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Analysis on Switching Cost versus Bundling Price

Under Consumer Adoption for Choosing Smart TV over Pay TV

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Abstract

The emergence of smart TV device encourages the reconsideration of the customer's subscription on the pay TV so that the phenomenon of cord-cutting evokes the other dimension of MVPD (Multi-Channel Video Programming Distribution) industry itself. Two major paths to adopt the new platform in MVPD market cover the switching cost and effect for the new platform such as smart TV and restrain the discount price by bundling triple-play which is one provision over a single broadband connection of two bandwidth-intensive services such as high-speed Internet access and television, and the latency-sensitive telephone. The research question over this simultaneous equation model exhibits that rate of customer subscription affects with more attention from demand-pull phenomenon by the high switching cost versus bundling price for multiple play service in behavioral economics way. Behavioral economics can explain the way of consumer's choice by providing it with more realistic psychological foundations. The hypothesis investigates the incentive mechanism has positive effect from the discount rate by tying the product bundling within MVPD service provision.

Shapiro and Varian (1998) examine some of the business strategy implications of switching costs at a lay reader level. The switching cost results in the lock-in effect and takes scale economies of demand side. Farrell and Shapiro (1989) mention that once they are locked in, they can be a substantial source of profit whether it is substitution or not. Also customer left

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the current service due to that cost. The prerequisite for switching cost investigate the product complexity (Gatignon and Robertson, 1992; Klemperer, 1995), heterogeneity of supplier in market (Schmalensee, 1982), the product diversity from the supplier side (Blattberg and Deighton, 1996; Klemperer, 1995; Ram and Jung, 1990), the level of modification in consideration of customer demand (Bhardawaj et al., 1993), the experience of alternatives (Bhattachary et al., 1995), the experience of switching choice (Bhattacharya et al., 1995; Nilssen, 1992), and time limitation of selection pressure or individual characteristic of risk aversion could be the factor to reorganization of switching cost by customer. Previous literature tries to explore the path and find out the factors which effect on the customer's switching behavior.

In terms of previous finding, this study categorizes the major effects by adoption of smart TV over Pay TV consist of four dimensions; the price effect, substitution effect, bundling effect and socio-demographic characteristic effect by household. The most important measurement factor by adoption of new platform service can be the economic factor; switching cost and bundling price directly and indirectly. The survey data is conducted by KISDI (Korea Information Society Development Institute) from 2010 to 2013. Recent panel data have 10,000 individual subscribers and 4,000 household with subscription fee of MVPD and the adoption of smart TV device by household. The data indicate the personal characteristics of using information goods and how various they adopt the media content, how often they spend the time with smart device, and total amount of time. From the technology push driven can predict the TV everywhere market in the pay TV and Smart device market.

The result highlights the insight to predict current trend of new device platform as well as the adoption of customer purchase and adoption within the price scheme. This finding is appropriate the telecommunication firms' new business model target is for bundling discount price scheme or lower switching device cost. This simultaneous equation model analyzes how they interact between the indirect and direct path for the adoption. Also it is being developed and tested the current cord-cutting phenomenon. This conclusion activates the government support system for technology push trend within the demand pull as well. The creation of ecosystem in smart TV over Pay TV meets the customer's satisfaction.

Keywords: Pay TV market, Switching cost, Bundling price, Smart TV, Simultaneous Equation Modeling

