모바일 어플리케이션이 오프라인 시장에 미치는 영향: 콜택시와 카카오택시를 중심으로

The Impact of the Mobile Application on Off-Line Market: Case in Call Taxi and Kakao Taxi

이 경 진 (Kyeongjin Lee)   경희대학교 경영학과
박 재 홍 (Jaehong Park)   경희대학교 경영학과, 교신저자

──────── 요   약 ────────

　　모바일 앱 시장은 스마트폰의 등장으로 폭발적으로 성장하였다. 최근 모바일 앱은 단순한 스마트폰 구성요소가 아니라 다양한 마케팅 채널로 활용되고 있으며 스타트업이 성장할 수 있는 발판이 되었다. 본 연구에서는 모바일 앱이 시장에 미치는 영향에 대해서 연구하고자 하였다. 안내원과의 전화를 통해서 소비자에게 서비스를 제공하던 전통적인 콜택시 산업이 카카오택시라는 새로운 모바일 앱 채널의 진입을 통해서 어떠한 영향을 받고 있는지 살펴보고자 한다. 최근 자가용과 대중교통의 발전으로 택시 수요는 감소한 반면, 개인택시 증가 등으로 택시 공급은 증가하고 있다. 택시산업은 크게 일반택시와 콜택시로 나누어진다. 일반택시는 택시기사가 직접 고객을 찾아다니기 때문에 우연적이고 비효율적인 행태를 보인다. 하지만 콜택시는 고객이 사용의도를 가지고 택시를 찾는다는 점에서 더 효율적인 업무가 가능하다. 이러한 장점에도 불구하고 콜택시 시장은 불완전한 고객-택시기사 매칭 시스템과 택시기사 관리 부족으로 크게 성장하지 못하였다. DID(differences in differences)는 하나의 시간 흐름에서 발생한 특정한 사건이 유의한 영향력을 행사하는가를 밝히는 계량경제학의 연구 방법이다. 본 연구에서는 DID를 사용하여 최근 큰 이슈와 함께 출시 된 다음의 카카오택시 어플리케이션이 기존의 콜택시 사업에 미치는 영향력을 밝히고자 하였다. 거기서 더 나아가 비윤리적인 행태로 여겨지는 대기업의 문어발식 산업 확장이 해당 시장에 어떠한 영향을 미치는지 알아보고자 하였다. 이를 위해 카카오택시 전후 콜택시 산업의 크기 비교를 통해서 콜택시 시장 변화를 확인하였다. 본 연구를 위해 2014년 8월부터 2015년 7월까지 1년치의 콜택시 수요 데이터를 수집하였으며 control group으로 사용한 대리운전 수요 데이터도 같은 기간 동안 수집하였다.

키워드 : 카카오택시, 모바일 앱, 모바일어플리케이션, DID, Differences in Differences, 택시시장, 콜택시

Ⅰ. Introduction

A mobile application is a type of computer software used on a portable computer device such as a smart phone or tablet PC (Kim *et al.*, 2011). According to a mobile application study (Digi-Capital, 2014), mobile application revenue was under $10 billion globally in 2011, but is expected to exceed $70 billion in 2017.

Starting from just as one of the components of a smart phone, mobile applications are now becoming important marketing channel due to the dissemination of smart phone universally more than ever. The state of the art smart phone is lighter and more portable than a PC. According to DIGIECO's "2015 Mobile Trend Prospect" (DIGIECO, 2015), the worldwide smart phone distribution rate (24.5%) exceeded the PC distribution rate (20.0%). Pursuant to the Ministry of Science, ICT and Future Planning and KISA (Korea Internet & Security Agency), the Korean smart phone distribution rate (82.1%) in 2014 exceeded the PC distribution rate (78.2%). Internet shopping via smart phone has rapidly increased from 23.8% to 58.6% while Internet shopping via PC is decreasing (Ministry of Science, ICT and Future Planning and KISA, 2014).

A taxi is a one of the public transportations along with bus and subway in Korea. The taxi industry can be divided into two kinds in regards to the methods of finding a vacant taxi. One is a general taxi which wanders around in search of passengers. To use this type of taxi, consumers have to search and wait on the roadside for an empty taxi. Taxi drivers also have no idea where the customer is and when they can take customers. As a result, the asymmetry between tax drivers and customers yields inefficiency.

The other is call taxi. There is a broker who connects the taxi driver with the passenger. Thanks to the existence of a third party, the taxi driver and pas-senger can exchange interact with each other more effectively. The broker, called a call taxi company, performs the duty of connecting the taxi driver who is located closely at possible consumers. The company collects the locations of taxi drivers and customers and gives information to them respectively.

