_t, \qquad \epsilon_t \sim \mathrm{N}(0, \sigma^2)$$

$$x_t^T \beta_t = \sum_{j=1}^{J} x_{j,t} \beta_{j,t}$$

$$\beta_{j,t+1} = \rho \beta_{j,t} + \eta_{j,t}, \qquad \eta_{j,t} \sim \mathrm{N}\left(0, \sigma_j^2\right)$$

$$\mu_{t+1} = \mu_t + \delta_t + u_t, \qquad u_t \sim \mathrm{N}(0, \sigma_\mu^2)$$

$$\delta_{t+1} = D + \phi(\delta_t - D) + \eta_{\delta,t}, \qquad \eta_{\delta,t} \sim \mathrm{N}(0, \sigma_\delta^2)$$

where y_t denotes the dependent variable and x_t denotes the contemporaneous independent variable with time-varying coefficients $\beta_{j,t}$, which follows an AR(1) process. Let μ_t denote a linear stochastic trend following a random-walk process with slope δ_t, which follows an AR(1) process and fluctuates around a nonzero value D. The dependent variable is the stock price of a firm that is affected by sharing technology. For independent variables, we use an aggregate stock price index and an aggregate bond price. Both individual and aggregate stock prices are unit-root processes. For the individual stocks that we investigated, we found no co-integration structure between individual and aggregate stock prices. Therefore, to avoid a spurious regression, we include the stochastic trend term in the observation equation.

We use Gibbs sampling method to estimate the model parameters. Let Θ denote the set of all parameters in the model. The Gibbs sampling procedure is stipulated as below.

1. Initialize Θ, β, and μ.
2. For $j = 1, \dots, J$, execute as follows.
   i. Sample $\beta_j | \Theta, \mu$.
   ii. Sample $\rho_j | \beta_j$.
   iii. Sample $\sigma_j | \beta_j, \rho_j$.
3. Sample $\mu | \Theta, \beta$.
4. Sample $\delta | \mu$.
5. Sample $\phi | \delta$.
6. Sample $D | \delta, \phi$.
7. Sample $\sigma_\delta | \delta, \phi, D$.
8. Sample $\sigma_u | \mu, \delta, \phi, D$.
9. Sample $\sigma | \beta, \mu$.
10. Go back to 2.

3. Data

3.1 Stock of Organizational Capital

In this research, we construct the firm-level stock of organizational capital from 2002 to 2015. We apply Li and Hall (2016) model to estimate the firm-level depreciation rates of organizational capital for the key Japanese and U.S. firms in the hospitality and transportation industries. Table 1 shows the depreciation rates of organizational capital for the firms where data are available for conducting the estimation.

Table 1: Depreciation Rates of Organizational Capital

for Key Japanese and U.S. Firms in the Hospitality and Transportation Industries

Firms	δ_OC [%]
U.S. Hospitality Firms	
Expedia	8%
Priceline	19%
Hyatt	36%
Starwood	33%
TripAdvisor	17%
Japanese Transportation Firms	
Park24	21%
DaiwaMT	26%
US Rental Car Companies	
Hertz	14%
Avis	36%
US Taxi Related Company	
Medallion financial	No SG&A data

Table 1 shows that: First, U.S. hospitality firms offering a complementary service to the incumbents' products at a discount price has smaller depreciation rates of organizational capital than those of incumbents. Expedia Inc., a spun-off company from Microsoft in 1999, has a new business model that provides a platform, which offers hotel rooms from different hotel chains at the same time and thus reduces the transaction costs, for travelers to purchase hotel rooms. Moreover, the Priceline Group provides an additional discount service, which allows travelers to bid hotel room at a higher discount price. Compared with Hyatt and Starwood, both Expedia and Priceline have smaller deprecation rates of organizational capital. Second, in the

Japanese transportation industry, Park24, a parking and car-sharing company, has a smaller depreciation rate of organizational capital than its counterpart, DaiwaMT, a taxi fleet firm, does. Third, in the U.S. rental car industry, Hertz, the market leader with the best recognizable brand name, does have a smaller depreciation rate of organizational capital. Note that both companies offer car sharing services,[3] but car sharing services only account for small portions of the businesses for both firms.

Depreciation rate of organizational capital can indicate the level of the appropriateness of a firm's organizational capital (Li and Hall, 2016; Li, 2015). If the rate is higher, it indicates that the firm can less appropriate the return from its investment in organizational capital. As shown in Li (2015), in the U.S. high-tech industries, market leaders in general have a smaller depreciation rate of organizational capital than their followers do. This is consistent with the argument in the resource-based theory: the sustained competitive advantage of a firm lies primarily in the application of valuable tangible or intangible resources are neither perfectly imitable nor substitutable without great effort (Barney, 1991).

In the new era of the sharing economy, sharing economy firms are applying new sharing technology to creatively destruct the existing business model in their industries. As a result, we expect to see that the organizational capital of existing incumbents will lose its value faster than those of sharing economy firms and firms providing similar services. This argument is consistent with the results shown in Table 1.

[3] http://www.businesstravelnews.com/Business-Travel/Hertz-To-Cease-Car-Sharing-Services-In-U-S-Next-Month

Before conducting further analysis, we first construct the stocks of organizational capital for all firms.[4] To construct the firm-level stock of organizational capital, we follow the method of constructing the annual stock of R&D assets for U.S. manufacturing industries in Hall (1998). First, for the U.S. firms, we deflate each firm's annual SG&A expenditures by using the U.S. GDP deflator with 2005 as the base year. Then, we apply our estimated depreciation rates and the perpetual inventory method to construct each firm's annual stock of organizational capital. Lastly, we use the U.S. GDP deflator again to bring back the real number to the correspondent nominal value in that year. We set the initial capital stock at the beginning to be zero and conduct the analysis without the first three-year data that were more influenced by the initial value. The time series of the stocks of organizational capital cover the period of 2002 to 2015. We also apply the same procedure for Japanese firms.

3.2 Data for Firm-level Stock Price

We use the time series of daily firm-level stock price for dependent and independent variables. In addition, we investigate the funding history of sharing economy firms in order to determine the timing of the introduction of sharing technology relevant to the firms in question. Below we describe the firms investigated in this study.

The data cover 10 Japanese and U.S. companies, which are listed on Table 1. For the U.S. transportation industry, this study covers three public companies. Medallion Financial Corporation, Hertz, and Avis, which acquired ZipCar in 2013. For Japan's transportation industry, this study covers Park24 and DaiwaMT. For the U.S. hospitality industry, this study covers

[4] All firms have no data on R&D investments.

discount sellers, Expedia, Priceline, and TripAdvisor, and existing incumbents, including Hyatt and Starwood. The choice of the companies is based on the availability of the data.

