

Consumer Welfare from a Ridesharing Service in Korea

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Abstract

Ridesharing services such as Uber and Didi Chuxing has rapidly grown over the last decade, but it is strictly prohibited in Korea. The problem is that consumers' preference for a ridesharing service is ignored in the process of making the policy, only considering taxi drivers' loss by introducing competition in the private transport market. This study examines consumer surplus by introducing a ridesharing service in Korea. Specifically, I use conjoint analysis with various hypothetical attributes of a ridesharing service to investigate the effect of each attribute enabled by using an ICT platform. I found that a ridesharing service would give additional benefits to traditional taxi services worth of 2,080 won for average users, and up to 2,784 won for consumers who have the intention to use a ridesharing service in the future.

Keywords: Ridesharing, Mobility Service, O2O, Consumer Welfare, Conjoint Analysis

1. Introduction

Over the last decade, the rapid growth of the sharing economy is driven by the prevalence of the smartphone and the emergence of an ICT platform that facilitates exchange. Ridesharing services are at the center of the sharing economy. Uber, Lyft, and Didi Chuxing are working all around the world. Grab and Go Jek are changing the environment of transportation in Southeast Asia. They have always been highly ranked in the list of global unicorn startups, and Uber and Lyft successfully listed in the stock market in 2019 with a valuation of USD 82.4 billion and 24 billion respectively.

South Korea is an exception from this ridesharing boom, along with Japan, Germany, Italy, and Spain. Since Uber start its business in South Korea in 2013, many ridesharing platforms had launched their services in various forms, but they all failed to settle in the market. Tada, a South Korean domestic ridesharing service, pushed forward with the large size vans combining with dedicated service and designated drivers despite the vehement opposition of taxi drivers. Despite their effort, Tada ended up abandoning its business after the revision of the Passenger Transport Service Act (of South Korean) in March 2020, which prohibits any type of paid ridesharing service except for sightseeing with vans in favor of taxi drivers. At the moment of termination, Tada had 1.7 million registered users and 90% of them were experienced users, even though

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the average fare of Tada is higher than the taxi fare. The major issue in the lawmaking process is that consumers' preference for a ridesharing service is ignored while the lawmakers only considering taxi drivers' loss by introducing competition in the private transport market.

Why do Kakao and other mobility start-ups try to run a ridesharing business even if it is illegal in South Korea? And what makes consumers use ridesharing services despite higher fares? One reason for Uber's success in the US and other developed countries is the high fares of a domestic taxi. Lee (2017) compared taxi fares for 6 kilometers in 5 metropolitan cities: 5,800 KRW (South Korean Won) in Seoul, 23,942 KRW in London, 13,721 KRW in Paris, 13,542 KRW in New York, and 20,617 KRW in Tokyo. In Southeast Asia, concerns about fraud taxi, which involves detour and rip-offs, and the safety of taxi users make Grab and Go Jek successful. The language barrier might be another reason for the popularity of ridesharing services for foreigners and tourists. However, it may not be the case in South Korea. Large subsidies are given to taxicab companies and individual taxi drivers in South Korea in exchange for low taxi rates. So it is hard for a ridesharing company to set a price lower than the public taxi fare unless it is considered as another type of taxi service which makes them eligible for the subsidy. Answering the source of consumer surplus from ridesharing services will give valuable insight into the innovative mobility policy, as well as for the improvement of the traditional taxi industry.

There are only a few studies on consumer welfare from the mobility platform service in South Korea. Kim (2017) investigates the effects of an ICT based taxi calling service on consumer welfare, and Seok et al. (2016) estimate the consumer welfare from O2O based designated driver service. None of them consider the impact of a brand-new ridesharing service. This study examines consumer preference for a ridesharing service based on the ICT platform. Specifically, I use conjoint analysis with various hypothetical attributes of a ridesharing service to quantify the effect of each attribute enabled by using the ICT platform. The result provides policymakers some implications on the mobility platform industry as well as the taxi industry.