However, the existing call taxi industry has some systemic problems. Call taxi system is operated by the telephone. People have to make a phone call to the call taxi company (the intermediator) to request the service. Customers need to memorize or save the telephone number of a call taxi company. It brings many inconveniences for user. Also insufficient call taxi management system is the problem. Each taxi drivers don't belongs to call Taxi Company but they are independent. Due to lack of driver management, customer satisfaction about call taxi is generally low.

The call taxi industry is now rapidly changing as adapting IT (Jang *et al.*, 2015). The new IT system of call taxi industry utilizes high-techs such as GPS (global positioning system) and the wireless Internet. GPS helps taxi drivers and customers find their destinations faster and more easily. Mobile applications are a key medium of the new call taxi system, which connects taxi drivers and customers efficiently. Therefore, call taxi companies with high-techs are becoming more popular.

Kakao started the Kakao Taxi business on 31 March 2015. As a call taxi that applies IT, Kakao Taxi provides differentiated service comparing with existing call taxi service. Kakao Taxi has its business model on on-line mobile application not on off-line. Kakao Taxi does not provide the matching service; instead, it offers a place that taxi drivers and customers can gather. On the Kakao Taxi mobile application, customers and drivers directly trade this service. In this process, the role of a broker disappears. As a result, Kakao Taxi has four dominant positions com-

pared with existing call taxi companies.

First, there is no matching fee in the Kakao Taxi service. A matching fee is usually imposed to both taxi drivers and customers by a call taxi company as brokerage pay. One of the reasons Kakao Taxi does not have to charge commission is due to its business model. Kakao Taxi is run automatically via programmed algorithm which means no need of human resource to mediate. Thus, Kakao Taxi can save the cost by reducing labor cost, and the company could appeal the customers and taxi drivers with no matching fee.

Second, Kakao Taxi's mobile application platform allows customers easy accessibility to the service. Kakao Taxi customers do not have to save or remember the phone number of call taxi companies. Once downloaded, the Kakao Taxi mobile application is available whenever and wherever. This makes the barrier to the entry low and attracts more customers.

The third advantage is that Kakao Taxi provides open information to their customers. There is a lot of real-time information the application offers: the location of call taxi drivers, the time of taxi driver's arrival, the taxi driver now available etc. The application further offers a review of taxi drivers and passengers. Everyone, including taxi drivers and passengers, who have used the Kakao Taxi service can post a review about their experience and also read the reviews of others. This motivates call taxi drivers to offer better service to get more calls.

The last advantage is that Kakao Taxi brings an increase of numbers of call taxi drivers. Daum Kakao's official blog (Hong, 2015) reports that, two months after the Kakao taxi application launched (May 2015), the number of registered call taxi drivers on Kakao Taxi exceeded 70,000. This figure outnumbers 63,000, which is reported by the Korea National Joint Conference of Taxi Association (2015). Thus, the ad-

vent of Kakao Taxi is expected to bring a complete transformation to the off-line taxi market.

Mobile application plays a key role for Kakao Taxi business. The platform of Kakao Taxi is on the mobile application, however the target and the field of business is on off-line as well as with the off-line call taxi companies. Hence, customer attitude accepting IT technics is very important.

This acceptance behavior has been extensively studied by many researchers. Current mobile studies have mostly focused on the effect of an off-line company's use of mobile applications and people's intention of application use. Park (2011) proposed four merits of mobile marketing when an off-line company adopts it: increased customer accessibility, segmented target marketing possibility, customer empirical factor, and marketing cost saving. Davis (1989) argued that perceived usefulness (PU) and perceived ease of use (PEOU) mainly impact the adoption of information systems. However, there is little research examining the effect of mobile business on the off-line market.

Currently, mobile applications are changing their role from business marketing tools to the new business platform with quick response, vitality, and new ideas. The on-line businesses and the mobile application businesses have become the most important tool to survive. Now, they are expanding the business from on-line to off-line market. Uber, Xiaomi, Snap Chat, and Airbnb are representatives of a startup. Reports claims these startups have more than $100 billion enterprise value (Austin *et al.*, 2015). In Korea, startups are also a big stream. The number of domestic startup companies has quadrupled in the past 10 years (2004: 7,967, 2014: 29,531) (KOCCA, 2015). A total of 101 startups have attracted investments, and the scale is more than $7 billion.