JEL Classification: L22, L82

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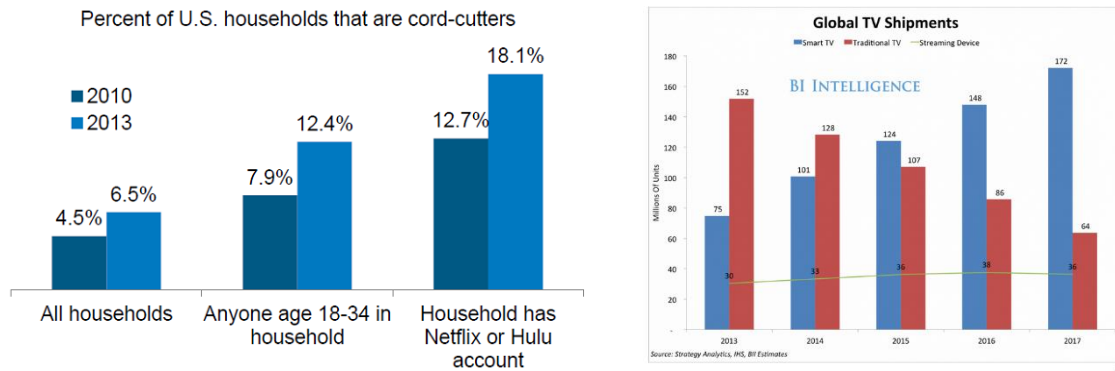
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1. Introduction

Cord-cutting and cord-shaving is on the rise of pay TV trends. In the second quarter of 2010, pay TV industry shrank for first time (Fernandez, 2010). The number of cord-cutter is increasing, according to Centris Marketing Science (2014), 8% of US household became cord cutter in the third quarter of 2013. Blackburn (2014) reports 18.1% of households that have Netflix or Hulu account are cord-cutters. Cord shaving is defined by cutting back on the total amount of subscription fee to have an OTT (Over the Top) service such as Amazon Prime, YouTube Premium and other multimedia streaming service like Hulu and Netflix.

Figure 1. Trends of cord cutter vs. global TV shipments

(Blackburn, 2014; Hoelzel, 2014)



On the other hands, you can buy the smart TV set-top box as well as the Smart TV itself that can provide the TV service as well as the internet web browsing service. World market share of Samsung smart TV is 26.4% at the top of all vendors and second place is LG TV with 14.4% in December 2013 (Smith, 2014). The global smart TV shipments in 2013 is 76 millions of units (Watkins, 2014), and by the prediction of Hoelzel (2014), it will grow as the graph above. Web TV streaming device provided by Roku and Google's Chromecast which have sold about 3.8 million units in U.S. market. This phenomenon can explain by the behavioral economics that consumer changes their behavior of way to adopt the subscription of TV. Why are these changes so important to response this current smart media phenomenon? Why the consumers change the type of their subscription? This paper tries to analyze the advantage of this cord-cutting and cord-shaving phenomenon and harmful effect of cord cutting. In general, consumer has a choice under the economic reason. But recent choice from technology to technology varies their reason by others' opinion and customers' ranking

through the video clips. People want to know everything what other think it by their surrounded network.

Table 1. Data classification

Classification		Obs.	Total	%
Smart TV User Sample	2011	115	1541	7.46%
	2012	252	2516	10.02%
	2013	391	3030	12.90%
	No reply	6		
Non- Smart TV User Sample	2011	1420	1541	92.15%
	2012	2264	2516	89.98%
	2013	2639	3030	87.10%
	No reply	6		

In South Korea, among those household units responding to the KISDI panel survey, the sample data set does include some data no reply to adoption of smart TV. The household who use the smart TV increase from 7.46% (115 households) in 2011 to 12.9% (391 households) in 2013. The adoption rate of total household for smart TV is growing about three percentage of total number of household respondent.

2. *Switching cost of smart TV*

At the news article “How to cancel the cable and to save TV subscription”, the cost for the monthly cable and other broadcasting subscription fee is over 60 dollar per household. With bundling the package with the cable TV, smartphone, and wireline internet at home, there exists the cost saving up to 10 percentage of their total amount. The reason why customer wants to switch TV from the monthly subscription cable broadcasting network to smart TV is not a single one. This study investigates the switching effort and cost to switch in the customer side. But there is hidden cost to switch the products. The cost is to cancel the leased duration for contract to discount their monthly description. Also the learning cost and adaptation cost is the matter of adopt the interface.

Interface problem – Apple TV and Google TV users criticize their interfaces in the result of failure to get market diffusion. When users use the interface to select and search the category of contents and contents itself is so complex. Because of the small remote control, does not control the whole internet access the computer which looks like a TV. Originally TV

itself is the type of lean-back and couch potato types median. However the smart TV should not easy to control over the traditional and little user customized controller. smart TV does not recognize the users' voice and user's perception. The total cost for switching is learning new control device over the smart TV. It should be the method of controller with artificial intelligence technology.

