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Lowering customer's switching cost using B2B services for telecommunication companies

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ABSTRACT

A B2B transaction is a transaction between organizations. However, the ripple effects of a B2B transaction can reach the members of the organization and generate additional economic impact. Enterprise LTE (Long term evolution) is a newly introduced B2B service in the South Korean telecommunications market. While it provides secure and fast telecommunications services to businesses, it can also affect the employees' utility in the business, since the service provider can provide a variety of additional services to employees who use the same telecommunications provider for their mobile devices. In this study, we empirically analyze how B2B and Enterprise LTE services affect consumer churn-in in the telecommunications market. We estimate consumer benefit based on the additional services provided after the introduction of the B2B service using conjoint analysis. We also estimate consumer switching cost for changing one's mobile telecommunications service provider using contingent valuation method. By comparing these values, we analyze the switching probability of employees when B2B services are introduced at their workplace. The results show that in order to maximize revenue, considering the revenue gained from new subscribers and from fees for providing additional services, lowering service fees for additional services and maximizing market share are advisable.

1. Introduction

Switching cost refers to time, monetary, and psychological cost that is incurred when consumers change their product or service (Dick and Basu, 1994). Since switching cost has important implications in analyzing competition in the market and designing marketing strategies, it has been studied in various markets with different perspectives (Park and Koo, 2016; Frank, 2015; Kenney and Pon, 2011). However, as previous studies suggest, the switching cost of consumers locked-in to a specific product or service is higher than that of those who are not (Calvo-Porral et al., 2017; Klemperer, 1995).

If the market is saturated enough and market share expansion by capturing new consumers is not easy, the only choice left for a marketer is to churn in customers who are already locked-in to other products or services, and have high switching costs. Therefore, many businesses design and practice various marketing strategies to attract customers, such as quality improvement, advertisement, incentive programs, and bundling to lower locked-in customers' switching costs (Ferguson and Brohaugh, 2008; Shin et al., 2015;

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Farrell and Klemperer, 2007).

Among various options to lower switching costs, this study empirically analyzes the effect of the option that indirectly lowers switching costs by introducing B2B services to workplaces. A B2B transaction is a transaction between businesses. However, the ripple effect of the transaction can influence employees in the workplace and provide additional economic opportunities for the B2B service provider (Gummesson and Polese, 2009). This study tries to empirically analyze the effect of the option that indirectly lowers switching costs by using the example of a newly introduced B2B service in the Korean telecommunications market: Enterprise LTE.

Enterprise LTE is a B2B service that provides businesses with faster and securer telecommunication services. However, it is also capable of providing additional services to employees who use the same mobile telecommunication service provider (TSP). If one can estimate the amount of benefits given to employees after the introduction of Enterprise LTE to their workplace, and the switching cost of employees using other TSPs, one can calculate the switching probability of employees, and measure the extent of introduction of B2B services that can affect the transaction between business and consumers (B2C market). The study also analyzes how various types of services affect the switching probability of employees, and suggests a service fee that is optimal in terms of revenue maximization of a B2B service provider.

The paper is organized as follows. In Section 2, we first provide brief information about the Korean telecommunications market and Enterprise LTE services. Then, we review some related literature. In Section 3, the research framework and methodology used for the analysis are explained. Section 4 provides estimation results and the results of the simulation analysis. Finally, in Section 5, we summarize the study and provide policy implications for marketers, and conclude with a mention of the limitations and directions for future research.

2. Background

2.1. The telecommunications market in South Korea and Enterprise LTE

First, the South Korean mobile telecommunications industry is oligopolistic, like those of many other countries. Through extreme competition and M&A during 1996–2002, three large TSPs, SK Telecom (SKT), KT and LG Uplus (LGU+) exist,[1] and the market share of these three TSPs in mobile telecommunications is fixed at around 5:3:2 since the 2000s. The reasons for this fixation can be because the mobile telecommunications market is saturated and new customer entrants are limited,[2] and switching cost and lock-in effects for mobile TSPs are high (Shin and Kim, 2007; Klemperer, 1995; Lee et al., 2006; Grzybowski, 2008). Switching cost for changing mobile TSP is generally high since various costs are related to compatibility, transaction, and search (Grzybowski, 2008) and high switching cost implies high lock-in effect (Klemperer, 1995). Lee et al. (2006) also mentions that a significant amount of switching costs exist due to various reasons (retention of phone number, retention of mobile terminal, etc.) in the Korean mobile communications market, resulting in consumers being locked-in with their current service providers. Moreover, Shin and Kim (2007) suggested that a high switching barrier still exists in the Korean telecommunications market even after mobile number portability (MNP) has been enabled.

In this situation, Enterprise LTE is an exclusive B2B service provided by KT that has been introduced since 2015. For companies introducing Enterprise LTE, KT install a private exclusive LTE gateway at the workplace and directly send high-speed LTE data to the company's intranet. Enterprise LTE assure secure and high quality telecommunications services for its organizational customers. Since massive telecommunication equipment is not needed after the introduction, the company can reduce its maintenance costs for its equipment. Moreover, the company can also manage their telecommunication resources on an integrated platform.

Enterprise LTE is also capable of providing additional services to users using the same TSP for their mobile devices. For example, by changing the data mode to "business" or "private" on their devices, employees can use free data for business purposes without worrying about security issues. Further, employees may also use secure interphone call and messenger services for business purposes on their private devices. However, employees using other TSPs cannot use such additional services and have to change their mobile TSPs to the Enterprise LTE service provider (KT) to use such services. The service is in its introduction stage, so it is not widely adopted in the market, but has already been introduced in some workplaces. The service is getting favorable comments from organizational customers, especially where the organization needs mobile data services with high levels of security provided to their employees for business purpose, such as laboratories, shipyards, steel companies, electric power companies and the fire and police departments (KT Corporation, 2018).

2.2. Review of literature

In the literature review section, we first briefly look at some literature that analyzes the effect of B2B transactions on B2C transactions. Then, we review literature on consumer preferences and switching costs in the telecommunications market.