2. A brief overview of the ridesharing industry

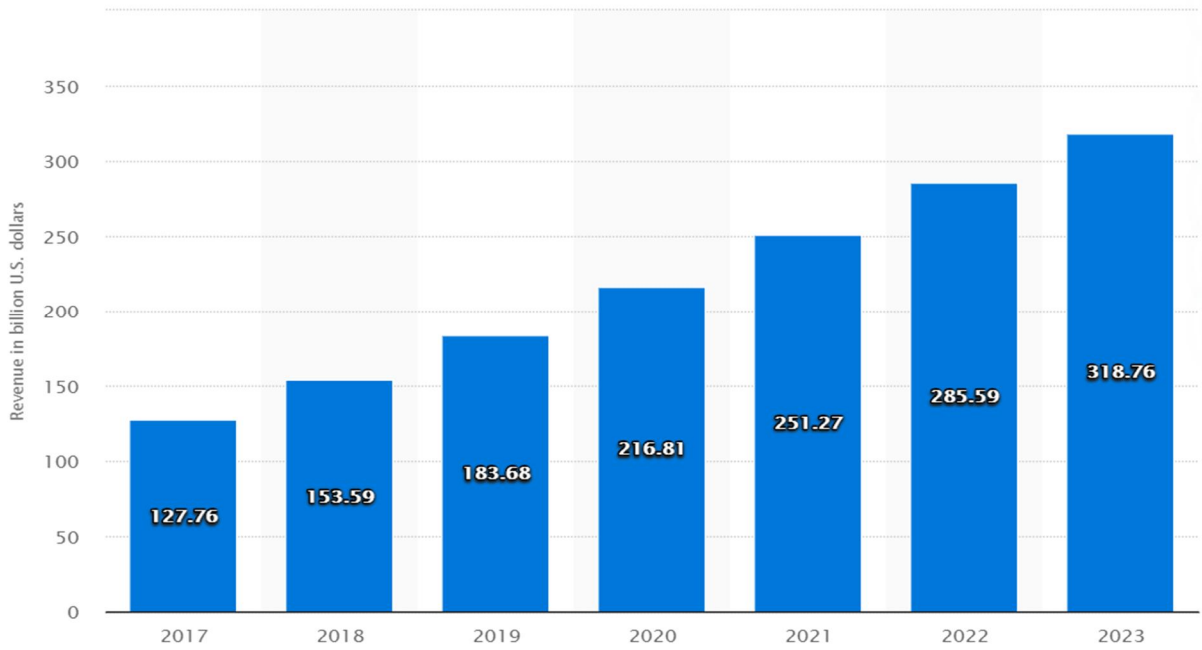
2.1 Global ridesharing market

Since Uber launched its UberX service in San Francisco in 2009, the ridesharing market has grown rapidly. The global ridesharing market was worth USD 127.76 billion in 2017 and is expected to reach 318.77 billion by 2023, exhibiting a CAGR of 16.5% (Figure 1). The number of users will double in 3 years, from 736.7 million in 2017 to 1,532 million in 2020 (Statista, 2019.7).

There are six major ridesharing platforms: Uber, Lyft, Didi Chuxing, Grab, Ola Cabs, and Go Jek. Uber is the leader of the ridesharing industry. Originated from the US, Uber expanded its business all over the world. Didi Chuxing is another giant player. Didi initiated its business in China but expanded it into East Asia, South America, and Oceania. The other platforms provide their service locally. Lyft operates only in the US and Canada. Grab and Go JEK focus on the Southeast Asia market, and Ola Cabs runs the service in India.

As the competition became intense, they customized their services, adapting to the regional situation, and the winner of the area acquired other services. Didi acquired Uber China in 2016, and Grab merged Uber's Southeast Asia business in 2018. On the other hand, Uber acquired Careem, the Middle East ridesharing company in 2019. Now, Uber offers the service in over 65 countries and 600 cities in the Americas and Europe.

Figure 1. Total revenue of the worldwide ridesharing market



Source: Statista (2019.7)

Table 1. Global ridesharing platforms

| | Uber | Didi | Lyft | Grab | Ola Cabs | Go JEK |
|----------------------------------|---|--|------------------------------|---|----------------|---|
| Founded | 2009 | 2012 | 2012 | 2012 | 2010 | 2010 |
| Headquarter | US | China | US | Singapore | India | Indonesia |
| Service area | Global | Asia, Latin America | North America | Southeast Asia | India, Oceania | Southeast Asia |
| # of users (in million) | 75 | 550 | 31 | 36 | 125 | 20 |
| # of drivers (in million) | 3 | 21 | 1.9 | 7.1 | 1 | 0.4 |
| Daily Average Usage (in million) | 15 | 30 | 1 | 4 | 2 | - |
| Other Services | UberEats, Uber Freight, Uber Bike, Uber Rent, Uber Air, Uber Works, Powerloop | Didi Express, Didi High, Didi Bus, Didi Bike | Lyft Line, Lyft SUV, Scooter | Grab Car, Grab Share, Grab Coach, Grab Rentals, Cycle, Food | - | Go-Send, Go-Pay, Go-Food, Go-Mart, Go-Clean, Go-Massage, Go-Med |

| | | | | | | |
|--|--|-------------------------------|--|----------|--|--|
| | | Didi Designated Driving | | Grab Pay | | |
|--|--|-------------------------------|--|----------|--|--|

Source: Samsung Securities (2019.3)

Also, ridesharing platforms are trying to expand their business into mobility-related services. Uber started a food delivery service (UberEats) in 2014, and a package shipping service (Uber Freight) in 2017. Also, it diversified types of vehicle, including bike and electric scooter, to provide the first and the last mile transportation. Go Jek added errand services on the existing bike taxi. Its service area includes food delivery (Go-Food), grocery delivery (Go-Mart), house cleaning (Go-Clean), and on-site massage (Go-Massage). Grab even branched out into fintech services such as online payment, loans-and-lending service, and insurance, reflecting the situation of Southeast Asia that many people do not have a bank account or a credit card.