In economic way, the switching cost might be the better off than the current sunk and opportunity cost to switch the product. Farrell (2001) define that a consumer faces a switching cost between sellers when an investment specific to his current seller must be duplicated for a new seller, that is, the switching cost is caused by the consumer's desire for compatibility between his current purchase and a previous investment. Shi et al. (2006) studies shocks by the reduction of consumer switching costs to the Hong Kong wireless telecommunication industry. A policy allowed consumers can hold their phone number when they switch providers. As a result, the unit price of service dropped as expected. However, the larger network provider expands market share more than smaller firms that are struggling. This paper analyzes networks' price and market share of the market from 1998 to 1999 to explain the consequence. Chen (1997) looks into the effect of switching costs in markets with repeated purchase. In a two-period duopoly model, two firms' market share are defined at the first period. At the second period, both firms can offer discount to each of new customers or cannot do this price discrimination.

The switching cost to smart TV is enough to encourage the change the medium of having the broadcasting signal at home and in mobility situation. In the rational economic people, they does not choose the smart TV from the adjusting new interface and new system. The switching cost contains learning cost and adaptation cost. Mckenzie (2003) defined the switching cost as if they are unmitigated blessing to incumbent firms because switching costs and locks in consumers. The lock-in effect in pay TV market seems given to its technology. Nilssen (1992) and Farrell and Klemperer (2007) address that some of the switching costs are learning costs that are for the consumer when they buy the product for the first time but not subsequently. Farrell (2001) states that switching costs do not only apply to repeat-purchases of identical goods. Villanueva et al. (2007) considered the switching cost in the context of customer recognition. The perception of switching cost is different by occasion and those learning effect can be explained as the switching cost either. In the pay TV market, one of substantial of switching cost is termination cost from existing pay TV service provider which

is IPTV, satellite TV or cable TV. However, the termination cost is varies from the period of contract. It can be assumed to calculate by firm's profit margin from that cost. Another example of switching cost is the search and evaluation cost for leaving the existing product and search for the new product (Shugan, 1980; Iyengar & Lepper, 2000; Kuksov & Villas-Boas, 2008).

So this study describe the switching cost as (1) searching cost (Villanueva et al., 2007) (2) learning cost (Nilssen,1992; Farrell & Klemperer, 2007) (3) new product adoption cost (4) termination cost (5) uncertainty cost (Klemperer, 1995; Jones et al., 2002). However this study stays on the economic factor not by the supplier sider but by the consumer side. The supplier side's profit profile does not guarantee the how demand pull of smart TV technology will forecast with future market on the pay TV. Also Beggs (1989) and Cabral (2008) mentioned that the sequential choice of product will explain the direction of innovation and what the consumer group can be differentiated by the selection of smart TV.

3. Bundling price in pay TV market

The previous section discuss about the switching cost's effect as the result of lock-in the certain firms and technology and it also the lock-in effect how much discount from bundling price. Hurkens et al. (2011) argues convergence in IT sector makes switching costs far larger, so bundling becomes a major strategy. When the incumbent competes against specialist entrants, bundling is always a credible for its own profit. And as the number of products in a bundle increases, the entry barrier is more important.

Adams and Yellen (1976) describes that bundling refers to the practice of selling two or more distinct goods together for a single price. Since the purposed for bundling products is for the firm's economics perspectives that one of lock-in strategy for improving the market power. It is possible to have the optimal pricing with two part tariff for pursuing the profit of firms'. To enhance the market power, the dominant firms provide the bundling price. The marginal profit can obtain from the efficiency that bundling offer low marginal cost goods may therefore lead to "winner-take-all" outcomes. In addition, content product has same characteristics due to zero marginal cost of providing additional copies of the information good. There are numerous studies from the supplier view point, the economics of bundling price is very anticompetitive issue and to obtain the anticompetitive position. However,

video-on-demand market share in pay TV market is less than 5 percent compared to 65 percent of sales revenues comes from the subscription fee by monthly based. The pay TV companies support the ultimate price of price bundling as fierce marketing strategy.