In the U.S. transportation industry, we cover two groups of companies of interest. First, Medallion Financial Corp (NASDAQ: MFIN) is a specialty finance company and a leader in originating, acquiring and servicing loans that finance taxicab medallions. Because the values of taxicab medallions have been negatively affected by the entry of Uber services, Medallion Financial Corp's stock price is expected to decrease.[5] The stock price data is a daily data from May 24, 1996 to October 17, 2016, and we use the post-intervention (Uber) period as from August 22, 2013, on the ground that on August 23, 2013, Uber raised its breakout US $258 million Series C at US $3.5 billion valuation, which overwhelms its previous fund raising of US $11 million and US $60 million valuation at Series A and US $37 million at Series B.[6] In addition to MFIN, we also analyze the time series of Chicago's Medallion price from January 16, 2011 to September 29, 2016 with the same research scheme.[7]

The second group of companies of interest is providers of rental car service. We choose two large providers, Avis Budget Group Inc. (NASDAQ:CAR) and Hertz Global Holdings, Inc. (NYSE:HTZ). Avis acquired Zipcar in 2013, which is a company providing short-term rental service but the term is shorter than that regular rental car service provides but longer than that provided by taxi and Uber. Thus, Avis operates a car sharing service through Zipcar. Hertz also offered a car-sharing service in 2008 to compete with Zipcar but closed most sites in the U.S. in

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[5] These expectations are expressed in the following media articles: https://biz.yahoo.com/e/160809/mfin10-q.html
https://www.cbinsights.com/blog/public-stock-driven-uber/
http://www.crainsnewyork.com/article/20141201/BLOGS04/141209994/as-uber-rises-yellow-taxi-medallion-stock-plunges

[6] https://www.crunchbase.com/organization/uber#/entity

[7] The medallion price data is publicly available at:
https://www.cityofchicago.org/city/en/depts/bacp/supp_info/medallion_owner_information.html

2015. Although rental car companies and Uber belong to the same transportation industry using passenger cars, it is not obvious whether they are substitute with each other. Uber mainly caters to the short- and medium-term transportation demand, whereas the rental cars mainly serve the medium- to long-term demand.

For the impacts of the sharing economy on the rental-car industry, we organize our study in two experiments. First, we study the difference in the stock price responses between Avis and Hertz against the Uber's intervention. Avis announced to buy Zipcar on January 2, 2013.[8] Hertz launched car-sharing service in 2008 to compete with Zipcar but ended the service in the U.S. and some European cities in 2015. However, it didn't exit all the international markets completely.[9] In 2010, Zipcar has 94 US locations, 128 in 2011, and 151 in 2012. Hertz has the most U.S. locations among all rental cars. So, in terms of convenience, it might be able to compete with Zipcar but may not be cost competitive. Both firms' entry into car-sharing business would potentially benefit from the advancement of sharing technology.

Second, Hertz signed deals with both Uber and Lyft to supply cars for the drivers of both platforms on June 30, 2016.[10] This announcement suggested that the ride-share industry and the rental-car industry might become complementary, and implied that Hertz would also benefit from the sharing economy. Thus, the stock price is expected to increase after the announcement. The stock price data of Avis is a daily data from December 31, 2010 to October

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[8] http://www.wsj.com/articles/SB10001424127887324374004578217121433322386

[9] http://www.businesstravelnews.com/Business-Travel/Hertz-To-Cease-Car-Sharing-Services-In-U-S-Next-Month

[10] https://www.bloomberg.com/news/articles/2016-06-30/hertz-signs-deals-with-uber-lyft-to-supply-cars-to-drivers

17, 2016 and of Hertz is from November 17, 2006 to June 30, 2016 for the Uber's intervention (August 22, 2013), and of Hertz to October 17, 2016 for the Uber/Lyft deal intervention.

In the Japanese transportation industry, we study Park 24 Co., Ltd (Tokyo: 4666) and Daiwa Motor Transportation Co., Ltd (Tokyo: 9082). Park 24 operates numerous small-size parking lots in large cities. Its business grew fast on the backdrop of large supply of small-lot land which were left idle partly due to low rates of realty tax in Japanese municipals. On the rise of sharing technology, Park 24 started offering car-sharing service called "Times Car Plus." Times Car Plus provides 13,149 cars at 7,311 locations (as of October 2015) for use in the unit of 15 minutes. Park 24 can profit by a sharing economy and the stock price is expected to increase.[11] Thus, we set the post-intervention (car sharing) period as from March 24, 2009 when they started the car-sharing service, and investigated their daily stock price data from April 30, 1999 to October 19, 2016. The other Japanese firm we study is DaiwaMT, which mainly focuses on the passenger automobile transportation business in the Kanto region which includes Tokyo. DaiwaMT is one of the incumbents in the taxi industry and the stock price is expected to decrease when the ride-sharing business comes into a wide use. Uber began the service on August 5, 2014 in Japan,[12] but they provide only a limousine-hiring service and not a ride-sharing one due to regulations. Thus, DaiwaMT's stock price is expected to be unaffected. We use the daily stock price data from December 25, 1997 to September 28, 2016, and the intervention (car sharing) timing is set at the date when Uber started service, August 5, 2014.

[11] http://www.park24.co.jp/en/keywords.html

[12] http://toyokeizai.net/articles/-/44594

In the hospitality industry, we study U.S. high-end hotel chains,[13] including Mariott International, Inc. (NASDAQ: MAR), Starwood Hotels & Resorts Worldwide Inc. (NYSE: HOT), Intercontinental Hotels Group plc (NYSE: IHG), and Hyatt Hotels Corp. (NYSE: H). Mid-range hotel chains are also considered: Choice Hotels International, Inc. (NYSE: CHH) and Wyndham worldwide corp. (NYSE: WYN) which competes with Holiday Inn and Best Western.[14] In addition, we study Japan Hotel REIT Investment Corp which invests in mid-range hotels in Japan (Tokyo: 8985). The stock price data covers from October 13, 1993 to November 16, 2016 for MAR; from May 11, 2001 to August 29, 2016 for HOT; from April 10, 2003 to August 31, 2016 for IHG; from November 15, 2009 to November 23, 2016 for H; from April 10, 2003 to August 31, 2016 for CHH; from July 19, 2006 to August 31, 2016 for WYN; from June 14, 2006 to September 30, 2016 for JHRIC. We use the post-intervention (Airbnb) period as from May 22, 2014, because Airbnb raised its breakout US $475 million Series D at a US $10 billion valuation on May 21, 2014.[15] Since Airbnb started the business in Japan from May, 2014, we use the same intervention date for the Japanese data.

[13] We do not study Hilton (NYSE: HLT), because Hilton put on market at 2013/12/12 and we do not have sufficiently long training data to generate the reliable estimate.
[14] For example, CHH includes Comfort Inn, Econo Lodge, and Rodeway Inn. WYN includes Days Inn, Ramada, and Super 8.
[15] http://www.wsj.com/articles/SB10001424052702303802104579451022670668410

4. Empirical Analysis

4.1 Stock Performance – the Effects of the Entry of the Sharing Economy Model

4.1.1 Transportation Industry

For the transportation industry, we first study the price impact on U.S. Medallion Financial Corp (NASDAQ:MFIN) as a proxy for the price of Medallion, and then the price impact on the price of Medallion in Chicago.