From theses points, we believe that Kakao Taxi brings a big conversion to the relationship between

mobile application business and off-line business

Ⅱ. Theoretical Background

2.1 Mobile Business

Basu says electronic business and mobile business refers to operations using the Internet and other networking technologies (Basu, 2016). E-business includes electronic commerce, customer and supplier relationship management, and business collaboration (Samuelsson and Dholakia, 2003). M-business is the extension of e-business to mobile devices, such as smart phones and other handheld devices.

M-commerce is the ability to purchase goods anywhere through a wireless Internet-enabled device. It offers ubiquity, convenience, localization, and personalization (Clarke, 2001). Mobile commerce (M-commerce) is a type of subordination of electronic commerce (E-commerce). But there are four differences: communication mode, Internet access devices, development language and communication protocols, and enabling technologies (Coursaris *et al.*, 2002).

The characteristic of mobile business is fast communication because of WOM (word of mouth), which means "communications between private parties concerning evaluations of goods and services rather than formal complaints to firms and/or personnel." It has been important marketing tool. PF-Bone (1995) studied WOM influences post-usage product judgment on the short- and long-term. Traditional WOM study has a perspective that people communicate with each other about products face to face.

However, as the Internet develops, mobile marketing has begun and the communications typically have been done on-line and mobile. The communication about products has grown bigger with SNS, and the reviews have been made in real time. WOM has be-

come more about large information than ever before, and it spreads in double-time. In accordance with the situation, the perspective of WOM study has changed from one-to-one direct communication to one-to-majority indirect and in volume. Phelps *et al.* (2004) claimed that mobile WOM is more influential than traditional WOM based on convenience, fast speed, information ripple effect, and eliminating face-to-face meetings. Burson-Marsteller (2005) used the term "E-fluentials" first to call the key person who spreads information on-line.

2.2 TAM

IT pervades everyday life. Smart phone and internet are necessities in modern daily life. From this circumstance, there are many studies in regards to the factors a person or organization considers when adopting high-tech.

With a social-psychological point of view, those studies treat perception and belief as important factors for accepting new technology (Son, 2001). The most extended and referred technology acceptance model is TAM. Davis (1989) and Davis *et al.* (1989) emphasized the efficacy of information technology decline due to personal and organizational take-away. The authors suggested TAM (technology acceptance model) based on TRA (theory of reasoned action) to utilize IT and improve performance. This has a cause-and-effect relationship that belief influences attitude, attitude creates effects of behavior intention and behavior intention influences behavior: accepting high tech (Nam *et al.*, 2013).

Davis (1989) explained the intention and that adopting new IT is affected by two precedent variables. One variable is perceived usefulness that users consider; the other is perceived ease of use. Perceived usefulness is the degree of belief that accepting new technology

brings a positive result. Perceived ease of use is the degree of belief that adopting new technology to the task does not require great labor.

Many latter researches support and extend TAM. The reason for this is because TAM is a simple and definite model; it is easy to modify to various situations. Hendrickson *et al.* (1993) proved that reliability of TAM via empirical study. Igbaria *et al.* (1997) proposed TAM with external variables and parameters. Follow-up studies have modified external variables, which affect perceived usefulness and perceived ease of use. Venkatesh *et al.* (2000) suggested ETAM (extended technology acceptance model). It further extended external variables emphasizing perceived usefulness. The external variables are social influence process and cognitive instrumental process. Moon and Ok (2005) also extended TAM. They studied the impact of variety of service and personal innovativeness on the adoption of new mobile service.

2.3 DID

DID (differences in differences) is the quasi-experimental design model that grafts design of experiment to social science study. Experimental design is a structuralized and planned test. It is a planned statistical method to look for the optimum and the best solution. By planning and controlling the process, DID removes external effects and analyzes the net impact of an event or a policy on a group.

Difference-in-difference estimates causal relationships. It compares the differences in outcomes after and before the events for groups affected by it to this difference for unaffected groups (Bertrand *et al.*, 2002). To study the effect of the policy's execution, the best method is to compare the results of the group affected by the policy and the group's result not affected by the policy. However, this is impossible.

Simple comparison also is not desirable because there is no uncertainty the outcome is affected only from the event.

One factor that influences the group result is time, which continuously passes. The ratio of men to women and change of preference are an example of time effect. These trends change naturally with time and cannot be controlled. There is relationship between time effect and the group certainly. Mixed with the effect of the policy, the time effect has an influence on the group.

Another factor is exogenous variables, which occur simultaneously with the event. Exogenous variables are assumed to be determined by factors outside of the models. The exogenous variable includes temporal variation, economic changes, etc. The opposite is endogenous variables. The endogenous variables are determined inside of the models. Exogenous variables are already decided, and the researcher cannot change theses. In this study, the endogenous variable is the amount of passengers of the call taxi and designated driving service. Exogenous variables have an impact on the call taxi industry by affecting and changing endogenous variables.