A lot of research and practices separate B2B and B2C, but some studies have analyzed the close relationship between B2B and B2C transactions. For example, Gummesson and Polese (2009) mentioned that the B2B demand is derived from the B2C market, and providers can benefit from making "consumer's consumers" more competitive. Also, since most companies operate both,

[1] There are mobile virtual network operators (MVNOs) in the market, but their market share is limited (12%) and they still use one of these three company's infrastructure (Ministry of Science and ICT, 2017).

[2] In December 2017, mobile telecommunications service subscriber per capita was 1.2 (Ministry of Science and ICT, 2017), which implies the market is quite saturated.

Table 1
Attributes considered in past literature using conjoint analysis.

	Scope	Attributes considered
Kim (2005)	South Korea	Availability of multimedia mobile internet, availability of video telephony, availability of global roaming, monthly fee
Lee et al. (2006)	South Korea	MNP, mobile TSP, customer service quality, availability of advanced data service, number of call interruptions, dummy variable for buying new phone, dummy variable for switching, monthly fee
Shin et al. (2011)	Uzbekistan	MNP, mobile TSP, discount calls within the same network, call and service quality, monthly fee
Klein and Jakopin (2014)	Germany	Voice call provision, SMS provision, data service provision, type of terminal device, monthly fee
Dagli and Jenkins (2016)	North Cyprus	Mobile internet speed, mobile internet limit, service quality, unrestrained use in adjacent countries, monthly fee
Czajkowski and Sobolewski (2016)	Poland	MNP, mobile TSP, friends and family in the network, others in the same network, on-net/off-net per minute call charges
Confraria et al. (2017)	Portugal	Market share of the mobile TSP, friends and family in the network, length of the commitment period, on-net/off-net per minute call charges, monthly fee

organizational customers and consumers, B2B and B2C marketing should be viewed from an integrated viewpoint. Further, Burnaz and Bilgin (2011) claimed that B2B brands may have the opportunity to expand to B2C markets if they can positively influence consumers in B2B transactions.

Next, studies analyzing consumer preferences in the telecommunications market were conducted incorporating various perspectives. There were studies relating to preferences for general telecommunications services (Shin et al., 2011; Paulrajan and Rajkumar, 2011; Kaur Sahi et al., 2016; Calvo-Porral et al., 2017; Ahn et al., 2006; Grzybowski, 2008; Grzybowski and Pereira, 2011) and preferences for newly introduced services (Kim, 2005; Dagli and Jenkins, 2016; Lee et al., 2006). Moreover, some studies have analyzed related hardware terminals (Lee et al., 2006; Park and Koo, 2016), government policy including MNP (Kaur Sahi et al., 2016; Grzybowski and Pereira, 2011; Shin et al., 2011; Lee et al., 2006; Czajkowski and Sobolewski, 2016; Kim et al., 2017; Confraria et al., 2017; Shin and Kim, 2007), and bundling strategies (Shin et al., 2015; Klein and Jakopin, 2014) in the telecommunications market.

Among these various studies, some focused on identifying the factors that influence switching intention or actual switching. These studies typically utilize the structural equation modeling (SEM) method with data collected using structured questionnaires. For example, Paulrajan and Rajkumar (2011) and Kaur Sahi et al. (2016) analyzed which factors affect satisfaction, switching intention, and actual switching in the telecommunications market in India. Calvo-Porral et al. (2017) conducted a similar analysis of the Spanish market and Ahn et al. (2006) analyzed the factors that affect actual switching using collected customer subscription data in the South Korean market. Generally, we could observe that service quality (including the availability of new technology and customer service) and switching barrier (customer loyalty, MNP, and other switching costs) are considered as key factors that affect consumer behavior in the telecommunications market.

Next, there are many studies that use conjoint analysis, as we do in our study to analyze consumer preference for mobile telecommunications services (Lee et al., 2006; Czajkowski and Sobolewski, 2016; Shin et al., 2011, Kim, 2005; Dagli and Jenkins, 2016; Klein and Jakopin, 2014; Confraria et al., 2017). Information on the key attributes considered in these studies is presented in Table 1. We can observe that many studies include MNP as one of the key attributes in their analysis (Lee et al., 2006; Czajkowski and Sobolewski, 2016; Shin et al, 2011). However, in South Korea, MNP was fully available after 2005, which means that MNP does not affect consumer's switching cost in South Korea now (Shin and Kim, 2007). Moreover, since we are trying to analyze the effect of the introduction of B2B services in the employee's workplace to the employee's choice of mobile TSP, we can assume that the network effect (in the workplace) is already included in its nature.

This study tries to estimate consumer's preferences toward the introduction of new services. Similarly, a few past studies have analyzed the preference for the introduction of new services in the mobile telecommunications market. For example, Kim (2005) analyzed consumer preference toward newly available services (multimedia mobile internet, video telephony, and global roaming) provided by IMT-2000 in South Korea. The results show that there is a large variation in consumer preferences toward new services, while video telephony services show highest mean WTP (40,919 KRW[3]/month). Similarly, Lee et al. (2006) analyzed the preference for newly available advanced data service (Evolution Data Only, EV-DO) in South Korea, which turns out to have a significant impact on consumer utility (WTP of 5973 KRW/month). More recently, Dagli and Jenkins (2016) analyzed consumer preference toward newly available services provided by the introduction of 4G technology in North Cyprus. These services include high-speed mobile internet, unlimited mobile internet use, improved quality, and roaming services to adjacent countries.

Finally, some studies provide their switching cost estimates to change mobile TSP. Lee et al. (2006) and Czajkowski and Sobolewski (2016) calculated switching cost using conjoint analysis. Lee et al. (2006) reports that switching cost[4] of mobile TSP in Korea is 40,963 KRW/month (34.2 USD/month[5]) and Czajkowski and Sobolewski (2016) reports the case of Poland as 4.22 PLN[6]/

[3] Korean won.
[4] Excluding the effect of retention of telephone number (MNP) and mobile terminal.
[5] 1 USD = 1197.7 KRW at the time of survey (December 2003).
[6] Polish zloty.