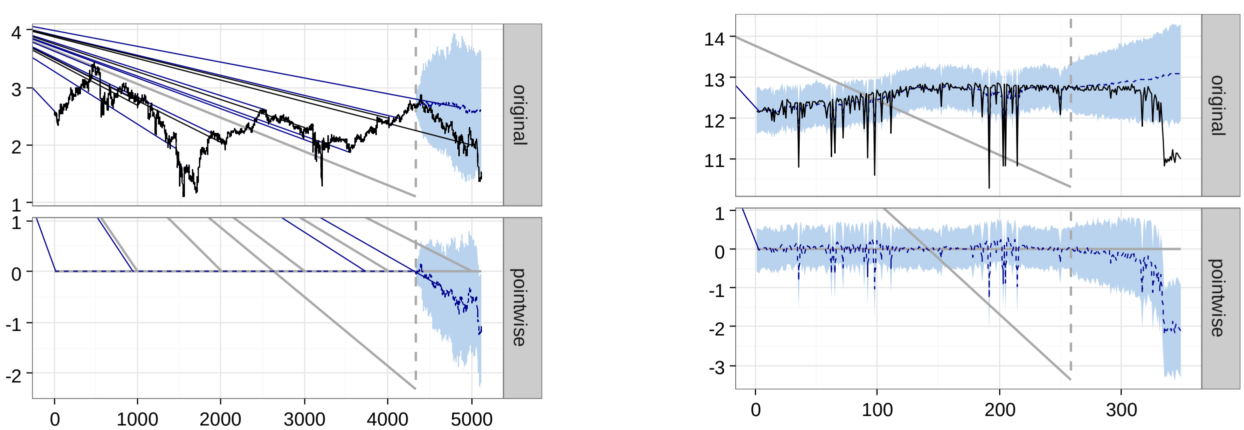


Figure 1: MFIN (left) and Medallion in Chicago (right)

The solid line shows an actual stock price data and the dotted line shows an estimated counterfactual time series with a 90% confidence interval. The "original" chart (top) compares the real and estimated data, whereas the "pointwise" chart (bottom) indicates the difference between the actual and the estimated time series.

Over the post-intervention period, the actual price level was 2.3 on average. For the same period, the time-average of the counterfactual estimate of MFIN is 2.6 with 90% confidence interval [1.9, 3.5]. Thus, when we consider the intervention period as a whole, the intervention has exerted a negative effect, but the magnitude of the effect is not statistically significant. This result may be due to that Medallion Financial is an imperfect proxy for the taxi industry, because nearly half of its business is commercial and consumer lending rather than medallion loans. As a lender, it is not as exposed to risks from falling medallion prices as the actual equity holders in taxi medallions are. Note that although the company does directly own some Chicago medallions, but that is a small part of its business.[16] Even though the effect is insignificant on average for the intervention periods, we do find the time point where the causal effect is statistically significant toward the end of the observation period.

Similarly, the estimation outcome of Chicago Medallion (the right panel of Figure 1) indicates some time point toward the end of the observation period where the causal effect is statistically significant, even though the estimated average effect over the entire post-intervention period is not statistically significant (counterfactual prediction at 13, with 90% confidence interval [12, 14], while actual observation is 12). Therefore, we conclude that we find a statistically significant decrease in stock price in some particular time horizon, even though we do not find a negative causal effect on average for the entity of the intervention period.[17]

Second, we study the two key U.S. rental car companies that we can find data: Avis Budget Group Inc. (NASDAQ:CAR) and Hertz Global Holdings, Inc. (NYSE:HTZ). The first

[16] https://www.washingtonpost.com/news/wonk/wp/2014/06/20/taxi-medallions-have-been-the-best-investment-in-america-for-years-now-uber-may-be-changing-that/
http://www.nytimes.com/2014/12/04/upshot/how-our-taxi-article-happened-to-undercut-the-efficient-markethypothesis.html?rref=collection%2Ftimestopic%2FMedallion%20Financial%20Corporation&action=click&contentCollection=business&region=stream&module=stream_unit&version=latest&contentPlacement=1&pgtype=collection&_r=0

estimation result for Avis (Figure 2) suggests that there is a time point at which a causal positive effect is statistically significant, although the average effect over the post-intervention period is insignificantly positive (the observation is 3.1, while the prediction is 2.9 with 90% confidence interval [1.5, 4.3]). We note the fact that Avis bought Zipcar seven months before the Uber intervention. Thus, Avis could benefit from the sharing economy. Our estimate indicates that there is a significant positive stock price impact in the short run, while the impact was blurred by random shocks in the long run.

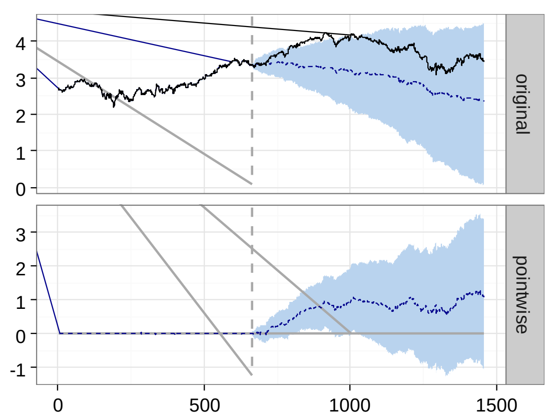
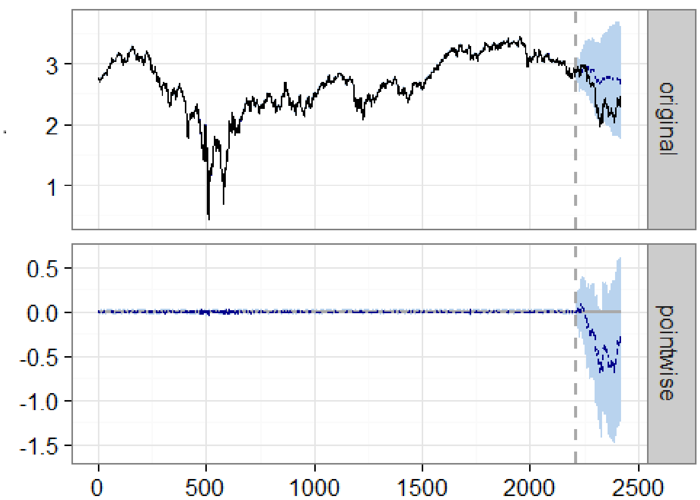


Figure 2: Avis

Figure 3 shows the estimate for Hertz. Overall, the intervention has exerted a negative effect on stock price when considering the intervention period as a whole, but this effect is not statistically significant (observed 3, prediction 3.3, 90% CI [2.2, 4.6]). Hertz did launch car-sharing service in 2008 to compete with Zipcar but ended the service in the U.S. and some European cities in 2015. It didn't exit from all the markets completely, however. This may explain why the negative impacts of the entry of Uber is not statistically significant. Additionally, the non-significant effect may be explained by market segmentation. Because Hertz has the highest brand recognition and is considered high-end rental firm, consumers that need cars to use few hours or a ride will tend to choose cheaper solutions rather than renting a car from the regular car rental service of Hertz. In the bottom panel of Figure 3, we observe that the pullback from car-sharing market had negative effects on the Hertz's stock price, although we do not find the average effect statistically



significant.

