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An empirical study of pay TV competition with bundled services in Korea[1)]

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Abstract

As the bundled services become widespread, the competition in pay TV, broadband, and mobile services markets is closely related to each other. When consumers subscribe to pay TV services, they also consider subscriptions of broadband and mobile services. Demand estimation for these services should be implemented with a careful consideration about the interdependence of the competition in these markets. This study examines pay TV competition with the consideration of the influence of bundling strategy. Specifically, I estimate the demand function of pay TV, broadband, and mobile services altogether by using nested logit model where the consumer's choice set consists of the combinations of pay TV, broadband, mobile service, and bundling type. Then I quantify demand substitutability between pay TV services such as IPTV, satellite, and cable services by simulating price change of each service. Empirical results show very low demand substitutability between pay TV services, which should be interpreted as the interdependence of competition in pay TV and telecommunication services rather than evidence for defining the narrow market for each pay TV service. In other words, evaluating the competition of pay TV market should take into account the influence of competition of pay TV on other markets and vice versa.

Keywords: demand estimation, pay TV market, nested logit model, market definition

1. Introduction

The Korean pay TV market has experienced rapid changes in recent years. IPTV(Internet protocol television) operators have grown rapidly, which contrasts with the sharp decline of cable operators. At the same time, demands for bundled services have risen so that consumers tend to subscribe to pay TV services through bundled services with broadband as well as mobile service. Recent rapid growth of IPTV operators is related to increased demand for bundled services because cable operators have disadvantages on the competition of bundling due to the lack of mobile services.[2)] Predominance of bundled services makes the competition in pay TV market related to the competition in broadband as well as mobile service markets. Antitrust authority should consider the influence of bundling strategy when it assesses competitive effects of firms' behavior in pay TV market.

There are a few studies to examine the competition in the Korean pay TV market. Lee(2009) and Bok(2011) investigate the competition in pay TV market, focusing on the issue of market definition. Lee(2009) conducts

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1) This paper extracts and revises "Hwang and Yuk (2017)

2) In general, IPTV is sold with internet service as a form of pure bundling in Korea.

a critical loss analysis using the direct survey while Bok(2011) estimates demand function of pay TV services. However, none of them consider the impact of bundled services on the competition in pay TV market.[3] This study examines the competition in the Korean pay TV market with the consideration of the influence of bundling strategy. Specifically, I estimate the demand function of pay TV, broadband, and mobile services altogether. In this setting, a consumer's choice is a combination of pay TV, broadband, mobile service, and bundling type.[4] Then I quantify demand substitutability between pay TV services by simulating price changes, which gives some implication on competition policy.

2. Brief overview of the pay TV market in Korea

There are 94 operators in 78 broadcasting areas across the nation in Korea, including 90 SOs(cable operators), 1 satellite operator, and 3 IPTV operators such as KT, SK, LGU+ as of the end of 2016. 80 out of the total 90 SOs belong to 5 MSOs. SOs' sharp decline and IPTV's rapid growth are remarkable, as pointed out earlier. As of the end of 2016, the proportion of IPTV subscribers to the total subscribers increased to 43% from 14.2% in 2010. During that period, SO's market share dropped from 72.9% to 46.4%.

Table 1. Number of subscribers per each pay TV platform

(unit: thousands)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
t-broad	3,468	3,426	3,234	3,137	3,139	3,336	3,303	3,239	3,231
CJ Hello	3,001	2,952	3,002	3,405	3,322	3,948	4,155	3,823	3,922
C&M	2,590	2,728	2,639	2,697	2,449	2,459	2,378	1,964	2,008
HCN	1,480	1,351	1,338	1,312	1,423	1,400	1,360	1,348	1,338
CMB	1,230	1,287	1,286	1,346	1,350	1,508	1,496	1,506	1,536
MSO Total	11,769	11,744	11,499	11,898	11,683	12,651	12,692	11,881	12,034
Independent SO	3,259	3,398	3,360	2,880	3,116	2,087	1,919	1,851	1,852
SO Total	15,029	15,142	14,859	14,778	14,799	14,738	14,611	13,732	13,887
KT(A+B)	2,302	3,466	4,178	5,059	6,024	6,906	7,770	8,344	9,078
OTV(A)	−	1,009	1,540	2,304	3,121	3,839	4,679	5,252	5,895
Skylife(B)	2,302	2,457	2,639	2,755	2,904	3,067	3,091	3,092	3,184
SK(C)	0.773	403	735	883	1,445	2,081	2,819	3,474	3,955
LGU+(D)	−	330	610	860	1,053	1,675	2,168	2,632	3,040
IPTV Total (A+C+D)	0.773	1,741	2,885	4,047	5,619	7,595	9,666	11,358	12,889
Total	17,332	19,341	20,382	21,580	23,321	25,400	27,368	28,182	29,959