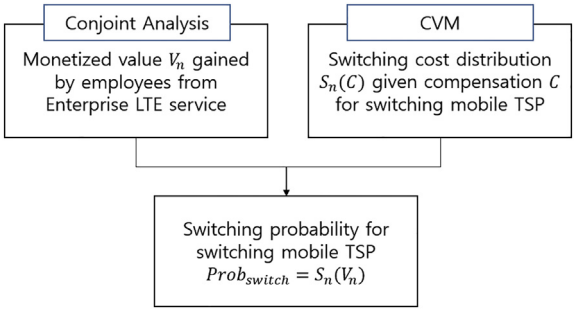

Fig. 1. Calculation of switching probability incurred by Enterprise LTE service.

month (1.26 USD/month). Grzybowski and Pereira (2011) analyzed panel data in Portugal and estimated switching cost as 31.9–37 EUR/month (37.8–43.36 USD/month). Finally, Cullen and Shcherbakov (2010) constructed a structural model to estimate the switching cost of customers in the United States as 225.7–236.3 USD.

As mentioned above, there have been various studies, but to the best of our knowledge, there has been no study that empirically analyzes the change in consumers' switching costs when influenced by the introduction of B2B services. Moreover, it was hard to find studies using multiple methodologies altogether in a single study to calculate switching probability of consumers. This study will empirically analyze the changes in switching cost by the introduction of B2B services using both, conjoint analysis and contingent valuation method (CVM).

3. Methodology

The objective of this study is to use both conjoint analysis and CVM to calculate the switching probability of employees when Enterprise LTE is introduced at their workplace. The research framework is as follows. First, conjoint analysis is used to estimate the monetized value V_n of additional services provided to employees by the introduction of Enterprise LTE. This can be done by estimating the marginal willingness to pay (MWTP) of employees for additional services (such as free mobile data service) after the introduction of Enterprise LTE at their workplace. Next, CVM is used to estimate the cumulative distribution function of switching cost $S_n(C)$ given employee n and compensation C. This can be done by estimating the distribution of an employee's marginal willingness to accept (MWTA) for changing one's TSP. After $V_n$and $S_n(C)$ are estimated, the switching probability of an employee using another TSP to switch to an Enterprise LTE service provider can be calculated as $S_n(V_n)$. This way, one can analyze how much churn-in can happen after the introduction of the B2B service. The framework is illustrated in Fig. 1.

B2B service providers can provide the additional services that are provided by Enterprise LTE to employees using the same TSP for free, to churn in new customers and expand its market share. However, there is an opportunity of gaining additional revenue if the service provider imposes certain service fees for these additional services. In this case, if the fee level is P, switching probability of employee n is $S_n(V_n-P)$, which is smaller than the case where no service fee is charged, $S_n(V_n)$. When a service fee is charged revenue from customer churn-in decreases, because the switching probability decreases. However, additional revenue from the service fee is generated. In this study, we calculate the revenue increase from the additional customer by using South Korean TSPs' monthly average revenue per unit (ARPU) and then identify the optimal pricing strategy for a B2B service provider.

3.1. Data

Two main methodologies of the study, conjoint analysis and CVM, are both based on consumer surveys. Therefore, this study used an online survey using a structured questionnaire and conducted both, conjoint and CV analysis, on the same sample. The survey was conducted by a professional research company from April 27 to May 1, 2017. The sample size comprised 558 South Korean customers who are currently employed (excluding KT users). The sample was selected through simple random sampling by the professional survey company. The respondent demographics are presented in Table 2.

Next, to understand consumers' motives for selecting their current TSPs, we asked the respondents to state two of the most important reasons for their TSP choices. The results are shown in Table 3.

Table 3 clearly shows the relative advantage of a consumer's current TSP. As expected, direct factors, such as purchase condition and payment plans (19.5% and 13.2% respectively), show high percentages. However, TSP-specific benefits that can cause lock-in effects, such as bundle services (15.3%), membership systems (12.1%), and exclusive services (7.5%) also highly influenced a consumer's TSP choice. This implies high switching costs for changing mobile TSPs. Therefore, various types of efforts are needed to overcome this high switching cost, and churn in customers, and the ripple effect from B2B services such as Enterprise LTE, can also be an option.

Table 2
Respondent demographics.

		Number of samples	Ratio (%)
Gender	Male	278	49.8
	Female	280	50.2
Age	20 s	145	26
	30 s	143	25.6
	40 s	146	26.2
	50 s and more	124	22.2
Current TSP	SKT	363	65.1
	LGU +	14	26.2
	MVNO	49	8.8
Total		558	100

Table 3
Reasons for selecting current TSP.

Reason for choosing current TSP	Responds*	Ratio (%)
Current TSP's purchasing condition (e.g. subsidies for smartphones) was good	218	19.5
To use bundle service with other telecommunication service (Internet, IPTV, etc.) provided by current the TSP	171	15.3
Current TSP has the payment system I want	147	13.2
Service quality of the current TSP is good	135	12.1
Membership system of the current TSP is good	135	12.1
To use telecommunication service that is only available by the current TSP	84	7.5
Public image of the current TSP is good	76	6.8
To benefit from the giveaways provided for new subscribers of the current TSP	65	5.8
Customer service of the current TSP is good	25	2.2
etc.	60	5.4
Total	1116	100

* Each respondent selects top two reasons.

3.2. Model

3.2.1. Conjoint analysis

Conjoint analysis is widely used in literature to analyze consumer preferences for key attributes that constitutes a product, service or policy, that is not widely introduced yet (Hong et al., 2012; Choi et al., 2013; Moon et al., 2017; Hong et al., 2016; Dagli and Jenkins, 2016; Lee et al., 2017; Cho et al., 2015; Koo et al., 2013; Jung and Koo, 2018). Results of the conjoint analysis can be used to forecast future market shares, calculate consumer's MWTP for key attributes, and design optimal products, services, and policies. In the conjoint analysis, the researcher presents hypothetical alternatives that constitute a few key attributes with varying attribute levels to respondents. The respondents are asked to choose the most preferred alternative from among them. Using the choice results collected from the analysis, the researcher can estimate how much each key attribute affects a consumer's choice (Louviere, 1988). This study used conjoint analysis to analyze an employee's preference for the introduction of Enterprise LTE in their workplace.