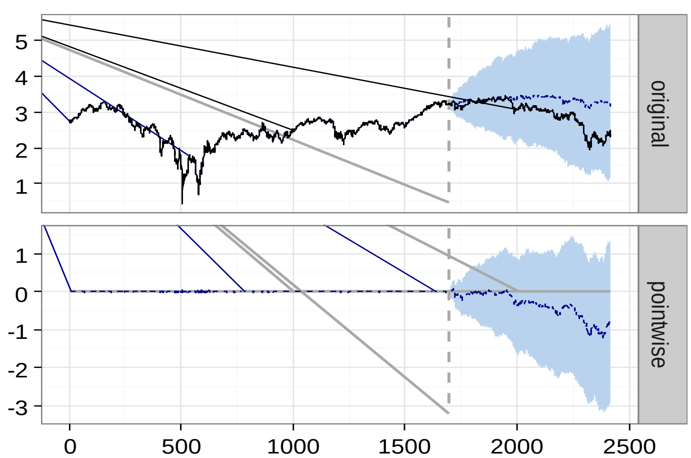


Figure 3: Hertz: Entry and Exit of Its Car-Sharing Service in the U.S.

Figure 4 shows the estimate for the impact of Hertz's alliance with Uber and Lyft. It indicates a statistically significant positive effect during the intervention period. The average observed price is 3.8, while the counterfactual average price is 2.4 with 90% confidence interval [2.1, 2.7]. Therefore, the average positive effect observed in the entire intervention period is unlikely due to random fluctuations. This result implies that market participants expected Hertz to benefit from the sharing economy through collaboration with Uber and Lyft.

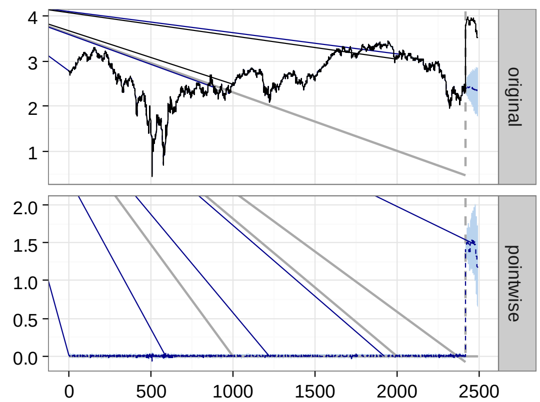


Figure 4: Hertz's Alliance with Uber and Lyft

Finally, we study the stock price impact of Uber's entry on Daiwa Motor Transportation (Tokyo: 9082), a Japanese taxi and limousine company. As shown in Figure 5, the estimate indicates a statistically non-significant impact of the entry of Uber (average observed price at 6.2, while the counterfactual is 5.9 with 90% CI [5.3, 6.6]). This result is natural, provided that Uber is so far prevented from introducing UberX ride-share service in Japan by Road Transport Vehicle Act.

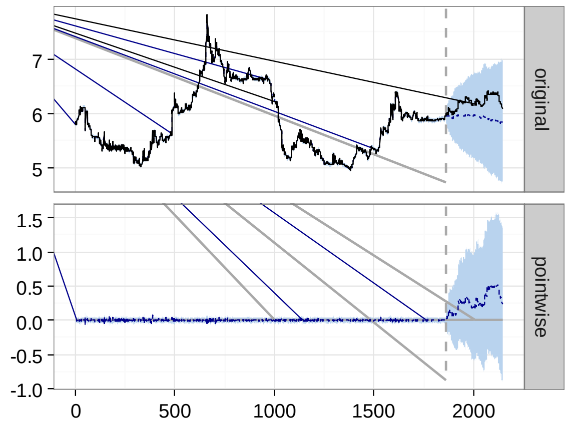


Figure 5: DaiwaMT

Third, we study the stock price impact of the car-sharing business by Park 24 (Tokyo: 4666). Figure 6 shows the result. The launch of car-sharing business seems exerted a positive effect throughout the post-intervention period, even though the positive effect is not statistically significant on average (observation 7.9, counterfactual 7.5 with 90% CI [7.0, 8.0]). However, we do find the time point where the causal effect is statistically significant. This result is consistent with the perceived development of Park24's car-sharing business. Five years after the launch, Park24's car-sharing business finally became profitable in October 2014,[18] and continues to strengthen its presence in the short- and medium-term transportation market.

[18] Nikkei Shinbun, December 10, 2014.

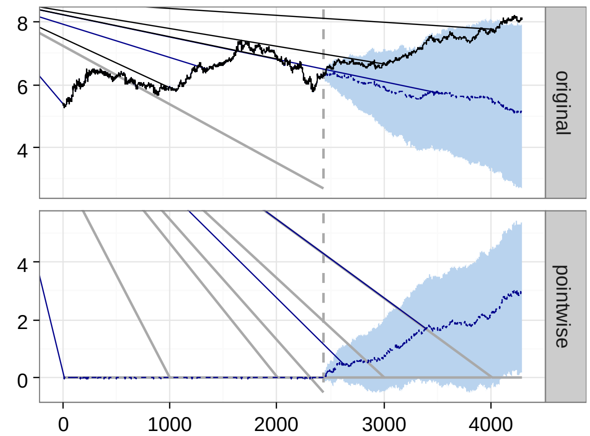


Figure 6: Park24

4.1.2 Hospitality Industry

For the hospitality industry, we study U.S. mid-range and high-end hotel chains and Japan Hotel REIT Investment Corp (Tokyo: 8985) which invests in the mid-range hotels. In this study, U.S. high-end hotel chains include Mariott International, Inc. (NASDAQ: MAR), Starwood Hotels & Resorts Worldwide Inc. (NYSE: HOT), Intercontinental Hotels Group plc (NYSE: IHG), and Hyatt Hotels Corp. (NYSE: H)). And, U.S. mid-range hotel chains include Choice Hotels International, Inc. (NYSE: CHH) and Wyndham worldwide corp. (NYSE: WYN), which compete with Holiday Inn and Best Western. Given the fact that Airbnb competes with hotels in the low and/or lower mid-end markets, we reasonably expect no Airbnb entry effect for both the above U.S. high-end hotels and mid-range hotels, and Japan Hotel REIT Investment Corporation (JHIRC).

From Figures 7 to 13, we can see that as expected, the analysis results show no response for high-end hotels (MAR, HOT, IHG and H). Besides, the empirical outcomes are the same for mid-range hotels (CHH and WYN) and for Japanese mid-range hotels (JHIRC).[19] These results are consistent with Zervas et al. (2016), where they empirically confirmed that the causal impact of Airbnb is non-uniformly distributed and low-end hotels are most negatively affected.