Source: 2017 report on the assessment of the status of competition in broadcasting market (KISDI, 2017)

3) Refer to Goolsbee and Petrin (2004) for estimating demand function in the US pay TV industry.

4) Kim and Kim (2017). and Kim et al. (2018). are closely related to this study in terms of empirical method. Both studies estimate the market demand function for bundled services. Based on the estimated demand function, Kim et al. (2018) investigates market definition of bundled services like triple-play service (TPS) while Kim and Kim (2017) examines switching costs for bundled services.

The proportion of subscription to pay TV through bundled services is increasing. 42.2% of pay TV subscription is in the form of bundled services by 2016 and this figure is getting bigger every year. All three IPTV companies provide their own mobile services, so they can sell bundled services as forms of the combination with mobile services. On the other hand, SOs do not offer mobile services in general. The number of subscribers including both pay TV and mobile services in their bundled services are 6.1 million in 2016, representing 48.6% of total bundled services including pay TV services. As the tendency to subscribe to pay TV services through bundled services including mobile services is strengthened, SOs are likely to decline in the pay TV market as they have been so.

3. Data and empirical strategy

I use the data of Korea Media Panel Survey for 2016 from Korea Information Society Development Institute(KISDI) which is a government-affiliated research institute. The media panel contains detailed information on pay TV and telecommunication services as well as bundling types. The sample of the year 2016 includes 9,788 individuals.

To consider the effect of bundled services, I construct consumers' choice alternatives as a combination of pay TV, broadband, mobile services, and bundling types. That is, it is assumed that consumers simultaneously select these three services and bundling types.[5] Unlike Kim and Kim (2017) restricting the sample to those who subscribe all three services, I allow no subscription to pay TV and broadband service as choice alternatives.[6] Specifically, pay TV services consist of IPTV, satellite, digital cable, analog cable and no subscription. Since there are three IPTV providers, the total number of pay TV services is equal to 7 for each consumer.[7] Broadband services have 5 alternatives, including KT, SK, LGU+, SO, and no subscription. Mobile services include 3 alternatives such as KT, SK, LGU+. Lastly, bundling types consist of four options as follows: DPS1 (pay TV + broadband), DPS2 (broadband + mobile), TPS (pay TV + broadband + mobile), and no bundle. Since IPTV is sold with broadband as pure bundling and SO does not provide mobile service, the type of DPS consisting of pay TV and mobile service only is excluded.[8] As a result, the choice set each consumer faces includes all possible combinations of 7 pay TV services, 5 broadband services, 3 mobile services, and 4 bundling types. When constructing a sample with only observed alternatives in the data, the total number of choice alternatives becomes 90.

Since the alternative is composed of three services such as pay TV, broadband, and mobile services, the price variable is defined as the sum of prices of these three components. I use the list prices for each service instead of using monthly costs reported in the media panel, which is largely due to the limitation of the data.[9] For pay TV services and broadband services, I use the average of list prices of services offered on the website of each provider. For mobile services, I classify mobile plans into multiple categories for each provider depending on data allowances and types of cell phone used, and use the average of list prices for each category. Then, for the

5) I exclude fixed-line phone services in this analysis because of data limitation. However, I believe that the absence of fixed-line phone service does not affect much the estimation results because the inclusion of fixed-line phone service in the bundled services does not change much bundling discount offered. Sellers compete intensely on bundles with pay TV, broadband, and mobile services.