Though it looks there are conflicts between the taxi industry and ridesharing platforms are all settled in some countries, there are still some on-going issues even in San Francisco where Uber and Lyft were born. The taxi licenses in San Francisco were originally managed by the local municipal. After 2010, the municipal changed taxi license policy, banning the trade of licenses between individuals. When a new taxi driver applies for a new taxi license, the municipal buys back a license from a current taxi driver for 200,000 dollars and sells it to the applicant for 250,000 dollars. Also, the municipal controls the total number of taxi licenses in the area by not issuing a new one. However, since it need not pay a license fee to be a ridesharing driver, persons who want to become a taxi or ridesharing driver chooses to work for a ridesharing company like Uber and Lyft. As a result, there has been no trade of taxi licenses for the last two years in San Francisco. Moreover, as the competition between taxis and ridesharing services intensified, the number of taxi riders shrunk, the revenue of taxis decreased. In turn, some taxi drivers even committed suicide because of the hardships of life. Taxi drivers claim that the municipal should buy back all the taxi licenses for 250,000 dollars and control the total number of ridesharing vehicles in San Francisco.

In Europe, the European Court of Justice classified Uber as a transportation service, not an information society service, which means that Uber is required to obtain the necessary licenses and authorizations under the domestic law of each member country as taxi services (Ester, 2018). After the decision, each member country in the EU revised its transport act and created new rules for ridesharing services to protect taxi drivers moderately and encourage innovative models in mobility services at the same time. For example, ridesharing drivers are restricted from street-hailing as taxi drivers do, and they should return to the garage after each ride to receive the next ride offer. Also, ridesharing vehicles cannot use the bus lane and designated waiting area at the airport or the train station. In Spain, a new regulation that one should reserve a ridesharing service at least 15 minutes before the ride was passed, which resulted in Uber's termination of service.

2.2 History of ridesharing service in Korea

A variety of ridesharing services had also appeared in South Korea, but all failed to settle down in the end. The first attempt was by Uber. The Uber X, Uber's controversial ridesharing service, entered the South Korean market in 2013, but the service was suspended in 2015 after the accusation of violating the Passenger

Transport Service Act (the Act, hereafter). The Act has been prohibited an individual without a taxi license to serve a paid personal transport service. A P2P-based ridesharing service is banned thereafter.

In 2016, Poolus and Luxi introduced another type of ridesharing service in 2016, taking advantage of the loophole in the Act that allows carpooling with compensation for commuting. Taxi drivers strongly against services and the South Korean Assembly revised the Act in favor of the taxi industry. The revision allowed carpools for commuting only 4 hours a day (7-9 am and 4-6 pm). Both services retreated from the market after the revision because of low profitability.

In 2018, Tada launched its ridesharing service, taking another loophole in the Act that a designated driver can be hired when a consumer rents a van with a seating capacity of over 11 passengers. Again, taxi drivers went on a strike against Tada, and some taxi driver committed suicide by setting fire to himself. In July 2019, the Ministry of Land, Infrastructure, and Transport announced the taxi industry development plan to accommodate innovative mobility services. Like the Transportation Network Company (TNC) in the US, a ridesharing service becomes legalized in terms of platform transport service. However, it requires for a ridesharing platform to pay 400,000 won per each vehicle monthly, or to buy a license for 7 million won, both of which Tada and other startups cannot afford. The National Assembly passed the revised bill on March 7, 2020, and Tada terminated its service.

Still, mobility startups in South Korea are preparing for new ridesharing services. Such services are ruled via the regulatory sandbox which provisionally allows the business before the revised act comes into effect in 1.5 years. Papa Kids presented by Papa Mobility offers a premium ridesharing service for kids and mothers. Car seats and safety guards for infants are installed on the vehicle. Coactus launched a ridesharing service driven by the hearing-impaired. It tackles taxi riders' complain about unnecessary talk with taxi drivers. Banban Taxi by Kornatus connects passengers whose routes overlap and split the bill, which is prohibited in Korea. Locar by Staryx offers a taxi reservation service that taxi fare is determined before the ride, not by the taximeter.

3. Empirical model and data

3.1 Conjoint analysis

Conjoint analysis or discrete choice experiment refers to a family of stated preference techniques used to measure individual preferences. In conjoint analysis, each participant is presented with a series of choice sets, consisting of two or more hypothetical alternatives. These alternatives are defined by their respective levels of attributes. Participants are asked to choose an alternative they prefer in each choice set (choice-based conjoint), to rank alternatives from best to worst (ranking-based conjoint), or to rate each alternative in the choice (rating-based conjoint). Compared to other alternative elicitation approaches such as a single binary choice question, conjoint analysis is preferred by researchers because of gains in statistical efficiency and the ability to estimate the value of attributes at the margin, providing a richer depiction of preferences and facilitating inferences to other situations even not in the choice set. (Holmes and Adamowicz, 2003) Hence, it is widely used to analyze consumer preference for ICT products and services and healthcare services which are not introduced in the market

Choice-based conjoint analysis is rooted in McFadden's (1974) random utility theory. An individual n faces a choice among J alternatives. He would obtain a certain level of utility from each alternative, which is denoted by $U_{nj}, j = 1, \dots, J$. He chooses the alternative that provides the highest utility, that is, chooses alternative i if and only if $U_{ni} > U_{nj}, \forall j \neq i$.