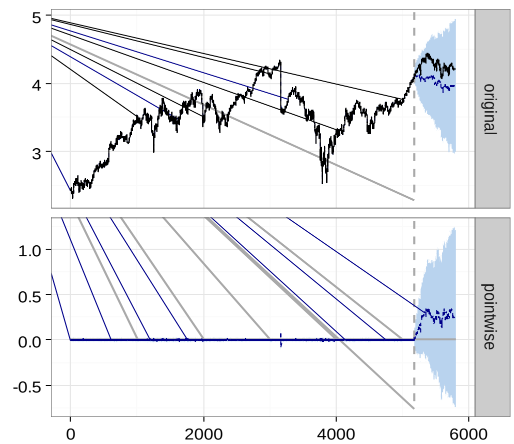


Figure 7: Marriot International (MAR)

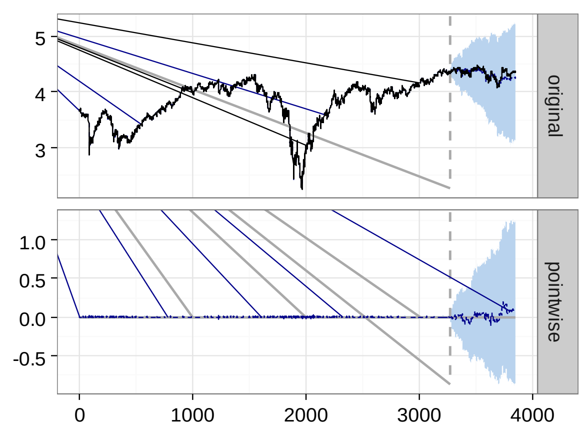


Figure 8: Starwood Hotels & Resorts Worldwide Inc. (HOT)

[19] The estimates are as follows: MAR (Observed (4.3), Counterfactual (4.1), 90% CI [3.6, 4.6]); HOT (Observed (4.3), Counterfactual (4.3), CI [3.9, 4.8]); IHG (Observed (3.7), Counterfactual (3.7), CI [3.4, 4.0]); H (Observed (4.0), Counterfactual (3.9), CI [3.4, 4.4]); CHH (Observed (3.9), Counterfactual (3.8), CI [3.3, 4.3]); WYN (Observed (4.4), Counterfactual (4.2), CI [3.5, 5.0]); JHRIC (Observed (11), Counterfactual (11), CI [10, 12]).

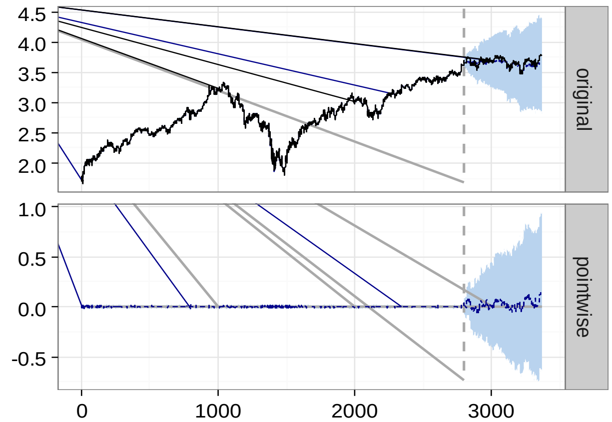


Figure 9: Intercontinental Hotels Group Inc. (IHG)

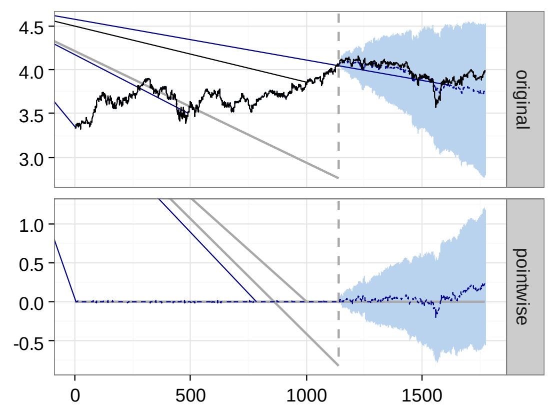


Figure 10: Hyatt Hotels International, Inc. (H)

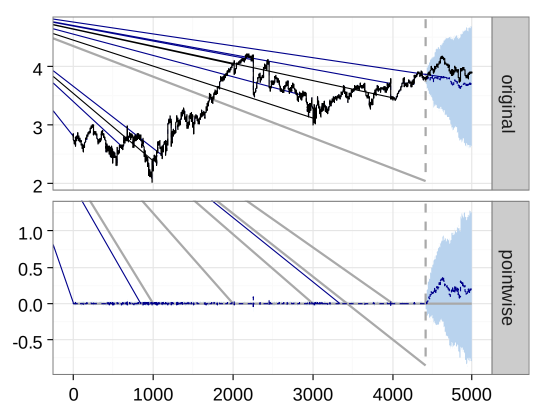


Figure 11: Choice Hotels International, Inc. (CHH)

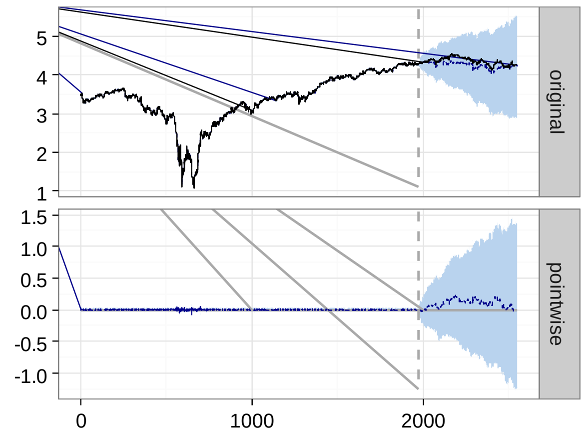


Figure 12: Wyndham Worldwide Corporation (WYN)

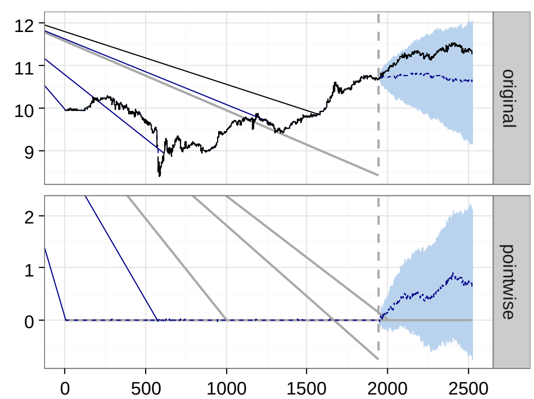


Figure 13: Japan Hotel REIT Investment Corporation (JHRIC)

4.2 Implied Welfare Effects: An Experimental Measurement of Consumer Surplus

We propose a new way to measure consumer surplus for the sharing economy in the transportation and hospitality industries. The decreased share prices of an incumbent could signal the value created by a new firm that is not necessarily listed yet. Airbnb is a technological shock on hotel industry. Because Airbnb provides a platform to allow low marginal cost firms to supply rooms, this technology shock shifts the supply curve to the right. The profits of the low MC firms are unobservable. While the hotel industry is loosely segregated by quality: low-, middle-, and high-end, studies have shown that the Airbnb shock hits the low-end hotels most (Zervas et al., 2014). However, the degree of the business-stealing effect is determined by the elasticity of substitution between Airbnb and a hotel category. We observe the profit declines and stock values of low-end hotels. We propose that this decline in the stock values of existing incumbents can be used to indirectly measure the consumer surplus Airbnb generates.

The impacts on welfare are divided into three areas. First, the profit margin, revenue minus cost, generated by Airbnb suppliers is a new value-added. Second, Airbnb renters gain consumer surplus, which is the triangular below the demand curve in the price range between the Airbnb price and the low-end hotel price. Third, competing with low-cost Airbnb suppliers, the low end hotels face the reduced mark-up, which causes revenue loss. This revenue loss represents a transfer from the low-end hotels to the consumers of low end hotels. Therefore, even though the value added by the low end hotel is reduced, the consumer gains it in the form of surplus.