The unnecessary price for this fierce marketing strategy is over price with ultimate price. For example, bundling price of online and offline product is magazine and newspaper (Li, 2013). This online-offline bundling service made a great success in general. The negative aspect of bundling strategy is deterring the entry level of new technological innovation (Whinston, 1990; Bakos & Brynjolfsson, 2000; Choi & Stefanadis, 2001). In addition, the market structure would be monopolized and doupolized at the end (Farrell and Shapiro, 1988). When there is assumed that two type of customers; the high demand type's demand function ($X_H(p)$) and low demand type's demand function ($X_L(p)$). Then the profit maximization problem for the monopolist is $\max_p 2V_L(p) + (p - c)[X_H(p) + X_L(p)]$ that $V_L(p)$ is the indirect utility of low demand type. The first-order conditions for this problem is $p - c = \frac{X_H(p)+X_L(p)}{-X_H'(p)+X_L'(p)}$. Bakos and Brynjolfsson (1999) means when there is the difference between

high and low demand getting larger, the price cost margin also gets lager. So the reason why provider discriminate bundle by price is to segment the customer by their demand type. When they discriminate the price with smart device with various contents such as information goods, there evokes the increased barriers to entry as well as the willingness to pay by price discrimination.

In addition, bundling significantly enhances firm profit and overall efficiency. However, the cost caused by the reduction of consumer surplus is even stronger for information goods that have zero marginal cost. Bakos and Brynjolfsson (2000) extends the model to discussions with large-scale bundling and competition arising from the internet as a new distribution channel. Information goods are usually produced with very low marginal costs, so adding goods and enlarging a bundle is easier. An entrant with a single good competing against a good in a bundle faces an aggressive pricing by the incumbent. The incumbent can offer almost zero cost for the competing good in its bundle that makes the potential profit zero. The incumbent may apply this strategy for all goods in its bundle to compete these single-good entrants. Nalebuff (2004) shows the entry-deterrent effect of bundling is larger than the price discrimination effect of that. With a simple two-good market model, the paper examines the pure bundling effect and bundling discount effect, both of

which reduce the entrant's potential profit.

Figure 2. Relationship between entry costs and incumbent's profits of Nalebuff (2004)

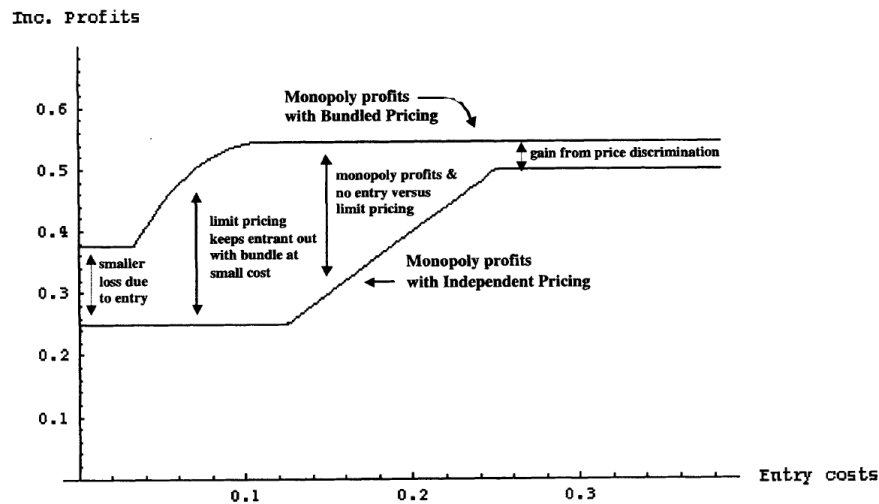


Figure 2 exhibits the entry-deterrent effect as a result of Nalebuff (2004). The maximum monopoly profit with independent pricing is 0.50. But with bundled pricing, the incumbent can earn 0.04 more from price discrimination. The incumbent with bundled pricing earn more than with independent pricing even though the entry barrier doesn't work when the entry costs is below 0.034. When the entry costs is above 0.1, there is no entrant in the market with pure bundling. However, the incumbent with independent pricing is still suffering from entrants and should apply limit pricing until the entry costs reaches 0.25.