6) No subscription to mobile service is quite negligible, so I exclude users without mobile service.

7) There are many SO providers, but only one SO provider is available in most areas.

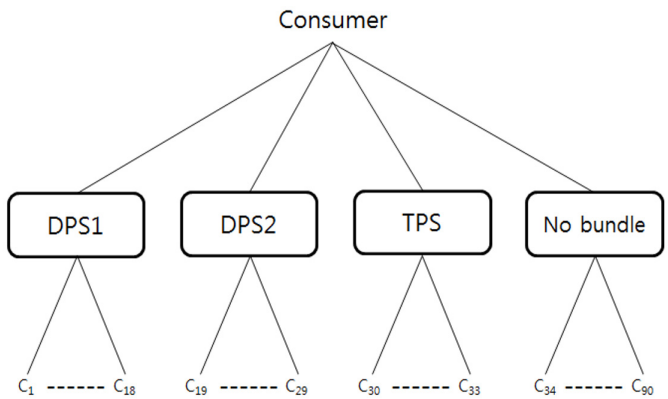
8) There are small mobile service providers(MVNO) in Korea, but the media panel does not identify providers for MVNO users. In this study, I exclude MVNO users which amounts to 158 individuals, 1.6% of the sample.

9) The survey does not provide detailed information on broadband speed, tier of pay TV service, and number of channels etc. Since the reported monthly costs might reflect these features, using the reported costs could be problematic.

mobile service, alternatives are constructed with the same categories from other mobile providers. Lastly, bundling discounts are applied based on the information on each provider's websites.

I use nested logit model to estimate the demand function in this analysis. Figure 1 shows the structure of consumers' choice in the nested logit, where nests are defined as 4 bundling types. In the first stage, consumers select bundling types such as DPS1, DPS2, TPS, and no bundle. In the second stage, the final alternative is chosen among alternatives included in each group which is chosen in the first stage.[10] This structure takes into consideration market conditions in which bundling discounts are fairly large and there is a high similarity in product characteristics including prices among service providers.

Figure 1. Decision tree in nested logit model



In the nested logit model, the probability of individual *i* choosing alternative *j*, Pr(y_i=*j*), is equal to the product of the probability to choose some alternative in nest B(*j*), Pr{$y_i \in B(j)$} and the conditional probability to choose exactly alternative *j* given some alternative in the same nest B(*j*) is chosen Pr{y_i=*j* | $y_i \in$ B(*j*)}; that is

$$P_j = \Pr\{y = j \mid y \in B(j)\} \cdot \Pr\{y \in B(j)\}$$

where the individual subscript *i* is dropped for the sake of a more concise notation. The nested logit model can be derived from a structural model of random utility maximization. The utility for alternative *j* is specified as

$$U_j = X_j'\beta + z'\gamma_j + \epsilon_j$$

where *z* is a set of individual-specific variables and X_j is a set of alternative-specific variables, and ϵ_j is a random error term. In this study, alternative-specific variables are such as price, dummies for brands for each service, while individual-specific variables include income levels, residential areas, ages, and education levels. I allow coefficients of individual-specific variables to vary with first level alternatives which are bundling types. To identify the model, parameters for the nest of 'No bundle' is set as zero.

10) This structure represents the nature of the consumer choice, not the chronological order of consumer choice.

Table 2. Descriptive statistics

	Variables	Mean	Std
Price (thousand won)	Pay TV	11.73	3.89
	Broadband	14.60	8.85
	Mobile	45.45	13.15
	Total	71.78	19.01
Dummies			
Bundling types	DPS1	0.26	0.44
	DPS2	0.06	0.24
	TPS	0.10	0.29
	No bundle	0.59	0.49
Pay TV	KT IPTV	0.10	0.30
	SK IPTV	0.12	0.32
	LGU+ IPTV	0.07	0.26
	Satellite	0.04	0.20
	Digital cable	0.47	0.50
	Analog cable	0.12	0.33
	No subscription	0.07	0.25
Broadband	KT	0.27	0.44
	SK	0.25	0.43
	LGU+	0.13	0.34
	SO	0.10	0.30
	No subscription	0.25	0.43
Mobile	KT	0.26	0.44
	SK	0.53	0.50
	LGU+	0.20	0.40