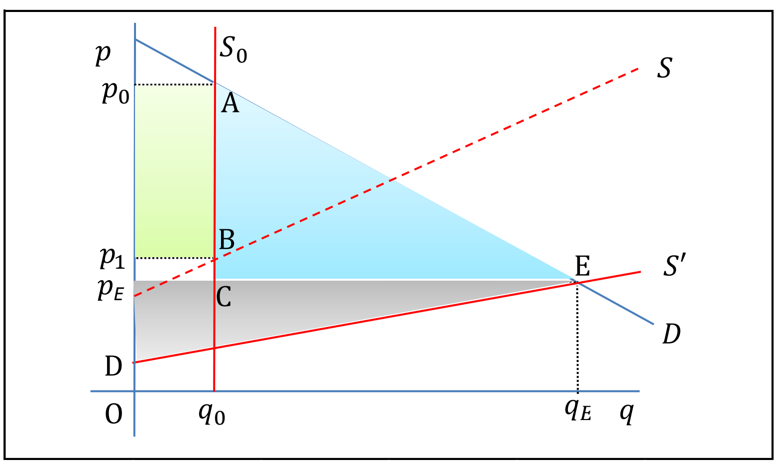


Figure 14: Uber Shock to the Taxi Industry and the Inferred Welfare

Similarly, for the simple scheme for the case of taxi and Uber, Figure 14 shows the demand and supply curves for automobile transportation service. Taxi industry was under the regulated quantity q_0, and the rent was received (rectangle p_0p_1BA). Introduction of Uber shifts the supply curve downward with low marginal costs, and potentially with higher elasticity (from *S* to *S'*).

The impacts of the Uber shock on the taxi industry are divided into two areas.

1. The impacts on consumer surplus:
    a. The rent of the taxi industry is transferred from producers to consumers. This impact is partly captured by the declined capitalization of MFIN and reduced Medallion price.
    b. Additional consumer surplus, shown by a large triangle ACE below the demand curve *D*, is potentially large, if the impact on quantity q_E is large.

2. Impacts on income (GDP)
    a. The rent was counted as a part of GDP as factor incomes of drivers or taxi companies. Thus, the reduction of rent may lead to an underestimate of GDP, if the price index of the transportation service is not properly adjusted in the official statistics. If the decline in transportation service price is properly measured, it will increase real GDP and compensate for the effect of rent reduction (similar point raised by Ahmad and Schreyer, 2016).
    b. Sharing platform, provided by firms such as Uber or Lyft, generates corporate income that is equal to the narrow triangle beneath the new price p_E and above the new supply curve *S'*. The stock price analyses of Park24, Avis (through the purchase of Zipcar), and Hertz (after its alliance with Uber and Lyft) indicate that

the discounted sum of this future cash flow is expected to be large by market participants. This might suggest that the future impact of this new transportation service innovation on *q* can be large. If so, it suggests that the consumer surplus (1b) can be large. However, it is possible that the large future cash flow can also result from finer price discrimination and monopoly power.[20] In that case, the large capitalization implies large rent above the supply curve and thus relatively small consumer surplus.

c. Suppliers through sharing platform generate income that is equal to the area $ODEq_E$ beneath the new supply curve. In principle, the drivers' incomes are taxable and should appear in the tax records. However, there may be underreported income for those "occasional self-employed workers."

[20] Kaplan (2015) suggests such possibility in the context of the use of artificial intelligence.

4.3 Organizational Capital

Firms with a higher degree of organizational capital are more productive and have a higher average market return rate (Eisfeldt and Papanikolaou, 2013). In this section, we examine the impacts of new sharing technology on firms' organizational capital. We conduct the analysis on the intangible capital of several firms in U.S. hospitality industry, U.S. transportation industry, and Japanese transportation industry. Figures 15 to 20 show the annual organizational capital stock, the growth rates of investment in organizational capital and the growth rates of organizational capital of key firms with data available in this study. Note that: in the transportation and hospitality industries, among all case studies, these firms do not report R&D investments in their financial statements. Therefore, it is reasonable to conclude that the only type of intangible capital in those companies is organizational capital.

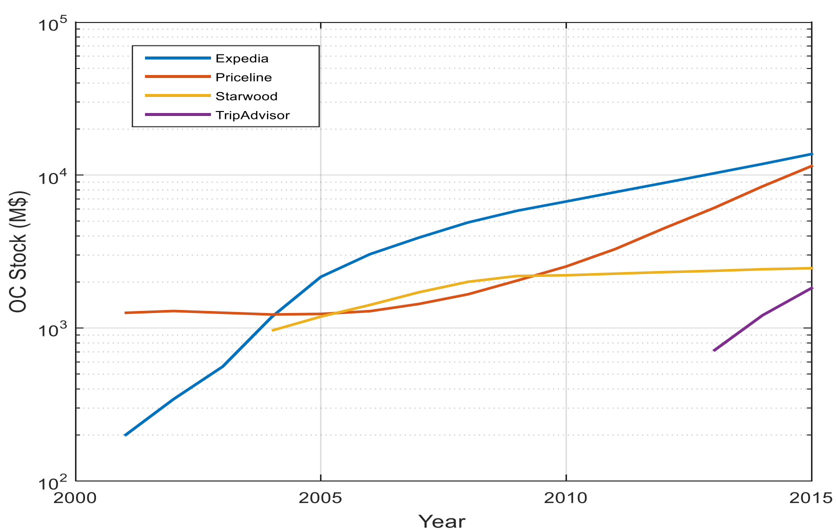
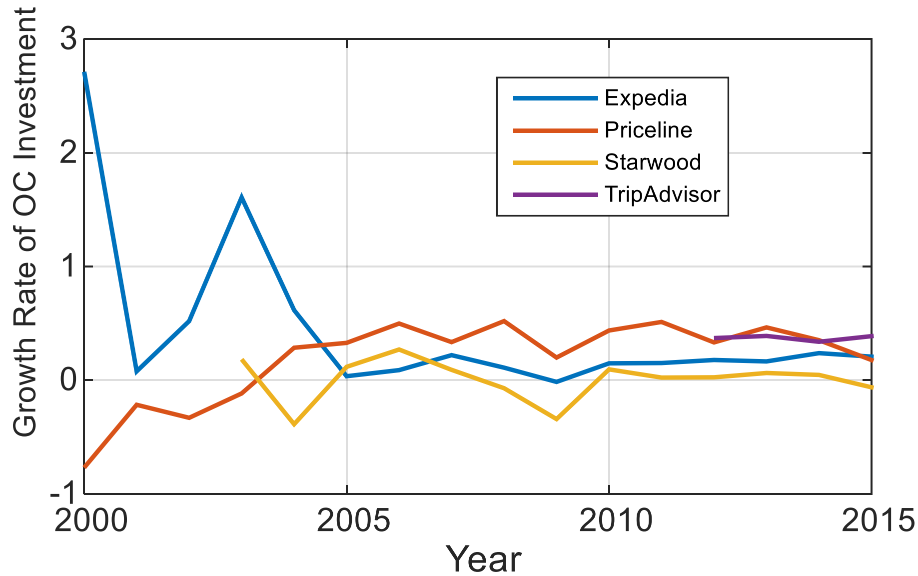