Table 2 is an example of how much amount of discount the telecommunication providers are recently offered for bundling services such as double play service, triple-play service and quadra-play service. Korean telecommunication market is oligopolistic dominated more than 99 percent of total mobile service subscribers by three companies - SKT has 50.02%, KT has 30.09% and LGT has remaining 19.89% of the market in 2013. All of them provides 30-40 dollar discount to quadruple play services by month. Among discounts on four services, a discount on mobile subscriptions in a same household is the largest in KT and LGT. SKT gives internet service for free with more than 3 mobile service subscribers in a household.

Table 2. Bundling prices and discounts offered by Korean telecommunication providers

Service category		Bundling PRICE (KRW/USD)	Total amount of DISCOUNT (KRW/USD)
KT			
Quadra play service	TV+INTERNET+VOICE+MOBILE	330,500/308.37	41,300/38.53
Triple play service	TV+INTERNET+VOICE	38,500/35.92	3,300/3.08
	TV+INTERNET+MOBILE	324,780/303.02	41,300/38.53
Double play service	TV+INTERNET	32,780/30.58	3,300/3.08
	TV+VOICE	19,800/18.47	
	TV+MOBILE	344,080/321.03	
IPTV service	TV	14,080/13.14	
SKT			
Quadra play service	TV+INTERNET+VOICE+MOBILE	337,700/315.07	35,870/33.47
Triple play service	TV+INTERNET+VOICE	43,570/40.65	
	TV+INTERNET+MOBILE	337,700/315.07	34,870/32.53
Double play service	TV+INTERNET	42,570/39.72	
	TV+VOICE	10,900/10.17	
	TV+MOBILE	337,700/315.07	2,200/2.05
IPTV service	TV	9,900/9.24	
LGT			
Quadra play service	TV+INTERNET+VOICE+MOBILE	318,890/297.52	39,600/36.95
Triple play service	TV+INTERNET+VOICE	39,490/36.84	2,200/2.05
	TV+INTERNET+MOBILE	317,790/296.50	37,400/34.89
Double play service	TV+INTERNET	38,390/35.82	
	TV+VOICE	14,190/13.24	
	TV+MOBILE	327,690/305.73	
IPTV service	TV	10,890/10.16	

* Assume 4 members in a household use same mobile service and without mobile-only discount & discount for regular customers

* 3-year contract monthly price, including taxes & the base charge only for voice service & currency at 8 October, 2014

4. Behavioral economics

Behavioral economics is defined the terms “Availability Heuristic” (Camerer, 2011). This availability heuristic is tend to provide the relative rational than the so complex solution from the exact algorithm based solution. To evaluate behavioral economics, Stigler (1965) mention to judge by the reality, generality and tractability. The representative behavioral rational for development of growth sales is the Bass model (Bass, 1969). This model have a strong assumption with the timing of initial purchase of new products is based upon the probability

of purchase at any time is related linearly to the number of previous buyer. Lee et al. (2012) suggests an empirical model to analyze the factors affect the adoption of smart TV, as a representative of convergence media. The paper examines the intention of consumer use is associated with the performance expectancy, the effort expectancy, and the social influence. These six factors that are expected to give influence on these three components are selected through prior literatures. To evaluate the interaction among these elements, simultaneous equation model based on UTAUT (the Unified Theory of Acceptance and Use of Technology) applied to the survey data. Based on the behavioral rational, this study categorizes the adoption and selection of smart TV over the OTT and Pay TV. The parameter value for the behavioral model can be fitted against any algorithm based parameter value. In the behavioral economic parameter for selection between the pay TV and Smart TV, there are the important factors that can figure out the result.