This study assumed five key attributes that constitute Enterprise LTE services. The first three attributes represent the additional service that would be available when Enterprise LTE is introduced. All three attributes have their strength in their secure data communication, and improvement in user convenience. Improved user convenience means that employees can do some part of their tasks securely using their smartphones, which may improve their mobility and competitiveness. First, free business data services enables employees to use safe, high-speed LTE data services for free on their smartphone when they are at their workplace. Next, smartphone interphone services enable employees to securely send and receive calls via their smartphone, using extension numbers at their workplace. Finally, the Enterprise messenger service is a secure internal messenger service that is available only during work hours. Employees can use their smartphones to message other members of the organization securely. Further, the service is linked to the organization chart, which enables easy communication within the organization.

The fourth attribute is the quality of the Enterprise LTE service. We assumed three attribute levels by the available service for each quality level. "Low" quality means data speed is less than 500 Kbps. At this speed, only simple web surfing is available. Next, "medium" quality means data speed is between 500 Kbps and 10 Mbps. At this speed, simple streaming service is available. Finally, "high" quality means data speed is over 10 Mbps, and real-time video conferencing and high quality video streaming are available at this speed. Enterprise LTE allows the same high-speed LTE data communications that are used in mobile telecommunications at workplaces. The speed is fifty times faster at best, than traditional telecommunications options (Wi-Fi, TRS, Wibro, etc.) for workplaces. In South Korea, the availability of high-speed 4G mobile data service (LTE or LTE-A) is over 97% (Open Signal, 2018). The speed of the LTE and LTE-A service is over 50 Mbps and 100 Mbps respectively. Either way, the quality is "high" in terms of attribute levels assumed. Therefore, "high" level can be considered as a baseline, and utility loss for the quality degradation to "low" and

"medium" levels can be estimated.

Finally, the last attribute is the cost attribute for the service fee, and its unit is KRW[7]/month. We set the attribute level considering the current pricing system for mobile additional services in South Korea.[8] We first set the maximum level as 10,000 KRW/month since monthly additional services does not exceed 10,000 KRW/month in general.[9] On the other hand, we set the minimum level as 3000 KRW/month considering the fee level of similar additional services with smartphone interphone services.[10] Then, we set the medium level between these two values as 5000 KRW/month.

Considering the number of attribute levels suggested in Table 4, a possible combination of alternatives is 72 ($2 \times 2 \times 2 \times 3 \times 3$). It is inappropriate to present respondents with all of these alternatives. Therefore, through an orthogonality test using SPSS 23, we extracted 18 orthogonal alternatives and constructed 6 choice sets with 3 alternatives each. Each choice set was then made into a conjoint card and presented to the respondents. The example of a conjoint card is presented in Fig. 2. Before responding to the conjoint cards, we provided detailed information about the Enterprise LTE services, information about each attribute and the attribute levels, key assumptions,[11] and response examples.

This study utilizes a mixed logit model to estimate respondents' preferences for each attribute. A mixed logit model can incorporate consumer preference heterogeneity, and overcome the constraint of independence of irrelevant alternatives (IIA) of the basic logit model (Train, 2009). However, in the mixed logit model, choice probability is usually not in a closed form, and therefore, parameter estimation is intractable using the classical maximum likelihood estimation method. In this case, Bayesian methods can be used to estimate parameters (Allenby and Rossi, 1998; Train, 2001; Train, 2009). Compared to the classical maximum likelihood approach, the Bayesian method has theoretical advantages, both, in classical and Bayesian perspectives (Train, 2001). Further, the Bayesian method provides estimates of individual preference parameters that can be useful in scenario analysis.

The specifications of the model are illustrated in Eq. (1). For the first three attributes, dummy variables ($\mathbf{X}_{data}$, $\mathbf{X}_{call}$, $\mathbf{X}_{messenger}$) are used to indicate the availability of each service (1: available, 0: not available). Next, for the quality attributes, we put the attribute level "high" as baseline and specified other attribute levels (low and medium) as dummy variables ($\mathbf{X}_{low\_quality}$, $\mathbf{X}_{medium\_quality}$). Therefore, parameter β_4 and β_5 indicate the utility of the low and medium quality services when "compared to" high quality services. We used dummy variables instead of continuous variables using the speed units (Mbps, Kbps) since the change in services available would have a more significant impact than the change in the speed units themselves. Finally, for the cost attribute, a continuous variable is used and the unit of the independent variable is 10,000 KRW/month. Finally, six parameters are to be estimated and the specific form of the utility function is provided in Eq. (1).[12]

$$\mathbf{U} = \mathbf{X}_{data}\beta_1 + \mathbf{X}_{call}\beta_2 + \mathbf{X}_{messenger}\beta_3 + \mathbf{X}_{low\_quality}\beta_4 + \mathbf{X}_{mid\_quality}\beta_5 + \mathbf{X}_{price}\beta_6 + \varepsilon \tag{1}$$

Finally, in order to derive the monetized value of each attribute from the estimation results, we calculated the MWTP of each attribute. MWTP shows the extent to which a respondent is willing to pay when the level of an attribute changes for a unit. MWTP can be calculated by dividing the estimated parameter of each attribute by the estimated parameter of cost attribute as in Eq. (2) (Train, 2009).

$$MWTP_a = -\frac{\partial U/\partial x_a}{\partial U/\partial x_{price}} = -\frac{\hat{\beta}_a}{\hat{\beta}_{price}} \tag{2}$$

In Eq. (2), $\hat{\beta}_a$ and x_a are the mean parameter estimates, and attribute values excluding the cost attributes, respectively. In this study, we define the MWTP of each service attribute for employee n as the employee's monetized value V_n from using the service.