Consider now the researcher. The researcher does not have complete information on the individual's utility function, and only observes some characteristics of the alternatives, labeled $x_{nj}, \forall j$, and some demographic features of the individual, labeled z_n , and can specify a utility function that relates these observed features to the individual's utility. The function is denoted $V_{nj} = V(x_{nj}, z_n), \forall j$. Since the researcher cannot fully observe the individual's utility, $V_{nj} \neq U_{nj}$, the utility derived from the consumption or selection of a good j among J alternatives is a function of a utility function that the researcher estimates and an error term which captures the unobservable factors in the individual n 's utility function:

$$U_{nj} = V_{nj} + \varepsilon_{nj}.$$

The researcher does know ε_{nj} and therefore treats these terms as random. Let $f(\varepsilon_n)$ be the joint density of the random vector $\varepsilon_n = \langle \varepsilon_{n1}, \dots, \varepsilon_{nJ} \rangle$. Then the probability that an individual n chooses alternative j is

$$\begin{aligned} p_{ni} &= \Pr(U_{ni} > U_{nj}, \forall j \neq i) \\ &= \Pr(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj}, \forall j \neq i) \\ &= \Pr(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj}, \forall j \neq i). \end{aligned}$$

Using the density $f(\varepsilon_n)$, the probability can be written as

$$\begin{aligned} p_{ni} &= \Pr(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj}, \forall j \neq i) \\ &= \int_{\varepsilon} I(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj}, \forall j \neq i) f(\varepsilon_n) d\varepsilon_n, \end{aligned}$$

where $I(\cdot)$ is the indicator function. Note that the choice probability p_{ni} depends only on the difference in utility, not its absolute level.

Assuming a linear utility function, the utility from alternative j is:

$$U_{nj} = V_{nj} + \varepsilon_{nj} = \sum_k \beta_k x_{nj k} + \varepsilon_{nj},$$

where $x_{nj k}$ denotes k -th characteristic of the alternative j faced by the individual n . β_k are the parameters of the model to be estimated, which decides the effect of k -th characteristic of an alternative to the utility. If β_k is positive, then the probability of choosing the alternative j goes up as $x_{nj k}$ increases, and vice versa.

The magnitude of β_k represents the marginal effect of the change of a product characteristic on the utility. Moreover, as long as the price (or the cost) of an alternative j , say p_{nj} , is included as a product characteristic, we can calculate the marginal willingness to pay (MWTP) for each characteristic β_k . MWTP represents how much additional cost an individual is willing to pay for the (marginal) change of a characteristic. This trade-off can be portrayed as

$$\text{MWTP}_k = -\frac{\partial U_{nj} / \partial x_{nj k}}{\partial U_{nj} / \partial p_{nj}} = -\frac{\beta_k}{\beta_p},$$

where β_p is the coefficient of the price p_{nj} in the utility function.

The error term ε_{nj} is not defined for a choice situation per se. For simplicity, we assume that ε_{nj} has Type I extreme value distribution independently and identically. Hence, the empirical model is the conditional logit model; it is known that the choice probability in the conditional logit model has a closed-form expression:

$$\begin{aligned} p_{ni} &= \Pr(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj}, \forall j \neq i) \\ &= \int_{\varepsilon} I(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj}, \forall j \neq i) f(\varepsilon_n) d\varepsilon_n \end{aligned}$$

$$= \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} = \frac{e^{\sum_k \beta_k x_{nik}}}{\sum_j e^{\sum_k \beta_k x_{nj k}}}$$

In a conjoint analysis, each respondent answers for T sets of alternatives. Let $t = 1, \dots, T$ denote the observations for the t -th set. The conditional log-likelihood is

$$\log L = \sum_{n=1}^N \sum_{t=1}^T \sum_{j=1}^J y_{njt} \log p_{njt}$$

where y_{njt} is a dummy variable, which has the value of 1 if the individual n chooses the alternative j in a choice set t and the value of 0 otherwise. Then, we can estimate the parameters β using maximum likelihood estimation.

3.2 Survey design

In the survey, subjects were asked to respond in the context of choosing the most attractive ridesharing service with different product attributes. Based on observations of the complaints on taxi services and current market trends of ridesharing services such as Uber and Tada, four critical attributes were identified, which are quality control, the information provided, credibility, and customization, in addition to the price.

Quality control refers to whether the ridesharing platform monitors the quality of drivers and vehicles. For example, Uber offers a bilateral rating system. After each trip, riders and drivers have the opportunity to rate one another from 1 to 5 stars, based on their trip experiences, such as the kindness of the driver, the cleanness of the vehicle, and driver's driving habit and observation of traffic law. A rider can see a driver's rating after the driver has accepted a ride request, and he might cancel the matching if the driver's rating is below a certain point. Uber provides re-training for the drivers with a lower rating and dismisses drivers if ratings are not improved even after the training. Also, the vehicles used are regularly audited by the ridesharing platform so that cleanness as well as maintenance is checked.