Figure 15: Annual Organizational Capital Stock for Selected U.S. Hospitality Firms



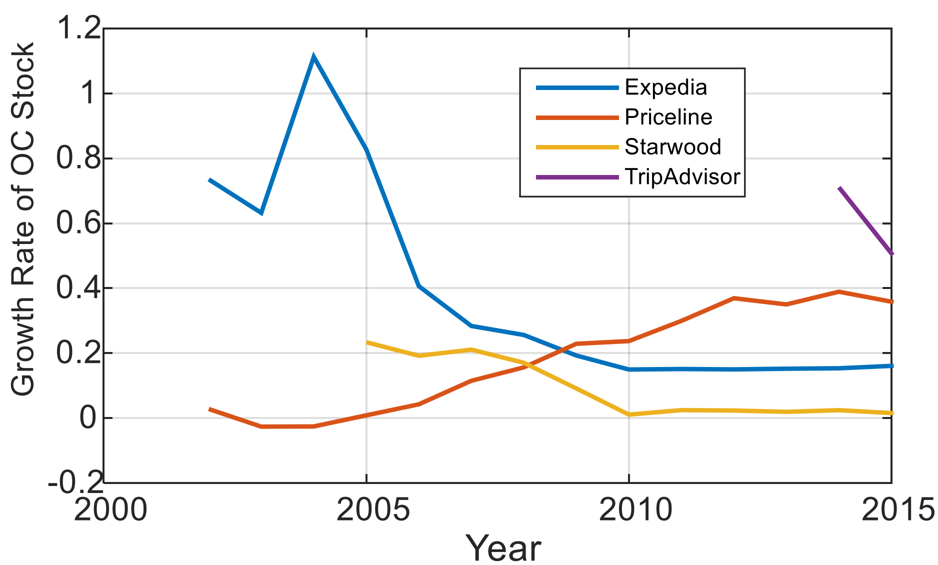


Figure 16: Growth Rates of Organizational Capital Investment and Stock for Selected U.S. Hospitality Firms

In the U.S. hospitality industry, we see that after 2004, Expedia Inc., a spun-off company from Microsoft in 1999, has a larger stock of organizational capital than Starwood does. The new business model of providing a platform which reduces the transaction costs for travelers to purchase hotel rooms from different hotel chains. Moreover, the Priceline Group provides an additional discount service, which allows travelers to bid hotel room at a higher discount price, and we see that the organizational capital of Priceline overtook Starwood during the period of financial crisis and has been catching up with Expedia fast. In contrast, Starwood had negative growth rate of investments in organizational capital during the period of financial crisis and around zero growth rate of investments in organizational capital in recent years, and later got purchased by Marriot International Corporation in 2016.

In the U.S. car rental industry, Avis has a smaller stock of organizational capital than its larger competitor, Hertz, does except during the period of 1998 to the period of financial crisis. Hertz, the best recognized brand in the industry, has a more stabilized growth rate of organizational capital. But, as we can see from Figure 18, after 2010, in terms of the growth rate of organizational capital stock, Avis has caught up with Hertz fast and note that it also acquired Zipcar in 2013.

As to the Japanese transportation industry, in general, Park 24, a sharing economy company, has a higher stock of organizational capital than DaiwaMT does during the sample period. In addition, in terms of the growth rates of investments in organizational capital and stock of organizational capital, Park 24 also has higher rates than DaiwaMT does.

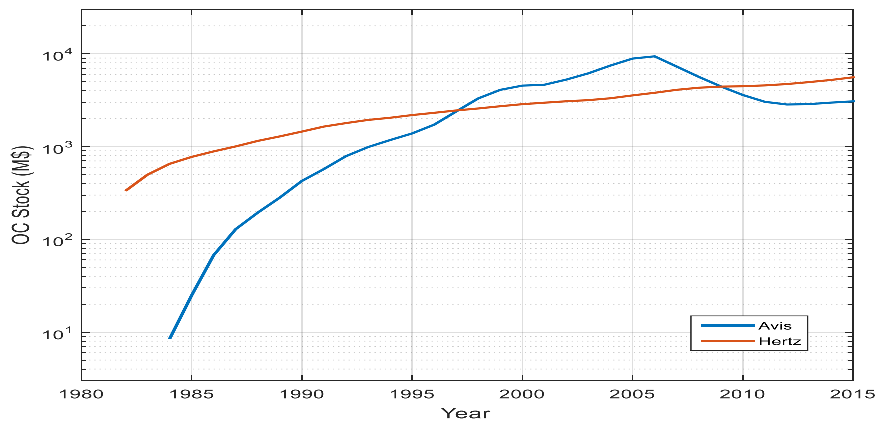


Figure 17: Annual Organizational Capital Stock for Selected U.S. Rental Car Firms

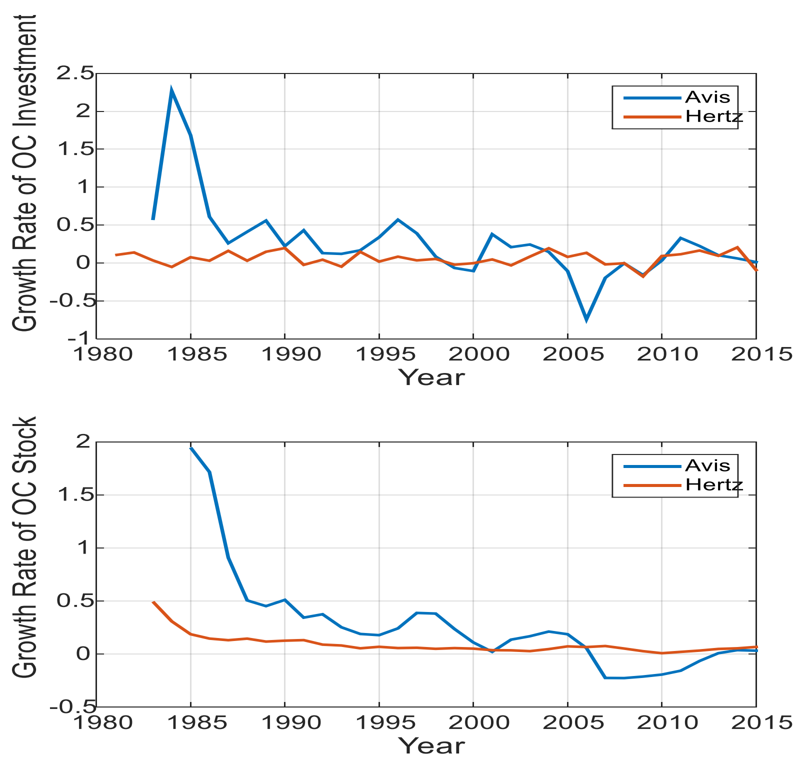


Figure 18: Growth Rates of Organizational Capital Investment and Stocks for Selected U.S. Rental Car Firms