Notes: N=7,408

Table 2 shows the descriptive statistics of the data. The average price of the sum of three services is around 72,000 Korean won, while the average price of mobile services is 45,000 won, 63% of the total price. These figures show that mobile services can have the greatest impact on the overall choice in terms of price. However, non-price factors are involved in the consumer's choice, and the effect of price is further reduced as the degree of product differentiation is higher.

4. Results

Before looking at the nested logit model estimates, let us look at the estimation results from the conditional logit model. Table 3 shows the results of the conditional logit model estimation. The coefficients of dummies imply the effect relative to the reference group. ‘No bundle’ is set as the reference group for bundling type. For

brand dummies, 'no subscription' is set as the reference group for pay TV and broadband services, while LGU+ is set as the reference group for mobile service because all individuals in the sample subscribe to mobile services.

Table 3. Estimation results for conditional logit model

Variables		coefficients	t-value
Price		-0.250***	-10.47
Dummies			
Bundling type	TPS	-1.902***	-5.37
	DPS1	-0.816***	-5.72
	DPS2	-1.220***	-9.19
Pay TV	KT IPTV	4.784***	10.53
	SK IPTV	4.822***	11.68
	LGU+ IPTV	5.192***	12.54
	Satellite	2.265***	5.6
	Digital cable	4.285***	12.94
	Analog cable	2.003***	10
Broadband	KT	3.108***	5.93
	SK	2.691***	5.19
	LGU+	2.117***	4.06
	SO	1.470***	3.6
Mobile	KT	-0.016	-0.35
	SK	1.023***	29.48
N= 666,720 (Individuals 7,408 * Alternatives 90)			

Notes: * p<0.05 ** p<0.01 *** p<0.001

The coefficient of the price is negative, indicating that higher price lowers utility as usual. It is noteworthy that coefficients for bundling types are all negative under 1 % of significance level and the absolute value of coefficient is the largest for TPS. This result means that bundled services could reduce consumer utility relative to separate subscription after controlling the effect of price. That is, most of benefits from the subscription of bundled services are coming from bundling discounts, not from the convenience of dealing with the same provider for all the services. If there is no additional utility for purchasing a bundled service except for the price discount and preferred providers are different by services, then the bundled service, which must purchase several services from the same provider, can lower the utility of the consumer. The fact that the coefficient value in terms of absolute value of TPS is larger than those of DPS1 and of DPS2 indicates that the more products you bundle together, the more likely you are not to choose your preferred services. The coefficients of dummies for all of pay TV brands are statistically significant with positive sign, which shows that consumer utility gets higher with pay TV subscription because reference group is defined as 'no subscription'. For broadband services, consumers utility from KT is the highest, followed by SK, LGU+ and SO, sequentially according to the rankings in broadband market.

Table 4. Estimation results for nested logit model

Variables		coefficients	z-value
Price (thousand won)		-0.207**	-2.99
Dummies			
Pay TV	KT IPTV	8.789***	4.39
	SK IPTV	9.452***	4.78
	LGU+ IPTV	10.710***	4.84
	Satellite	1.479	1.54
	Digital cable (QAM)	8.846***	4.99
	Analog cable	3.381***	4.12
Broadband	KT	2.674*	2.03
	SK	1.433	1.23
	LGU+	-0.503	-0.53
	SO	-1.164	-1.81
Mobile	KT	0.248*	2.10
	SK	2.983***	6.38
Middle income level	DPS1	0.094	1.37
	DPS2	-0.163	-1.33
	TPS	0.075	0.76
High income level	DPS1	0.418***	5.14
	DPS2	0.308*	2.34
	TPS	0.515***	4.71
Metropolitan city	DPS1	1.331***	10.81
	DPS2	0.886***	3.88
	TPS	0.813***	4.41
Medium-sized city	DPS1	0.919***	7.35
	DPS2	0.912***	3.99
	TPS	0.985***	5.39
Age <= 60	DPS1	0.964***	11.91
	DPS2	1.357***	7.81
	TPS	1.477***	10.11
College and higher	DPS1	0.240***	3.77
	DPS2	0.516***	4.73
	TPS	0.416***	4.65
LR test for IIA: Chi2(4) = 305.17, Prob > chi2 = 0.0000			