3.2.2. Contingent valuation method

Like conjoint analysis, CVM is also based on consumer surveys. Conjoint analysis uses the choice pattern of consumers from the choice set that consists of multiple hypothetical alternatives, which are defined as combinations of multiple attributes, to estimate the part-worth of each attribute. In contrast, CVM provides situations before and after a certain change to the respondents and asks for the respondents' willingness to pay (WTP) or willingness to accept (WTA) in response to the change (Hanemann, 1984; Yoo and Kwak, 2009; Lee et al., 2004; Choi and Koo, 2018). Conjoint analysis has its strength in its flexibility, which enables analyzing preference changes for various attribute level changes, but one can only analyze the marginal utility changes. On the other hand, CVM cannot analyze WTP or WTA for various situational changes, but it can ask respondents their "total" WTP or WTA. Enterprise LTE can be implemented by providing various combinations of services, so using conjoint analysis is appropriate. On the other hand, changing the mobile TSP is rather simple in terms of situational complexity, so we used CVM to estimate switching costs of

[7] South Korean Won. 1131 KRW was equivalent to 1 USD in 2017 (source: Bank of Korea; www.bok.or.kr).

[8] We used the KT's official website to get information on all their 30 additional services (https://www.ktmmobile.com/content/additionBasic.do, accessed: 2018-05-28).

[9] In case of KT, price level of the most expensive additional service was 8800 KRW/month (free WiFi service).

[10] The smartphone interphone service is quite similar to the Two Number Plus service (3300 KRW/month) in KT since it enable users to use two separate numbers in a single device.

[11] Factors not mentioned in the conjoint card are assumed to be same for all alternatives.

[12] For the estimation of the model, we assumed that parameter estimate of the cost attribute is smaller than zero ($\beta_6 < 0$) and parameter estimate of low and medium quality service is smaller than zero and parameter estimate of low quality service is smaller than parameter estimate of medium quality service ($\beta_4 < \beta_5 < 0$). These are reasonable assumptions since consumers dislike paying more for the service, and prefer higher quality.

Table 4
Attributes and attribute levels for conjoint analysis.

Attributes	Description and attribute levels	
1. Availability of free business data service	Description	Enterprise LTE service enables free intranet access using smartphone. Also, by the workplace's telecommunications policy, user can also access to the internet for free using smartphone
	Levels (2)	Available Not available
2. Availability of smartphone interphone service	Description	Smartphone interphone service enables interactive interphone service using smartphone. When the user's interphone receives call, one can receive it with one's smartphone. Also, one can call interphone using smartphone with extension number
	Levels (2)	Available Not available
3. Availability of Enterprise messenger service	Description	Enterprise messenger service enables messenger service that is only available in worktime, which separates work and private life. Also, it is connected to company's organization chart, which enables easy communication within company
	Levels (2)	Available Not available
4. Quality (speed)	Description	The intranet/internet access speed of Enterprise LTE service
	Levels (3)	Low (~500 kbps): Simple web surfing is available Medium (500 kbps–10 Mbps): Simple streaming service (music, low-quality video) is available High (10Mbps ~): Real-time video conference and high quality video streaming is available
5. Service fee	Description	Service fee for Enterprise LTE service
	Levels (3)	3000 KRW/month 5000 KRW/month 10,000 KRW/month

Q. Please choose the most preferred service from among the three hypothetical options provided below.
Note: Assume that all the other attributes, besides the five proposed here, remain the same

❒ **Questionnaire 1**

	Service A	**Service B**	**Service C**
1. Availability of free business data service	Available	Not available	Not available
2. Availability of smartphone interphone service	Not available	Available	Available
3. Availability of corporate messenger service	Available	Not available	Available
4. Quality	500kbps ~ 10Mbps	10Mbps ~	~ 500kbps
5. Service price	3000 KRW/month	3000 KRW/month	5000 KRW/month
Choose the most preferred one →		**O**	

Fig. 2. Example of conjoint card used in the survey.

consumers.

For data collection, the double-bounded dichotomous choice (DBDC) approach was used (Arrow et al., 1993). The first question used for the survey was "You are now trying to buy a new smartphone. If switching your mobile TSP to KT provides you KRW [X] amount of additional subsidy, are you willing to switch your mobile TSP to KT?" If the respondent answered "yes" to the first question, the same question was asked again with [X/2] amount of subsidy and if the respondent answered "no" to the first question, the same question was asked again with [X*2] amount of subsidy. Using this information about the respondents' WTA, parameter estimation was conducted.

There are various ways to specify CVM. In this study, we defined WTA_n as WTP of respondent n, which includes explanatory variable X_n and random disturbance $u_n \tilde{N}(0, \sigma^2)$. Then, respondent n's WTA can be written as $WTA_n(x_n, u_n) = \mathbf{x}_n\beta + u_n$ (López-

Feldman, 2012). If we let Y_n^{YY}, Y_n^{YN}, Y_n^{NY}, and Y_n^{NN} be indicators where they take the value of one, if respondent n answered "yes-yes," "yes-no," "no-no," and "no-no" to two questions asked, and zero otherwise, and if we let t^1 and t^2 be the bid for each question, the likelihood function for the double-bounded model of the whole sample can be written as Eq. (4), where Φ is the cumulative distribution function of the standard normal distribution.

$$\sum_{n=1}^{N}\left[Y_n^{YY}\ln\left(\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)+Y_n^{YN}\ln\left(\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^1}{\sigma}\right)-\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)+Y_n^{NY}\ln\left(\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)-\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^1}{\sigma}\right)\right)+Y_n^{NN}\ln\left(1-\Phi\left(\mathbf{x}'_n\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)\right] \tag{4}$$

For the independent variable $\mathbf{x}_n$, we have considered age and current mobile TSP of the respondent. To be specific, for the age factor we have set those who are in their twenties as the baseline and used dummy variables to represent the thirties, forties and fifties. Next, for the current mobile TSP factor, we have set those who are using SKT as the baseline and used dummy variables to represent LGU+ and MVNO. CVM estimation can be represented as Eq. (5).