Information provided refers to the information provided before the arrival of a ride. A ridesharing app provides expected time of waiting and arrival, and expected fare based on previous service data and traffic conditions when a rider sets a destination. After a driver is assigned, the matched driver's photo and rating, car type, and license plate number are also displayed. Taxi riders usually complain about rip-offs by taking a detour and overcharging, especially when it is the first time travel to the area. Providing expected time and fare calculated by the platform, not the driver, can solve this age-old problem of the taxi-like industry.

Credibility means the information collected while the riding service is in use. This information can be used to settle disputes between the rider and the driver from suspected detouring and verbal violence and to assure the safety of both the rider and the driver from a more heavy felony. Examples of the information for assuring credibility is the route of a trip, the image and sound in the vehicle during a trip.

Customization refers to whether riders can choose options for their trip. People may wish to call spacious vehicles because they are heavy or bring lots of luggage. Some riders like to hold a conversation with taxi drivers, while others want to keep silent during their trip. Female drivers prefer female drivers especially at night, concerning sexual assault or other crimes. Possible options are not only the age and gender of the driver and the vehicle type but the ambiance of the car such as the music played during a trip and the talkativeness of the driver.

Price refers to the amount of money that consumers are willing to pay for a ridesharing service. Taxi fare is composed of the base fare plus the distance fare, and the rate is usually determined by the local government or taxi authority in the region. However, a ridesharing service may have a different fare system from that of

the taxi, depending on the federal and local rules. In South Korea, surge pricing for a regular taxi is strictly prohibited, but ridesharing service may use surge pricing. I assumed that the distance rate for hypothetical ridesharing service is the same as that of taxis, and the ridesharing service may charge additional base fare only. It is because taxi fare in South Korea is very cheap so that ridesharing platforms cannot lower distance rates, and because previous services such as Kakao T and Tada charged additional base fare as a ‘calling fee.’ The minimum-maximum range is from actual services in South Korea. In the survey, the additional base fares were set at 1000, 2000, and 3000 KRW.

Table 2. Attributes and levels of ridesharing services

| Attributes | Level | Range |
|----------------------|-------|--|
| Quality Control | 1 | Ridesharing platforms do not monitor the quality of drivers and vehicles. |
| | 2 | Ridesharing platforms monitor the quality of drivers and vehicles and re-train, or dismiss drivers with lower ratings. |
| Information Provided | 1 | No information except the plate number of an assigned vehicle is provided. |
| | 2 | Information on expected waiting and travel time, expected fare, photos of assigned driver and vehicle are provided. |
| Credibility | 1 | No information is collected during a trip |
| | 2 | Route of a trip and the image and sound inside the vehicle during a trip is recorded. |
| Customization | 1 | A driver and a vehicle are randomly assigned. |
| | 2 | A rider can choose the gender of a driver and the vehicle type. |
| | 3 | A rider can choose the ambiance of the vehicle, as well as the gender and age of a driver and the vehicle type |
| Price | 1 | KRW 1,000 |
| | 2 | KRW 2,000 |
| | 3 | KRW 3,000 |

3.3 Data

The Ridesharing Conjoint Survey was collected during February and March 2019 through online surveys. Survey respondents were randomly selected, considering the ratio of gender and age in the population. Since a ridesharing app is operated on a smartphone, any respondents who do not use a smartphone were excluded from the sample. Respondents over the age of 60 were excluded.¹ Respondents under 20 were also excluded, because they may not use taxis or ridesharing platforms on their own income; hence, the age range of respondents was between 20 and 59. Respondents living in Seoul and Gyeonggi province were over-sampled since previous ridesharing services in South Korea, like Uber and Tada, operated in Seoul. So that I assumed that people living in these areas are expected to evaluate hypothetical situations better. The total number of respondents was 1,000, but 936 samples were used in the analysis after discarding 64 unreliable respondents.

¹ Respondents over the age of 60 were excluded for two reasons. First, the survey was conducted online, and familiarity with IT may affect the pool of respondents on this age group — the elderly who proficiently use internet and mobile devices are more likely to participate in the web-based survey. But the familiarity with IT may also affect the adoption of a ridesharing service. In this case, the marginal willingness to pay for the ridesharing service in this age group may be biased upward, violating the representativeness of the elderly. Second, most people who have used a ridesharing service were young; only 13% of those aged 65 and old used ridesharing services in the US (Reinhart, 2018), and Tada reported that 68% of their users were in their 20s and 30s. If those aged over 60 are not familiar with the service, they may not be able to fairly evaluate the combination of attributes, or hypothetical ridesharing service, in the conjoint survey.