The DID method is used to analyze the net effect of the policy or event in the way that it can control time and exogenous variables with differences and control group. The DID controls the time effect by differentiating treatment group before and after the event. With the control group, it controls exogenous variables. The control group is the group that has similar characteristics to the treatment group, but it hasn't been affected by the event. By comparison of the control group and treatment group, the influence of exogenous variables is offset. As a result, the only net event's effect remains.

It is usually used in empirical economics to study the effects of event interventions and policy changes

that do not affect all in the same group (Lechner, 2010). Marcus (2013) studied the spillover effects of unemployment on other household members through DID. Karisson *et al.* (2014) analyzed the impact of the 1918 Spanish flu epidemic on Sweden's economy. They use two more degrees of treatment intensity than standard DID. Thus, they could categorize the distinct groups into more than two. Koo *et al.* (2010) did an empirical study on the effect of "the national basic livelihood protection scheme" to labor, salary, and poverty. Seok (2010) studied public pension's impact using DID. Min (2011) examined the effect of the Act on Long-Term Care Insurance for the Aged on family relations. Gebel and Voßemer (2014) combined the difference in differences and a propensity score matching tool to reveal the causal effects of unemployment and reemployment on health condition.

But DID model has disadvantages in that the common trend assumption is dependent on functional form or scale of measurement (Lechner, 2010). And the intervention event may differ in ways that would affect their trends over time. Also their compositions may change over time. Stuart *et al.* (2014) revealed that the AQC (Alternative Quality Contract) affects out-of-pocket mental health service expenditures of enrollees. They solved the problem by combining DID models and four group propensity score weighting. Kim (2013) studied the effectiveness of government support project with DID. He applied PSM and DID sequentially, and got more accurate result by eliminating selectivity bias.

Ⅲ. Methodology

The purpose of this research is to reveal the effect of mobile applications in the off-line market by studying the relationship between Kakao Taxi and the call taxi market. To do this, the number of passengers

of the existing call taxi industry before the Kakao Taxi launched was compared with the number of passengers after the Kakao Taxi was launched. However, simply comparing the numbers before and after the event contained many errors. The call taxi passenger has been affected not only by Kakao Taxi but also by time and exogenous variables. Thus, in analysis, to study Kakao Taxi's net effect to the existing call taxi market, the effect of time and the exogenous variables had to be removed. So this study uses DID as the methodology for analysis of the Kakao taxi's net effect to that of the existing call taxi market.

Ⅳ. Data

4.1 Data Collection

Three kinds of data are needed in a DID analysis. First is the number of call taxi passenger data as a treatment variable. Second is the number of designated driving service passenger data as a control variable. Last is the time point to compare the changes in call taxi company sales.

SKT is a Korean telecommunications company. The SKT Big Data Hub site (www.bigdatahub.co.kr/index/do) offers a variety of monthly big data based on SKT user data. Everyone can use it for free. For the study, the number of call taxi passengers data is substituted with "Seoul call taxi use analysis" data, and the number of designated driving service passenger data is substituted with "Seoul call taxi/designated driving service use analysis' data offered by SKT Big Data Hub." These data each count the number of SKT user phone calls to the call taxi and designated driving companies. Most calls to the Taxi Company and designated driving service company are from customers. It can be said that the intention of using a call taxi service and the call number is con-

nected with the sale. Thus, the number of passenger data in this study is the number of phone call data to use the service.

The data have a limitation in the way that they are restricted to SKT and not to every Korean tele-communication company. However, SKT is the largest telecommunication company in Korea. The data are fully significant in regards to the fact that SKT has more than a 50% Korea telecommunication market share (Kim, 2014). Kakao taxi started at 31 March 2015. So this research regards 1 April 2015 as the Kakao Taxi starting date and uses this date as the time point.

There is no missing value in the data. But "Seoul call taxi use analysis" consists of daily data, and "Seoul call taxi/ designated driving use analysis" data consists of monthly data. So "Seoul call taxi use analysis" data was reorganized as a monthly data. The data period is 14 months from August 2014 to September 2015. DID analysis require the data before and after of the event. Thus, 14 months is comprised of eight months before the event and six months after the event. Data consists of calls to call taxi company and des-ignated companies placed at all 25 districts of Seoul. The number of traffic in the Seoul call taxi use analysis is 977,419 and the number of traffic in the Seoul call taxi/ designated driving use analysis is 358,008 so the total number of traffic of call data is 1,335,427.