Notes: N = 666,720, * p<0.05 ** p<0.01 *** p<0.001

Notes: income levels are defined as three groups such as ‘High income level’ if income is above 3 million won, ‘Middle income level’ if income is between 1.5 and 3 million won, otherwise ‘Low income level’.

Table 4 shows the estimation results of the nested logit model. LR test for IIA on the bottom of the table indicates that nested logit is probably more appropriate than a standard logit model. The coefficients of consumer characteristics such as income level, residence area, age, education level were allowed to be different according to the first stage choice which is the type of bundling. 'No bundle' is set as the reference group for the first stage. The results show that consumers with higher income level, the urban area, younger age, higher education level have higher probability of choosing the bundled services. Looking at the price and service-specific brand dummies, we can see that the results are generally similar to those of the preceding conditional logit model.

Based on the above estimation results of the nested logit model, I examine the demand substitution between pay TV services. To this end, I simulate the changes in market share of each pay TV service as the price changes. Then I interpret the results in terms of the practice of market definition. The most commonly used method of market definition is SSNIP(Small but Significant and Non-Transitory Increase in Price) test and critical loss analysis is a common application of SSNIP test.[11] There is no answer for how big SSNIP is, but 5% and 10% are employed in general, so I use 5%, 10%, and 20% for the change of price in this practice.

On the other hand, in the critical loss analysis, the critical loss is determined by the percentage change in price divided by the sum of the percentage change in price and the margin. For example, given by 10% increase of price and 60% as margin, the critical loss equals 14.3% (=10/(10+60)). The condition for the market definition is that the critical loss is bigger than the actual loss which is defined as the diversion ratio (the fraction of consumers switching to other services with the price increase). That is, more consumers leave with the price increase, less likely the service is defined as a single market. Table 5 below shows the level of the critical loss to every combination of the margin and the price increase.

Table 5. Critical loss for the price increase and the margin

		Margin			
		20%	40%	50%	60%
Price increase	5%	20.0%	11.1%	9.1%	7.7%
	10%	33.3%	20.0%	16.7%	14.3%
	20%	50.0%	33.3%	28.6%	25.0%

Table 6. Simulation result of market share with the increase of IPTV price

		5% increase		10% increase		20% increase	
	Before	After	Difference (%p)	After	Difference (%p)	After	Difference (%p)
IPTV	29.1%	27.1%	-2.0	25.2%	-3.9	21.6%	-7.5
Satellite	4.3%	4.3%	0.1	4.4%	0.2	4.6%	0.3
Digital cable	47.3%	48.7%	1.4	49.9%	2.6	52.3%	4.9
Analog cable	12.5%	12.8%	0.3	13.2%	0.7	13.8%	1.4
No pay TV	6.9%	7.1%	0.2	7.3%	0.5	7.7%	0.9

11) For discussion of SSNIP test and critical loss analysis, refer to Nam(2008) and Jeon(2007, 2009)

Table 6 shows the change in market share with the increase of IPTV price. When the price of IPTV is increased by 5%, 10%, 20% respectively, IPTV loses 2.0%p, 3.9%p, and 7.5%p in terms of market share respectively. Then, the diversion ratios are 6.9%, 13.5% and 25.8% respectively, implying that the demand for IPTV is quite inelastic. When applying the critical loss analysis, it is very likely that IPTV itself will be defined as a single market. To conduct the precise critical loss analysis, we need to know the margin for IPTV which is not available. However, Table 5 implies that IPTV could be a single market even with 60% as the margin for IPTV at 5% and 10% price increase. For example, when the price increase is 10% and the margin is 60%, the critical loss is equal to 14.3% shown in Table 5. Since the actual loss (13.5%) is less that the critical loss, IPTV is defined as a single market according to this analysis.