Table 3 presents descriptive statistics for the 936 respondents with complete information on the relevant variables. 52% of correspondents are male, and the average age is 39.42 years old. 32% of correspondents live in Seoul, 34% in Gyeonggi, and the others in the other areas. 75% of correspondents graduated from college, and 16% were postgraduates. The average household income of the respondents is about 5.38 million KRW, which is higher than the average labor income of 4.83 million KRW in 1Q 2019 (Statistics Korea, 2019). It might be because I excluded the age over 60, and oversampled from Seoul and Gyeonggi. 82% of respondents have experience on using mobility O2O services, such as calling a taxi, reserving a designated driver, carsharing, and ridesharing service. But only 9% have ever used ridesharing services either in South Korea or abroad. Here, the experience of using mobility services on the phone was not counted. 55% of respondents report that they will use ridesharing service in the future.

Table 3. Respondent descriptive statistics (N=936)

| | Mean | SD | | Mean | SD |
|-----------------|-------|-------|---|---------|---------|
| Gender (1=Male) | 0.52 | 0.50 | Household income (in thousand won) | 5,378.2 | 2,341.0 |
| Age | 39.42 | 10.06 | Experience on using mobility O2O service | 0.82 | 0.38 |
| Region | | | Call taxi | 0.73 | 0.45 |
| Seoul | 0.32 | 0.47 | Designated driver | 0.31 | 0.46 |
| Gyeonggi | 0.34 | 0.47 | Car-sharing | 0.11 | 0.31 |
| Others | 0.34 | 0.47 | Ridesharing | 0.09 | 0.29 |
| Education Level | | | Intend to use ridesharing in the future | 0.55 | 0.50 |
| ≤ High school | 0.09 | 0.28 | | | |
| Postgraduate | 0.16 | 0.37 | | | |

Note: Intend to use a ridesharing service in the future on 5 points Likert scale

4. Empirical results

The conditional logit model was used to estimate the coefficients of the model using *clogit* function on Stata 15. Table 4 shows the estimation results of the conditional logit model. The coefficients of dummy variables imply the size of effect relative to the reference group. Here, taxi service is set as the reference group or “status-quo”: no quality control for a driver and a vehicle by a ridesharing company, no information provided on reserving a ride, no information collected during a ride, and vehicle and driver randomly assigned.

In Model 1, I exploit the full sample as a benchmark. All the coefficients in the model are significant. The coefficient of the price is negative and all other coefficients are positive, indicating that higher price lowers utility and the increase in levels for the four attributes results in respondents’ utility increasing, as expected. Since all the attributes of a ridesharing service are qualitative, the magnitude of the coefficients implies how much each attribute affects the utility. The result shows that quality control gives the highest utility gain, information provided before a ride, ambiance choice during a ride, and credibility during a ride, in turn. The choice of gender and vehicle type (Level 1 customization) does not give much utility gain.

In the survey, 45% of correspondents report that they will not use a ridesharing service in the future, and 18% of correspondents even choose “status-quo” or taxi services for all the conjoint questions. They may think some features of a ridesharing service are unnecessary or unpleasant. In the questions asking the reason for not using a ridesharing service, they report that they worried about privacy infringement and cybersecurity issues. Hence, I focus on the persons who have an intention to use a ridesharing service in the future in Model 2. The coefficient of the price in Model 2 is lower than that of Model 1, which means they are less sensitive to price change due to the additional features of a ridesharing service. All other coefficients for attributes of a ridesharing service are higher in model 2.

Table 4. Estimation results for ridesharing

| | Model 1: Full Sample | Model 2: Have the intention to use in the future | Model 3: Live in Seoul or Gyeonggi |
|------------------------|-------------------------|--|---------------------------------------|
| Price (KRW 1,000) | -0.687*** (0.027) | -0.587*** (0.036) | -0.660*** (0.033) |
| Quality control | 0.441*** (0.035) | 0.473*** (0.046) | 0.461*** (0.042) |
| Information provided | 0.403*** (0.031) | 0.470*** (0.040) | 0.468*** (0.038) |
| Credibility | 0.273*** (0.032) | 0.308*** (0.042) | 0.307*** (0.040) |
| Customization: Level 1 | 0.095** (0.037) | 0.164*** (0.049) | 0.094** (0.044) |
| Customization: Level 2 | 0.310*** (0.038) | 0.382*** (0.051) | 0.375*** (0.045) |
| Observations | 44,928 | 24,720 | 29,760 |
| Number of respondents | 936 | 515 | 620 |
| Log-likelihood | -13,957.12 | -7,836.73 | -9,299.38 |
| Wald statistics | 837.23 | 427.37 | 621.71 |
| | Model 4: Female | Model 5: Aged 20s and 30s | Model 6: Aged 40s and 50s |
| Price (KRW 1,000) | -0.734*** (0.038) | -0.764*** (0.039) | -0.611*** (0.038) |
| Quality control | 0.427*** (0.054) | 0.470*** (0.050) | 0.418*** (0.050) |

| | | | |
|------------------------|---------------------|---------------------|---------------------|
| Information provided | 0.397*** (0.044) | 0.381*** (0.043) | 0.428*** (0.045) |
| Credibility | 0.263*** (0.048) | 0.269*** (0.046) | 0.280*** (0.045) |
| Customization: Level 1 | 0.084 (0.057) | 0.128** (0.055) | 0.068 (0.051) |
| Customization: Level 2 | 0.321*** (0.056) | 0.285*** (0.054) | 0.338*** (0.054) |
| Observations | 21,648 | 23,328 | 21,600 |
| Number of respondents | 451 | 486 | 450 |
| Log-likelihood | -6,632.46 | -7,089.06 | -6834.49 |
| Wald statistics | 525.48 | 488.37 | 371.41 |