$$\mathbf{WTA}=\beta_7+\mathbf{X}_{30s}\beta_8+\mathbf{X}_{40s}\beta_9+\mathbf{X}_{50s}\beta_{10}+\mathbf{X}_{LGU}\beta_{11}+\mathbf{X}_{MVNO}\beta_{12}+\mathbf{u} \tag{5}$$

However, as explained in the research framework section, the objective is to find switching probability distribution $S_n(C)$ of user n when compensation C is given. Using the results of Eq. (5) and standard deviation estimated in Eq. (4), $S_n(C)$ can be defined as Eq. (6).

$$S_n(C)=\frac{1}{2}\left(1+\mathrm{erf}\left(\frac{C-WTA_n}{\sigma\sqrt{2}}\right)\right) \tag{6}$$

4. Results and discussion

4.1. Estimation results

4.1.1. Conjoint analysis

Using Eq. (1), Sawtooth CBC/HB 5.3.0 was used to estimate parameters of the conjoint analysis. Among a total of 200,000 iterations, every tenth draw was kept. Then, among 20,000 draws kept, the last 10,000 draws were used for the estimation. The estimation results are presented in Table 5.

Among three services, data services showed the highest MWTP of 4422 KRW/month and interphone and messenger services showed relatively low MWTPs of 1171.9 and 1899.6 KRW/month, respectively. MWTP for data services was larger than the sum of MWTP for interphone and messenger services, which implies the importance of data services. Further, if the quality of the Enterprise LTE service is downgraded to medium or low, the monthly compensation needed was estimated to be 2352.1 and 3930.6 KRW/month respectively. These results imply that a service provider working with Enterprise LTE should be cautious of the downgrading of its data service quality.

Using the estimation results of mean MWTP, one can calculate a representative consumer's monetized value V_n for the additional services provided by Enterprise LTE. For example, if all three services are provided, representative consumer n's monetized value V_n can be calculated as 4422 + 1772 + 1900 = 8094 KRW/month. However, as mentioned previously, this study estimated each individual's preference parameter β_n. Therefore, 558 respondents have different V_n and these individual-specific V_n were used for scenario analysis.

4.1.2. Contingent valuation method

Using Eq. (4), STATA 14's *doubleb* package (López-Feldman, 2012) was used to estimate parameters of the CVM. The estimation results are presented in Table 6.

Results show that respondents' average WTA (switching cost) for changing their mobile TSP is about 111,000 KRW. This implies

Table 5
Estimation results of conjoint analysis.

Choice		Mean coefficient	[95% Conf. Interval]		Mean MWTP (KRW/month)
data service (β_1)		1.7317*	1.5338	1.9263	4422.4
interphone service (β_2)		0.6939*	0.4483	0.9596	1771.9
messenger service (β_3)		0.74383*	0.5489	0.9571	1899.6
quality	Low (β_4)	−2.13702*	−2.1370	−1.0513	−3930.6
	Medium (β_5)	−1.32683*	−1.3268	−0.5838	−2352.1
	High	baseline			
cost (β_6)		−3.9158*	−4.5621	−3.3017	–

* Significant on 95% confidence interval.

Table 6
Estimation results of contingent valuation method.

			Coefficient	Standard error	Z	P > z	95% confidence interval	
beta	constant		11.1083***	1.2123	9.16	0	8.7322	13.4845
	age	~20 s	Baseline					
		30 s (β_7)	−0.59299	1.5694	−0.38	0.706	−3.66898	2.483
		40 s (β_8)	2.631715*	1.5825	1.66	0.096	−0.46985	5.7333
		50 s (β_9)	1.416131	1.6335	0.87	0.386	−1.78553	4.6178
	MTSP	SKT	Baseline					
		LGU+ (β_{10})	−2.76367**	1.3136	−2.1	0.035	−5.3383	−0.1891
		MVNO (β_{11})	−1.2362	2.0083	−0.62	0.538	−5.1724	2.7
Sigma (σ)			12.1641***	0.6352	19.15	0	10.9192	13.4091

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

$S_n(111, 000) = 0.5$. For the effect of independent variables, consumers in their forties showed a higher switching cost (26,317 KRW higher) and consumers currently using LGU+ showed lower switching cost (27,637 KRW higher). Therefore, by checking whether a consumer was in their forties or not and checking whether a consumer was using LGU+ at the time or not, four different types of distributions were assumed for $S_n(C)$.

4.2. Switching probability of consumers

Using the estimation results presented in Section 4.1, this section calculates the consumer's switching probability. As the combination of additional services changes, V_n of each consumer changes. This section attempts to analyze the switching probability of employees for each type of service. However, unit consistency should be adjusted first, since the unit of V_n is KRW/month and the unit of one-time compensation C for $S_n(C)$ is KRW. According to a 2016 Survey on Internet Usage (Ministry of Science, ICT, 2017), the average replacement period of smartphones in South Korea was two years and seven months (31 months). By dividing WTA estimated through CVM with 31, the average monthly compensation needed for switching was 3580 KRW/month.

Switching probability can be calculated as follows. For explanation's sake, we selected a case of a specific respondent (Respondent 31). Respondent 31 was not using LGU+, and he was in his forties. Therefore, his switching cost was higher than average. To be specific, his switching cost distribution $S_n(C)$ followed a normal distribution with mean 4432 KRW/month, and standard deviation 3923 KRW/month. Then using individual MWTP estimates, Respondent 31's V_n for data services only was 2800 KRW/month and V_n for all three services was 5581 KRW/month. Using this information, Respondent 31's switching probability for each case could be calculated using Eq. (5). The results showed that respondent 31 switched his mobile TSP with 33.9% probability when only data services were given. If all three services were provided, his switching probability would rise to 61.5% (Fig. 3).

By applying the introduced calculation process to the whole sample and taking average, we can calculate the average switching probability of the sample. Average switching probability for all combinations of additional services that can be provided from the introduction of Enterprise LTE is presented in Table 7.

4.3. Scenario analysis: optimal pricing plans for service provider

In this section, we conducted a simulation analysis for a hypothetical workplace with 10,000 employees to find optimal service fees that could maximize the service provider's revenues. Among 10,000 employees, we assumed that 30% of them already used KT and the remaining 70% used other TSPs, following the ratio of the collected sample. For the additional services provided by Enterprise LTE, we assumed that only free data service was available (case 1 in Table 7).