4.2 Data Structure and Variables

〈Table 1〉 Treatment Group & Control Group Variable

	Name	Group Description
Treatment Group	The number of Call taxi call	The group Influenced by the kakao taxi
Control Group	The number of Designated driving service call	The group compared with the treatment group

To research Kakao Taxi's impact on the off-line taxi industry, call taxi is used as a treatment group. It is expected that, if Kakao Taxi has an effect on the call taxi market, the number of call taxi phone calls will be lower than before Kakao Taxi was launched. The research question is if Kakao Taxi has an influence on the call taxi industry, then the number of call taxi phone call would have decreased after Kakao Taxi's introduction compared with the des-ignated driving service.

<Table 2> shows the descriptive statistics. Call is the number of calls to taxi companies and designated driving service companies. Time is the dummy varia-ble that separates before and after the time period. Treat is the dummy variable that separates treatment variable (call taxi) and control variable (designated driving service).

〈Table 2〉 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Id	28	14.5	8.225975	1	28
T	28	13.5	8.225975	0	27
Data	28	6.785714	3.337299	1	12
Call	28	47693.82	24350.3	18298	92639
Time	28	.3571429	.48795	0	1
Treat	28	.5	.509175	0	1

4.3 Research Model

$$Y_{i,t} = \beta_0 + \beta_1\,Time\_kakaotaxi_{i,t} + \beta_2\,Treat\_calltaxi_{i,t}$$
$$+ \beta_3\,Time\_kakaotaxi \times Treat\_calltaxi_{i,t} + \epsilon_{i,t}$$

The research model is as above. The dependent variable $Y_{i,t}$ is the number of calls to call taxi companies. This call is made from call taxi customers to call taxi companies to get a call taxi service. The first independent variable $\beta_1\,Time\_kakaotaxi_{i,t}$ is the time separation dummy variable. It divides the result of the group after being affected by an event from the group before being affected by an event. Through this independent variable, the changes in call taxi passengers before and after Kakao Taxi is figured out.

The second independent variable $\beta_2\,Treat\_calltaxi_{i,t}$ is the treat separation dummy variable. It divides the treatment group and the control group. Through this dummy variable, it is possible to compare them by analyzing the trend of existing call taxi customers and designated driving service customers. As a result, exogenous variables are controlled, and the pure Kakao Taxi effect is detected.

The last independent variable $\beta_3\,Time\_kakaotaxi \times Treat\_calltaxi_{i,t}$ is the interaction variable of time and treatment variable. It shows call taxi passenger trends, which considers the time and treatment variables.

β_3 is the coefficient that this study wants to estimate.

If Kakao Taxi has an effect on the call taxi industry, the number of call taxi would have decreased after Kakao Taxi launched compared with a designated driving service. Therefore β_3 is expected to be a negative. <Table 3> is the definitions of the variables.

Ⅴ. Study Result & Implications

5.1 Study Result

M-business studies have been actively discussed since the 2000s. Mobile business is now an irresistible trend, and a maladjusted company cannot survive in the market. As we noted earlier, researches are focused on a set of off-line business points and not a set of on-line businesses. But as M-business influence is getting bigger and competitive M-companies are appearing, M-business study is imperative.

This paper asks if on-line business has an effect on the off-line market. It analyzes the relationship of Kakao Taxi and the call taxi industry. DID (differences in differences; the quasi-experimental design model) is used for the study. It removes time effect and the exogenous variable effect and captures only the net effect of the event. By comparing the trend of call taxi passengers (treatment variable) and the trend of designated driving service users (control variable),

〈Table 3〉 Variable Description

Variable	Variable name	Variable description
Dependent variable	Call taxi phone call	The volume of the phone call to call taxi
Independent variable	Time_kakaotaxi	Time classify dummy variable (before kakao taxi = 0, after kakao taxi = 1)
	Treat_calltaxi	Treat classify dummy variable (control group = 0, treatment group = 1)
	Time_kakaotaxix Treat_calltaxi	time and treat interaction variable

it is possible to figure out whether Kakao Taxi influences the call taxi industry.

<Table 4> is the result of the DID analysis. "Kakao taxi impact on call taxi" is the interaction term of time and treatment variable. It shows whether the call taxi market is affected by Kakao Taxi or not. The p-value of interaction variable is 0.024 and efficiency is -11147.8. The result is statistically significant at 0.05 significant levels.

This indicates that; after Kakao Taxi application was launched; off-line call taxi company passengers are decreased as -11147.8. As a result the research question is confirmed empirically. There is a negative relationship between Kakao Taxi and the call taxi industry. Kakao Taxi has an effect on the call taxi industry and it reduced the sale of call Taxi Company.