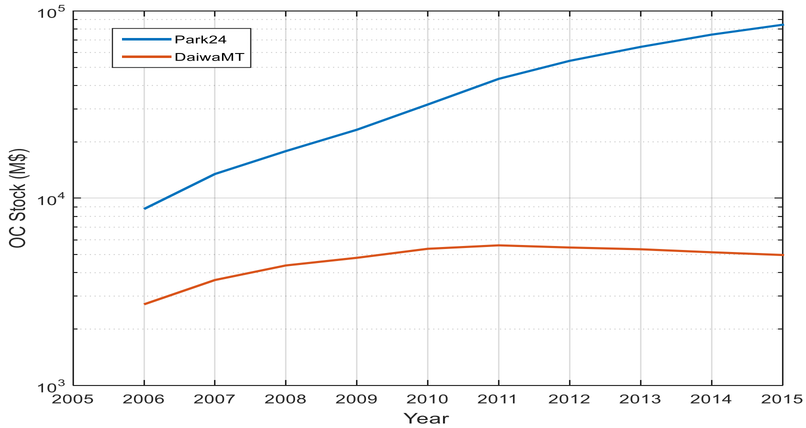


Figure 19: Annual Organizational Capital Stock for Selected Japanese Transportation Firms

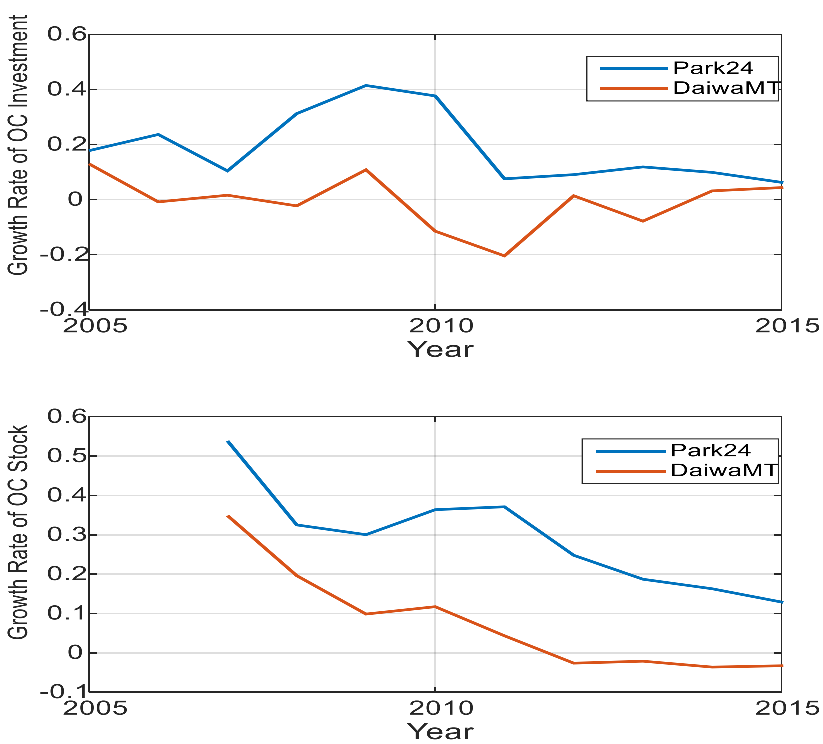


Figure 20: Growth Rates of Organizational Capital Investment and Stock for Selected Japanese Transportation Firms

After taking out the firms with a very short length of data in the U.S. hospitality industry, we find that in general, in both Japan's transportation industry and U.S.'s hospitality industries, the existing asset-heavy and less-digitized incumbents have higher depreciation rates of organizational capital. It implies that their existing business model and brand equity, etc. are losing value faster, a result that is consistent with people's expectations and our analysis on the impacts of the sharing technology shock on incumbents' stock prices. That is, in the new era of digital economy, their existing business model and marketing strategies, etc. may be outdated and need to be revised. In contrast, companies, such as Expedia and Priceline, are accumulating a larger stock of organizational capital by investing in tangible and intangible capital like Uber, an asset light model[21] to build strong brand recognition and accumulate deep knowledge of demand patterns and consumer behavior. That is, compared with existing incumbents, those firms are highly organizational capital intensive.

In Japan's transportation industry, there is a sign that the Daiwa Motor Transportation has increased its investment in organizational capital after 2011; however, due to the higher depreciation rate of organizational capital, its growth rate of the stock of organizational capital is smaller. In contrast, in the U.S. hospitality industry, Starwood did not increase the investment in organizational capital in recent years and later was sold to Marriot in 2015.

In the U.S. rental car industry, we study Hertz and Avis. Hertz entered the sharing car services in 2008 to compete with Zipcar but the sharing business did not run successfully in the U.S. and closed operations in certain cities. However, Zipcar later was purchased by Avis in 2013

[21] Here, the asset light model refers to the low investments in physical assets.

and continue operating nowadays and we see Avis has higher growth rate of the stock of organizational capital after 2010 and catches up with Hertz fast since then.

Last not but least, in this study, we find that firms with light-asset model and adopting the sharing economy model also have a higher degree of organizational capital intensity and the sharing technology shock has a positive impact on their stock prices. These findings are consistent with the key results from other studies related to organizational capital. A growing body of studies have find the importance of organizational capital in the production process (Prescott and Visscher, 1980; Hall, 2000; Atkeson and Kehoe, 2005; Carlin, Chowdhry, and Garmaise, 2011; Lustig, Syverson, and Van Nieuwerburgh, 2011) and have empirically confirmed the positive relationship between organizational capital and the TFPs of U.S. industries (Corrado et al., 2009; Li, 2016). Moreover, Eisfeldt and Papanikolaou (2013) find that firms with a higher degree of organizational capital intensity also are more productive and have higher managerial quality scores measured based on the measure of Bloom and Van Reenen (2007), more information technology (IT) intensive, and have average returns that are 4.6% higher than firms with less organizational capital. Note that Bryjolfsson and Hitt (2002) find the complementary relationship between organizational capital and IT investment.

5. Conclusion

The wide application of digital technology has inspired the rise of various new business models across industries and caused the creative destruction of existing business models in the affected industries, which cover not only service industries but also manufacturing industries. Moreover, people have been concerned about how the sharing economy will shape the future industry structures, job creation and destruction, and how it affects consumer welfare.

In this research, we focus on the study of sharing economy in the transportation and hospitality industries in both Japan and the U.S. We find that in general, the sharing technology shock has caused a negative impact on existing incumbents' stock prices but a positive impact on firms incorporating and/or adopting the new technology. In addition, studies have find that firms with a higher degree of organizational capital intensity also are more productive, IT intensity, and have a higher average return. And, in this study, we find that compared with existing incumbents, firms incorporating and/or adopting the new sharing technology also are more organizational capital intensive and have accumulated a larger stock of organizational capital. More importantly, we find a new way to indirectly measure the welfare impacts of the sharing economy, which can be huge potentially. For example, the analysis also points out that given the rapid growth of the adoption of sharing technology in the transportation industry, lacking correct adjustment in the price index of the transportation service could cause the underestimation of GDP and hence, the productivity growth.

Due to the data limitation, we are unable to study the impacts of sharing technology on all the firms in the U.S. and Japan's hospitality and transportation industries and other industries. We plan to explore more data to study the full impact of the new sharing technology.

Last but not least, because the sharing economy has grown rapidly across industries and around the world, future research should also work on the correct measurement of related price indexes to avoid the underestimation of GDP and resulting GDP and productivity growth.

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