There are two types of revenue that B2B service providers can get from introducing Enterprise LTE to workplaces. The first type of

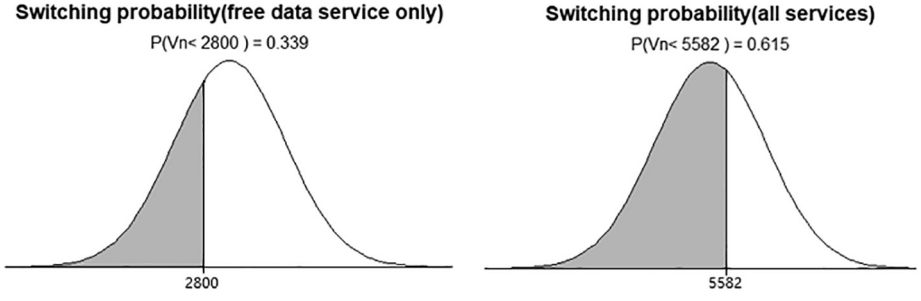

Fig. 3. Switching probability of respondent 31.

Table 7
Average Switching Probability for all possible service combinations.

case	Service Type	Switching Probability
1	data	66.3%
2	interphone	42.6%
3	messenger	48%
4	data + interphone	68.9%
5	data + messenger	72%
6	interphone + messenger	55.4%
7	data + interphone + messenger	75%

revenue is switching revenue, which is expected from churn-in users. This can be calculated by multiplying the number of churn-in users with ARPU, which is the expected revenue per customer. The ARPU level used was 35,000 KRW/month, which is similar for all three main TSPs.[13] The other type of revenue is service fee revenue, which is expected from additional services. This can be calculated by multiplying the number of churn-in customers with service fee levels. However, not only churn in users, but also existing KT users can use the service. Since we did not have a sample for KT users, we assumed that KT users and other TSP users derived the same utility from additional services, and calculated the service use probability of existing KT users.

Switching revenue increases as the number of churn-in users increases. However, service fee revenues are dependent on both, the number of churn-in users and the service fee levels. Annual switching revenues can be calculated as "(number of churn-in users) * ARPU * 12 months" and annual service fee revenues can be calculated as "(number of churn-in users + service users from existing KT users) * service fee level * 12 months." First, switching probability of other TSP users and KT users by service fee level are shown in Fig. 4.

As expected, switching probability of users using other TSPs was over 60% when the service fee was zero, but decreased gradually as the fee level increased. More specifically, switching probability gets lower than 50% when service fee is 3300 KRW/month, and it reaches 43.97% when service fee is 5000 KRW/month. On the other hand, the use percentage of existing KT users are extremely high (97%) when service fee is zero, and decreases rapidly and stabilizes near 50% after the service fee level exceeds 3500 KRW/month. Next, using the results in Fig. 4, total additional revenue and comparison of switching revenue and service fee revenue by service fee level is presented in Fig. 5.

As one can easily observe from Fig. 5, the service fee level that can maximize total additional revenue is when it is zero. This implies that it is best to provide additional services for free, to maximize revenue from switching revenues. This may be so because ARPU is quite large when compared to additional service fees.[14]

Finally, Fig. 6 shows the comparison between the former existing revenue from existing users, and the additional revenue that can be achieved through indirect effects of the introduction of a B2B service. As one can see, the amount of additional revenue is quite large, when compared to the amount of existing revenues. This implies that the introduction of a B2B service had a significant effect on the B2C market.

5. Conclusion

This study used conjoint analysis along with CVM to empirically analyze the effect of B2B transactions on consumer's mobile TSP switching behavior. To be specific, this study used conjoint analysis to estimate benefits gained from additional services available after the introduction of Enterprise LTE service, and used CVM to estimate the distribution of switching costs for changing their mobile TSP. Then, using these results, we simulated the switching probability of consumers as attributes of the service varies. The study is the first to empirically analyze the impact of the introduction of B2B services to the B2C market. The study also makes a contribution by mixing two different methodologies to calculate the switching probability.

First, the results of conjoint analysis show that among additional services available after the introduction of Enterprise LTE services, free data service (WTP of 4422 KRW/month) provides significantly greater benefits on average than smartphone interphone (WTP of 1722 KRW/month) and Enterprise messenger (WTP of 1900 KRW/month) services do. In the real market, only free data service is currently available after the introduction of Enterprise LTE service. Considering the big WTP difference between free data service and the other two services, the service provider's decision to implement free data service first among three available services is considered as a reasonable choice. Nevertheless, the service provider should still work on introducing the other two services, since it would almost double the average benefits provided to employees from the service (4422–8094 KRW/month).

On the other hand, switching cost estimated using CVM was approximately 111,000 KRW on average. Age and current mobile TSP were used as explanatory variables in the CVM analysis. The results show that people in their 40 s have higher switching cost when compared to others (about 26,000 KRW higher), and people currently using LGU+ as their mobile TSP have lower switching cost when compared to others (about 28,000 KRW lower). This may be because LGU+ has the lowest market share among three mobile

[13] According to each company's investor relations report, in 2017 3Q, ARPU of three major mobile TSPs were 35,488 for SKT, 34,608 for KT, and 35,316 for LGU+ (Yonhap Yonhap News 2017).

[14] This study has conducted the same analysis for all service types presented in Table 7, but only presents the case of one type of service to conserve space.