The result also shows mobile application has an impact on the off-line industry. There is interaction between an off-line market and a mobile application. It means there are no longer market borders between on-line and off-line and on-line business becomes a significant competitor of off-line business. So to speak, on-line business and off-line business have a connection, and they compete with each other. Nowadays customers are easy to accept online service. They are not unwilling to accept online things. Rather they feel comfortable when using IT technology and prefer quick and easy service providers regardless of the company platform. Off-line Company doesn't hold any definite superiority to on-line company.

5.2 Implications & Limitations

One of the academic implications of this research is studying the impact of mobile applications on the off-line market. It studies the impact of Kakao taxi on the call taxi industry. Kakao taxi is a successful O2O business. O2O business is one of the methods that connect online and offline. Internet development and mobile devices make people get service regardless of place and time (Choi, 2015). So O2O service is considered a promising future business. This research takes meanings in the way that it confirms mobile business, and the off-line market has a close relationship empirically. And also reveals O2O business is affecting offline business industry.

Second academic implication is that this study suggests the needs of application business studies. Analyzing the impact of mobile applications has been taken certain lack of attention. Most mobile business studies have focused on the utility of mobile applications to off-line companies and the factors that affect people adopting mobile applications. The representative research model is TAM, which is modified to the diverse aspect and a lot of following researches have been conducted. But this one-direct study is not any more gives significant implication when understanding the current fast and technical situation. The relationship of off-line and on-line is identified by this paper. So it establishes value of mobile study and increases the interest of mobile study.

〈Table 4〉 Research Result

call	Coef.	Std.err.	t	P>|t|	[95% conf. interval]	
Time_kakaotaxi	-7657.689	1993.154	-3.84	0.001	-11747.3	-3568.075
Treat_calltaxi	48255	3276.267	14.72	0.000	41502.65	54947.35
Kakaotaxi impact on calltaxi	-11147.8	4665.163	-2.39	0.024	-20719.92	-1575.677
_cons	28306.89	1647.845	17.18	0.000	24925.79	31687.99

First empirical implication of this study is that impressing mobile business is not any more a subsidiary of off-line business but a strong competitor. Kakao Taxi definitely gives negative effect to call taxi companies and becomes a new competitor of call taxi companies. Kakao Taxi offers customers innovative technologies and high efficiency service. It already has an influence on the call taxi company's sales and aims to take a high call taxi market share.

Second empirical implication is advising that off-line call taxi companies have to prepare themselves against the advent of Kakao Taxi. This paper shows the decreasing sales trend of off-line call Taxi Company. The preparation can be developing a killer app and providing improved and differentiated service to customer only Offline Company can offer. To keep its stand, the offline business must strive hard and approach this situation from a new viewpoint.

The last empirical implication is utilization of public data. Public data which also called open data spread all over the internet. As data is becoming valuable in the business and life, public institutions and the government offer the collected big data for free to the public. So called big data, it has 3 characteristics; volume, velocity, and variety. EU and other advanced countries have been taken economic benefits by utilizing public data. The Korean government also aims to make use of public data to contribute national economy (A study on an analysis of the economic impact on open public data, NIA, 2012). This research makes good use of public open data and it can be said the study improves usefulness of public data.

This study has a limitation that the passenger data of call taxi and designated driving service are restricted to one Tele Company. Reinforced personal information protection, makes collecting privacy data using hard. Thus, it is restricted to public data. Also due to the short Kakao Taxi business period, the amount of data

is small. Therefore, there is a need for further study with data supplements. The other limitation is validity of designated driving service as a control group. In the study, it is selected subjectively and intuitionally, and lacks theoretical support. So follow-up studies are required verifying the validity of the control group. And those have to take more strong control groups to back up the study.

References

[1] Austin, S., C. Canipe, and S. Slobin, "The billion dollar startup club", *The Wall Street Journal and Dow Jones VentureSource*, 2015. 2. 18, Available at http://graphics.wsj.com/billion-dollar-club/.

[2] Basu, C., "The operational differences between e-business & m-business", *Small Business*, 2016, Available at http://smallbusiness.chron.com/operational-differences-between-ebusiness-mbusiness-25054.html.

[3] Bertrand, M., E. Duflo, and S. Mullainathan, "How much should we trust differences-in-differences estimates?", *National Bureau of Economic Research*, No.w8841, 2002.

[4] Bone, P. F., "Word-of-mouth effects on short-term and long-term product judgments", *Journal of Business Research*, Vol.32, No.3, 1995, pp. 213-223.