Notes: Cluster-robust standard errors in the parenthesis. * p<0.1; ** p<0.05; *** p<0.01

In Model 3, samples from respondents living in Seoul and Gyeonggi are used, since ridesharing services like Uber and Tada operated in these areas so that people are likely to be more familiar with a ridesharing service. Although the difference of the coefficients between Model 1 and Model 3 is not statistically significantly different, the coefficients of information provided and level 2 customization (choosing the ambiance of the vehicle) are higher than the benchmark case. This implies that people living in Seoul and Gyeonggi consider these attributes more valuable.

In Model 4, data only from female respondents are analyzed, because female taxi riders are more critical of taxi services so that they may prefer a new ridesharing service. However, the estimation result says that except for the sensitivity to the change of the price, women have a similar preference for each attribute.

In Model 5 and 6, samples from the younger generation (aged below 40) and from the older generation (aged over 40) are estimated, respectively. We can see that they have different preferences for each attribute. The younger generation is far more sensitive to the price change than the older generation. The young think quality control important, but the information provided on the ridesharing app not much important as the older generation did. There is no difference between the two groups on credibility.

To compare additional benefits provided by a ridesharing service in terms of money, I calculate marginal willingness to pay (MWTP) for each attribute. Since all the characteristic variables are qualitative, MWTP can be interpreted as the additional pecuniary value of each attribute compared to the taxi service. Also, since I assumed linear utility and no interaction between features in the empirical model, the change of total benefit can be computed by adding MWTPs of all attributes. Table 5 shows MWTP for each attribute.

Overall, the value of a typical ridesharing service with a moderate customization amount to 1,766 KRW, and a service with full customization 2,079 KRW on average (Model 1). Quality control gives the highest additional benefit, worth of 642 KRW. This result is related to the satisfaction survey on traditional taxi service; people often complain about the attitude of taxi drivers. Since a ridesharing platform company controls the quality of service provided by their drivers with the rating system, drivers are more likely to be polite to customers and keep their vehicles clean. Information provided before the ride is worth of 587.4

KRW. Credibility from collecting the route of the trip and the video and the audio during the trip gives a benefit of 398 KRW. Moderate customization gives riders the additional benefit of 138.4 KRW and full customization gives that of 451.7 KRW.

For those who have an intention to use a ridesharing service in the future (Model 2), the additional benefits of a ridesharing service are 2,413 KRW and 2,784 KRW respectively, nearly 700 KRW more than the benchmark case of Model 1. Quality control still gives the most benefit of 806.1 KRW, and the information provided gives that of 801.5 KRW. Notably, the MWTPs of quality control and information provided are almost the same, which means that information becomes more important for this group. Credibility gives additional welfare of 525.1 KRW. Moderate customization that one can choose the gender of the driver and the vehicle type provides consumer welfare worth of 280.2 KRW, more than doubled than the benchmark case. In an auxiliary analysis that is not reported here, I found that female respondents have the intention to use the service in the future, which values the moderate customization even higher, with an MWTP of 338.9 KRW. It can be interpreted that the possibility to choose the gender of the driver is critical for female riders because of concern about sexual harassment, especially at night. Full customization for female users does not show the same result.

Respondents living in Seoul and Gyeonggi value a ridesharing service as much as 2,015 KRW and 2,441 KRW (Model 3), depending on the level of customization. The amount of additional benefit is closer to the price charged by Kakao and Tada. The taxi fare from Gangnam subway station to Sinsa subway station, a two kilometers distance trip, charges the base fare of 3,800 KRW. Kakao charges 1,000 KRW for a taxi calling service and 3,000 KRW for Kakao T as a calling fee, and Tada charges around 6,700 KRW for this route on average. Since these services provide additional features such as mandatory matching and spacious vehicles for a service, which are not considered in the conjoint analysis, the actual price may be higher than the total MWTPs in the analysis. Overall, MWTPs are similar to the benchmark case, but people living in Seoul and Gyeonggi give more value to the information provided before the ride and full customization.

Female ridesharing users value the service as much as 1,594 won and 1,917 won. The relative importance of each attribute is similar to that of the benchmark model, but they are more sensitive to the price change, so MWTPs are lower than in Model 1.