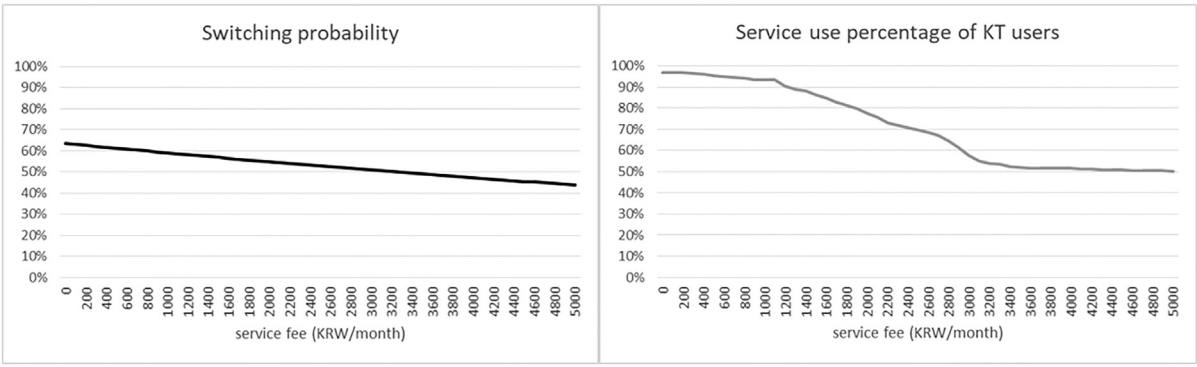

Fig. 4. Switching probability of users using other TSPs (left) and service use percentage of existing KT users (right) by service fee levels.

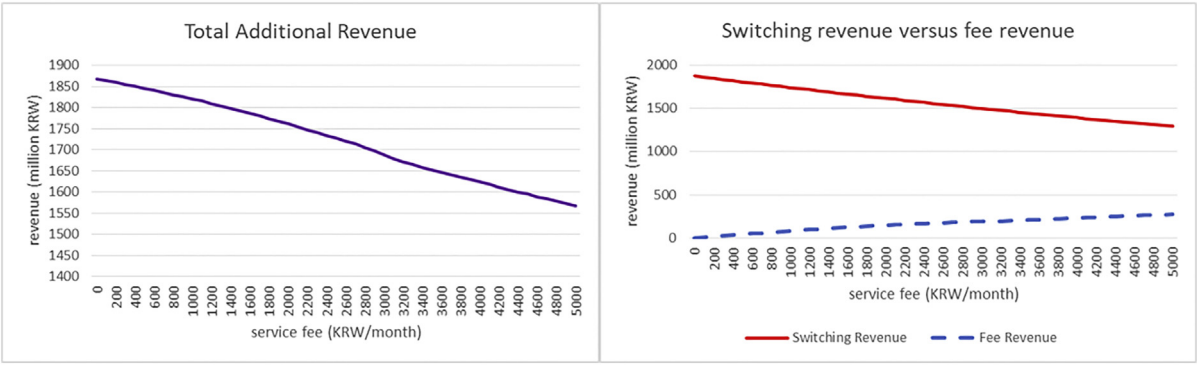

Fig. 5. Total additional revenue (left) and comparison of switching revenue and service fee revenue (right) by service fee level.

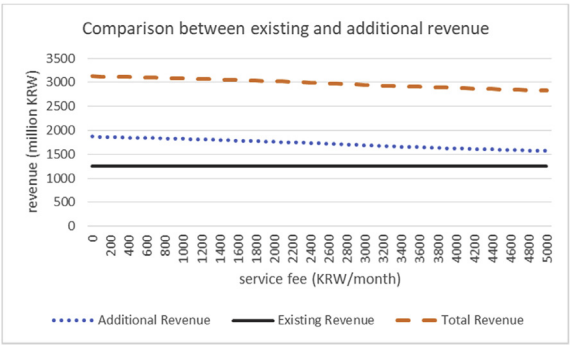

Fig. 6. Comparison between existing and additional revenue.

TSPs, and past literature suggests that people prefer larger networks (Confraria et al., 2017; Czajkowski and Sobolewski, 2016) in choosing their telecommunications service provider. We divided the estimated switching cost with average smartphone replacement period (31 months) in order to get the average monthly compensation needed for switching mobile TSP. The results show that the compensation to be provided until replacement is 3583 KRW/month on average. Switching cost lower than the additional benefit gained from the introduction of Enterprise LTE implies that consumer churn-in from the introduction of B2B service is possible.

The results of the simulation analysis show that a considerable number of employees in the workplace can switch their mobile TSPs to the B2B service provider after the introduction of Enterprise LTE. Moreover, it is advisable for the service provider not to charge the employees an additional service fee in order to maximize churn-in and its revenue, since revenue from additional service fee is quite small when compared to the revenue from new customer churn-in. The results of the study offer marketing implications for companies that conduct both, B2B and B2C transactions. Companies can use a similar framework to establish their marketing plans. Further, companies can use the results to roughly decide the feasibility of the business, given the total cost information.

However, the scenario analysis of the study has a limitation in that it assumed no marketing reaction from the competitors. Since the mobile telecommunications market is highly oligopolistic, KT's churn-in marketing using the Enterprise LTE service will elicit reactions from their competitors. The most probable reaction would be the competitors launching similar B2B services and providing

similar additional services. If there is competition in the market, different marketing direction may be needed. Normally, a workplace will select one B2B service among similar services. Therefore, in the market with competition, the B2B service provider may even consider providing additional incentives for workplaces to introduce its B2B service since the introduction of the B2B service can bring significant amount of churn-in and additional revenue.[15] To be specific, the service provider may consider providing incentives up to their expected additional revenues gained from customer churn-in. For example, the amount is about 1.86 billion KRW for the hypothetical workplace assumed in our scenario analysis[16] (see Fig. 5).

Finally, the study has a limitation in that it could not incorporate the cost side of the introduction of Enterprise LTE. In other words, we only analyzed the change in company's revenue by churn-in consumers. The results may have limitations in assisting marketers to establish marketing plans considering the profit of the company. In this study, we focused on the revenue, since considering the characteristics of the telecommunications industry, the fixed cost is large and marginal cost for additional user is rather trivial. However, future studies may consider the cost side to provide a more detailed analysis.

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[15] However, in the actual Korean telecommunications market, competition is not likely to occur. This is because KT has constructed a strong patent barrier before launching the service to prevent similar services being launched by competitors. Therefore, KT's exclusive position for the Enterprise LTE service will be maintained for the time being.

[16] Assuming that only free business data is available.

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