[5] Burson-Marsteller, "Influential Internet users rely on company web sites as they spread word of brands, products and services", 2005, Available at http://www.efluentials.com/documents/PressRelease.pdf.

[6] Chang, Y. H., Y. W. Ha, and J. M. Kim, "Analyses of resistance behavior of taxi application user", *The Korea Society of Management Information Systems*, 2015, pp. 145-148.

[7] Choi, D. S., "Evolution of O2O services and the new future suggested by O2O services", 2015,

Available at http://navercast.naver.com/magazin e_contents.nhn?rid=1103&contents_id=100722.

[8] Coursaris, C. and K. Hassanein, "Understanding M-commerce", *Quarterly Journal of Electronic Commerce*, Vol.3, No.3, 2002, pp. 247-271.

[9] Davis, F. D., "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol.13, No.3, 1989a, pp. 319-340.

[10] Davis, F. D., R. P. Bagozzi, and P. P. Warshaw, "User acceptance of computer technology: A comparison of two theoretical models", *Management Science*, Vol.35, No.8, 1989b, pp. 982-1003.

[11] Digi-Capital, "Mobile apps to hit >$70B revenue driven by explosion of diversity", 2014, Available at http://www.digi-capital.com/news/2014/04/m obile-apps-to-hit-70b-revenue-driven-by-explosi on-of-diversity/#.VzsvuhHVzX4.

[12] DIGIECO, "2015 Mobile Trend Prospect", 2015, Available at http://www.digieco.co.kr/KTFront/r ss/report/issue_trend._xml.

[13] Gebel, M. and J. Voßemer, "The impact of employment transitions on health in Germany: A difference-in-differences propensity score matching approach", *Social Science & Medicine*, Vol.108, 2014, pp. 128-136.

[14] Hendrickson, A. R., P. D. Massey, and T. P. Cronan, "On the test-retest reliability of perceived usefulness and perceived ease of use", *MIS Quarterly*, Vol.17, No.2, 1993, pp. 227-230.

[15] Hong, J. E., "KaKao Taxi, the number of calls became more than 500 Million - 150,000 calls per day", *Money Today,* 2015. 7. 6., Available at http://news.naver.com/main/read.nhn?mode=LS D&mid=sec&sid1=105&oid=008&aid=000350 1677.

[16] Igbaria, M., N. Zinatelli, P. Cragg, and A. L. M. Cavaye, "Personal computing acceptance fac-

tors in small firms: A structural equation model", *MIS Quarterly*, Vol.21, No.3, 1997, pp. 279-305.

[17] Irvine Clarke, "Emerging value propositions for M-commerce", *III Journal of Business Strategies*, Vol.18, No.2, 2001, p. 133.

[18] Karisson, M., T. Nilsson, and S. Pichler, "The impact of the 1918 Spanish flu epidemic on economic performance in Sweden: An investigation into the consequences of an extraordinary mortality shock", *Journal of Health Economics*, Vol.36, 2014, pp. 1-19.

[19] Kim, H. K., "Evaluating effectiveness of a government's supporting program through sequential applications of PSM and DID", *The Korea Society of Management information Systems*, Vol.15, No.3, 2014, pp. 729-734.

[20] Kim, S. S., K. S. Han, B. S. Kim, S. K. Park, and S. K. Ahn, "An empirical study on users' intention to use mobile applications", *Journal of Korean Institute of Information Technology*, Vol.9, No.8, 2011, pp. 213-228.

[21] Kim, Y. J., "The Market Share of LG U+ in mobile phone industry became more than 20%", *Seoul Newspaper*, 2014. 5. 7, Available at http://w ww.seoul.co.kr/news/newsView.php?id=201405 27017004.

[22] KOCCA, "Statistics about the start-up-the start-up performance with infographics", 2015, Available at http://www.kocca.kr/k_content/vol15/vol15_0 4.pdf.

[23] Korea National Joint Conference of Taxi Association, "The current status of call taxi industry", 2015, Available at http://www.taxi.or.kr/02/02. php.

[24] Ku, I. H., S. H. Im, and H. J. Moom, "An analysis the national basic livelihood security program effects on work, income, and poverty using differences-in-differences", *Korean Journal of Sociology*,

Vol.44, No.1, 2010, pp. 123-148.

[25] Lechner, M., "The estimation of causal effects by difference-in-difference methods", *Foundation and Trends in Econometrics*, Vol.4, No.3, 2010, pp. 165-224.

[26] Marcus, J., "The effect of unemployment on the mental health of spouses: Evidence from plant closures in germany", *Journal of Health Economics*, Vol.32, No.3, 2013, pp. 546-558.