The younger generation and the older generation have different tastes on each attribute of a ridesharing service, as seen in Table 3. Due to the purchasing power, MWTPs of the older generation overwhelm those of the younger generation, except for moderate customization. They both consider quality control as the most valuable feature of a ridesharing service. The information provided is as important as the quality control for those aged the 40s and 50s, but it does not have much value for the younger generation, showing the difference of more than 200 KRW. The differences of MWTPs between moderate and full customization are much more for the older generation, MWTP of which for full customization is about five times more of MWTPs for moderate customization. Overall, the total benefits of a ridesharing service for those aged 20s and 30s are 1,633 KRW and 1,839 KRW, and 1,954 KRW and 2,397 KRW for those aged 40s and 50s.

Table 5. MWTPs of the attributes (in KRW)

| | Model 1: Full Sample | Model 2: Have the intention to use in the future | Model 3: Live in Seoul or Gyeonggi |
|-----------------|-------------------------|--|--|
| Quality control | 642.0*** (51.7) | 806.1*** (80.5) | 698.5*** (64.6) |

| | | | |
|--|--------------------|----------------------------------|----------------------------------|
| Information provided | 587.4*** (46.7) | 801.5*** (74.9) | 709.0*** (61.9) |
| Credibility | 398.1*** (47.5) | 525.1*** (73.3) | 465.4*** (61.0) |
| Customization: Level 1 | 138.4*** (53.4) | 280.2*** (81.3) | 141.7** (66.1) |
| Customization: Level 2 | 451.7*** (55.2) | 651.4*** (86.9) | 568.5*** (70.2) |
| Total benefit with level 1 customization | 1,765.9 | 2,412.9 | 2,014.6 |
| Total Benefit with level 2 Customization | 2,079.2 | 2,784.1 | 2,441.4 |
| | Model 4: Female | Model 5: Aged the 20s and 30s | Model 6: Aged the 40s and 50s |
| Quality control | 581.3*** (73.4) | 614.9*** (66.8) | 683.6*** (81.2) |
| Information provided | 540.9*** (63.4) | 498.6*** (57.4) | 700.8*** (77.4) |
| Credibility | 357.8*** (67.0) | 351.7*** (60.6) | 458.8*** (75.6) |
| Customization: Level 1 | 114.0 (77.3) | 167.4** (70.3) | 111.1 (82.2) |
| Customization: Level 2 | 437.1*** (76.1) | 373.3*** (69.4) | 554.0*** (89.7) |
| Total benefit with level 1 customization | 1,594.0 | 1,632.6 | 1,954.3 |
| Total Benefit with level 2 Customization | 1,917.1 | 1,838.5 | 2,397.2 |

Notes: Standard errors in the parenthesis are computed using delta method². * p<0.1; ** p<0.05; *** p<0.01

5. Conclusion

This study tries to quantify consumer surplus from using a ridesharing service like Uber and Tada in South Korea. Conjoint analysis was used to estimate the MWTP for the attributes of quality control, the information provided before a ride, credibility guaranteed by a ridesharing service, and customization. A ridesharing service is found to give additional benefits to traditional taxi services. It is worth of 2,080 KRW for average users, and up to 2,784 KRW for consumers who have the intention to use a ridesharing service in the future.

The result provided here gives an important policy insight into the taxi and ridesharing industry. The taxi service has been served as semi-public transportation so that it was highly regulated in South Korea. The government kept taxi fare as low as possible and controlled the total amount of taxi licenses. This policy helped people to take taxis without much burden, but the quality of taxi services deteriorated with the policy. The taxi industry became supplier-oriented, and there were no other options for consumers. For example, taxi drivers can refuse service for a short distance at night though it is illegal, consumers cannot choose

² Standard errors are calculated from Taylor series approximation to the variance of the ratio of two random variables $\text{var}(b_1/b_2) = 1/b_2^2 [\text{var}(b_1) - 2(b_1/b_2)\text{cov}(b_1, b_2) + (b_1/b_2)^2\text{var}(b_2)]$.

drivers and vehicles, and they have to stand with unsatisfactory talk with the driver or music during their ride. A ridesharing service operated on an ICT platform can overcome this discrepancy and can return consumers' rights to consumers. Consumers choose drivers and vehicles and rate the service after use. Detailed information for their reservation is provided, and they cancel the reservation if they want. Any dissatisfaction with ridesharing services can be tackled; at least, there is somewhere to file a claim on the service. And consumers are willing to pay for these features, as the result of this study shows.

Nevertheless, this study has some limitations. First, the five attributes considered here are only parts of ridesharing services. Ridesharing services are evolving even now, and players develop many other business models using consumer mobility data collected. For example, they bundle electric scooter or bike with a ridesharing service to provide the first and the last mile transportation. Also, carpooling is another important model of ridesharing to get a discount, but it is not considered here. Second, the motivation to use ridesharing platforms may be different across the region, but it is not well explained due to the relatively small sample size. Since taxi is seldom street-hailing in a rural area and the waiting time is longer than in an urban area, people living in the urban area might consider a matching P2P ridesharing service, like UberX, more valuable. The demographic variables need to be considered to provide rich policy implications. Third, concern about privacy infringement, which may produce a negative effect, is not well recognized.

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