Although it is difficult to know the precise numerical value of the critical loss, KISDI(2012) reports that the critical loss with 10% price increase would fall between 16% and 27%, depending on pay TV services. Since the estimated actual loss above (defined as diversion ratio) is 13.5% with the 10% price increase, IPTV can be a single market if the critical loss reported by KISDI(2012) is correct. In addition, considering that the degree of competition in the pay TV market has risen since 2012, it is reasonable to assume that the margin for pay TV would be lower in 2016 than in 2012, which means that the critical loss might be even higher in 2016. Hence, IPTV is highly likely to be defined as a single market according to the analysis of critical loss.

However, I do not believe that this result should be interpreted as evidence that IPTV is a single market with low substitutability. Rather, it reflects the tendency to subscribe to pay TV service as the form of bundled service with broadband as well as mobile services. As consumers prefer bundled services, the effect of price change of the pay TV only would be limited on the competition in the pay TV market. On the other hands, there is an additional effect of the price change of pay TV on the competition in the broadband market as well as in the mobile market. The same pattern is found in simulation results with the change of satellite price. Table 7 shows the change of market share when satellite price increases, indicating that diversion ratios are even lower than those of IPTV found in Table 6. This result supports the claim that competition between pay TV services is related to the competition in other markets through bundled services. Since only one satellite operator, KT Skylife, exists in Korea, the estimated diversion ratio means that satellite operator maintains its current price level in spite that it could increase profits by increasing the price, which does not make sense when we consider pay TV market only.[12] Although the increase of price of pay TV service might incur relatively small loss of revenues from pay TV, there exists additional loss of revenues from broadband or mobile service as consumers switch all the services responding on the increase of pay TV price.[13] In a situation where the consumer's choice is based on multiple services altogether, changes in the characteristics of one service have an impact on competition of all the services involved.

12) If the satellite is a single market, then KT skylife is the monopoly. When we apply the critical loss analysis to the monopoly market, the condition of the market definition is not satisfied, which is wrong. The monopoly sets the price to maximize the profit, so that any deviation from the current price level incurs profit loss. This is called the Cellophane fallacy.

13) Same patterns are found from the simulation of cable prices.

Table 7. Simulation result of market share with the increase of satellite price

		5% increase		10% increase		20% increase	
	Before	After	Difference (%p)	After	Difference (%p)	After	Difference (%p)
IPTV	29.1%	29.2%	0.1%	29.4%	0.3%	29.6%	0.5%
Satellite	4.3%	4.1%	-0.2%	3.9%	-0.4%	3.5%	-0.8%
Digital cable	47.3%	47.4%	0.1%	47.5%	0.1%	47.6%	0.2%
Analog cable	12.5%	12.5%	0.0%	12.5%	0.0%	12.5%	0.1%
No service	6.9%	6.9%	0.0%	6.9%	0.0%	6.9%	0.0%

5. Conclusion

I have estimated the demand function for pay TV services with the consideration of bundled services by using the nested logit model. Then, I examined the change of market share with the price changes, and then interpreted the results in the sense of market definition. The main results are as follows. First, when the price is controlled, the utility from bundled services tends to decrease as the number of services included in the bundled services increases. This result suggests that the bundling discounts might be a major motivation for subscribing through bundled services, rather than the utility increase from the collective purchasing of multiple services from the same provider. Second, simulation results show that the price change in pay TV service affects relatively little on the competition in the pay TV market, which also implies that there would be additional effects on broadband and mobile competition. These results give important implications for the market definition of pay TV services. Simulation results about demand substitution mean that IPTV, satellite, cable services can be defined as each separate market, when we apply the critical loss analysis. However, simulation results should be interpreted as the interdependence of the competition in pay TV and telecommunication services rather than evidence for defining the narrow market for each pay TV service. When the market experiences rapid changes, it is not a good approach to apply the critical loss analysis as it is. Estimated low demand substitutability between pay TV services indicates that evaluating the competition in the market should take into account the influence of competition of pay TV on other markets and vice versa.

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