[27] Min, K. C., "The difference-in-difference model analysis about the effects of long-term care insurance on family relationships' change", *Journal of the Korean Gerontological Society*, Vol.31, No.4, 2011, pp. 999-1014.

[28] MISP and KISA, "2014 Summary Report of the Survey aboutInternet Usage", 2014, Available at http://isis.kisa.or.kr/board/index.jsp?pageId=040100&bbsId=7&itemId=804.

[29] Moon, H. P. and S. J. Ok, "A study on the factors influencing mobile service usage", *The Journal of Information Systems*, Vol.14, No.2, 2005, pp. 133-154

[30] Nam, S. T. and C. Y. Jin, "A meta-analysis of relationship between constructs of the technology acceptance model: Focusing on the research papers published for smartphone in Korea journals", *Asia-Pacific Journal of Business Venturing and Entrepreneurship,* Vol.8, No.4, 2013, pp. 67-79.

[31] Park, J. H., "Mobile marketing in smart phone era", *Excellence Marketing for Customer,* Vol.45,

No.1, 2011, pp. 33-38.

[32] Phelps, J. E., R. Lewis, L. Mobilio, D. Perry, and N. Raman, "Viral marketing or electronic word-of-mouth advertising: Examining consumer responses and motivations to pass along email", *Journal of Advertising Research*, Vol.45, No.4, 2004, pp. 333-348.

[33] Samuelsson, M. and N. Dholakia, "Assessing the market potential of network-enabled 3G M-business services", *Wireless Communications and Mobile Commerce*, 2003, pp. 23-48.

[34] Seok, J. E., "Analyses of impacts of the public pension based on the difference-in-differences model", *Korean Soial Security Studies,* Vol.26, No.3, 2010, pp. 73-98.

[35] Son, D. H., "The role of psychological factors towards the tam model", *Journal of the Korean Operations Research and Management Science Society,* Vol.26, No.1, 2001, pp. 1-14.

[36] Stuart, E., A. Haiden, A. Huskamp, K. Duckworth, J. Simmons, Z. Song, M. E. Chernew, and C. L. Barry, "Using propensity scores in Difference-in-Differences models to estimate the effects of a policy change", *Health Services and Outcomes Research Methodology*, Vol.14, No.4, 2014, pp. 166-182.

[37] Venkatesh, V. and F. D. Davis, "A theoretical extension of the Technology Acceptance Model: Four longitudinal field Studies", *Management Science*, Vol.46, No.2, 2000, pp. 186-204.

The Impact of the Mobile Application on Off-Line Market: Case in Call Taxi and Kakao Taxi

Kyeongjin Lee[*] · Jaehong Park[**]

Abstract

Mobile application is growing explosively with the advent of a new technology: smartphones. Mobile application is a new marketing channel and performs as a start-up platform. This study examines the effect of mobile application on the off-line market.

Despite the continuous declining demand for taxi service, paradoxically, the supply of taxi service has increased. The taxi industry can be categorized into general taxi and call taxi. General taxi is accidental and inefficient because it has to search for its own passenger. As call taxi takes the request of a passenger, it is more efficient than general taxi. However, the current defective passenger‐taxi driver matching system and insufficient taxi driver management hinder the development of the call taxi market.

Differences in differences (DID) is an econometrical methodology that examines whether or not an event has meaningful influence. This research uses DID to investigate the effect of the Kakao taxi application on the call taxi industry. Furthermore, it examines the effect of major companies' reckless diversification, which is considered unethical behavior.
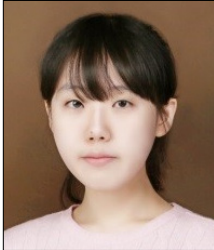
The passengers of call taxi data from August 2014 to July 2015 and those of designated driving service data of the same period were collected as the control group.

---

* School of Management, Kyung Hee University
** Corresponding Author, School of Management, Kyung Hee University

◐ 저 자 소 개 ◑

Kyeongjin Lee (leekjin32@gmail.com)

Kyeongjin Lee studied management information system and earned master's degree from Kyung Hee University. Her main research interest concerns the econometrics, interaction between online and offline, recommendation system.

Jaehong Park (jaehp@khu.ac.kr)

Jaehong Park is an associate professor at the School of Kyung Hee University. His research interests are information economics, social media analysis, online word-of-mouth effect, IT investment evaluation, and others. He earned master's degree from the Stanford University, and earned his PhD degree from the University of Texas at Austin. His works have been published at various journals and conference proceedings such as Information Systems Research, Electronic Commerce Research and Applications, and International Conference on Information Systems.