First factor is economic reason which is that the discount price from the smart device under technology development and saving cost from the monthly subscription fee by cord-cutting and shaving. Colgate and Lang (2001) categorize switching barriers and compare the relative importance of them based on survey data from consumers of bank or insurance company who decide not to switch even if they pondered moving. Shaffer and Zhang (2000) compares two strategies: paying consumer to switch and paying consumer to stay. It depends the price of each firm and the switching cost of each consumer group in two-price setting firm model. The brand royalty indicates the switching costs in the model.

The second factor is user satisfaction. The consumer enjoys the connected environment through the application development from the variety and seamless connection. These user satisfaction causes from the incentive for technology development from the supplier side. User satisfaction is result from the user intention, which is behavioral intention. In the switching cost, Burnham et al. (2003) shows the integrated effect of procedural, financial, and relational switching costs is positively related to consumers' intention to stay with an incumbent provider. It also mentions that the switching costs explain consumers' intention better than consumers' satisfaction. This study shows a typology of switching cost by consumer side and a theoretical framework to test consumers' perception of switching cost. In addition, Keaveney(1995) defines behavioral intentions are an imperfect proxy for behavior. The intention of switch is consists of the contribution of quality and satisfaction uniquely to service switching (Bintner, 1990; Boulding et al., 1993). Keaveney (1995)

categorizes the switching behavioral intention into pricing, inconvenience, core service failure, service encounter failure, response to service failure, ethical problem, competition for finding better service and involuntary switching. There is evolving issues in switching behavioral intention or decision related to switching psychic causes and cost of switching.

In addition, the third factor is the change of technology environment from IoT (Internet of Things). The smart TV can be the hub for controlling the electronic device from individual smart device to smart home and smart city device. The behavioral model is for these experience goods. QoE (Quality of Experience) is more focused on customer experience using smartphone or smart TV devices. QoE holds customer loyalty with continuous experience within the service provider. Burnham et al. (2003) adapts the structural model to the survey data from consumers of the credit and card the long-distance. The model investigates the major theoretical factors that affect consumers' intention to stay – product complexity, provider heterogeneity, breadth of use, extent of modification, alternative experience, and switching experience suggested in prior research – at user-centric view.

Focusing on the economic reason, this paper investigates 5 hypotheses with respect to switching cost of smart TV and bundling of pay TV with following parameter estimate.

Hypothesis 1.

The subscription of bundling service at T times has effect on the selection of smart TV at T+1 time.

Hypothesis 2.

The switch of smart TV at T time has negative effect on the number of bundling service subscription at T times.

Hypothesis 3.

The amount of bundling service telecommunication/broadcasting subscription fee at T times has positive effect on the switch of smart TV at T time.

Hypothesis 4.

The higher income group per household have has positive effect on the selection of smart TV at T time.

Hypothesis 5.

The regional size of household area has positive effect on the selection of smart TV at T time.

5. Data and methodology

5.1 Data

Data source is KISDI Media Panel from 2010 to 2013 for 4 years. KISDI (Korea Information Society Development and Institute) lead the survey on the household and individuals with personal data and media diary and it has 10,319 of personal data set and 4,381 of household data each year. The sampling is stratified, considering the distribution of demographics in Korea. Furthermore the extensive survey form of media diary is the information about each person's media behavior in random straight three days. These data can anticipate on how the media have categorized, how they use, and how they can reuse. For selecting variable, Keaveney (1995) provides a base model to examine customers' switching behavior in service industries. The questionnaire asked 25 different services that respondents had purchased during previous six-month period. Through the critical incident technique, answers are coded into separate critical behaviors of service providers which cause customers to switch. As shown in Keaveney (1995), 'core service failure', 'failed service encounter', and 'pricing' are the three most frequently answered reasons to makes customer switching. The 'pricing' category of this paper contains high prices, price increase, unfair pricing practices, and deceptive pricing practices. And the more than half of service switching is involved in multiple reasons. We apply the switching cost of smart TV in terms of price of smart TV for each provider: Samsung, LG, Daewoo, Sony, Panasonic, Phillips, and other domestic vendors. The following table 3 shows the definition of each variable by property.

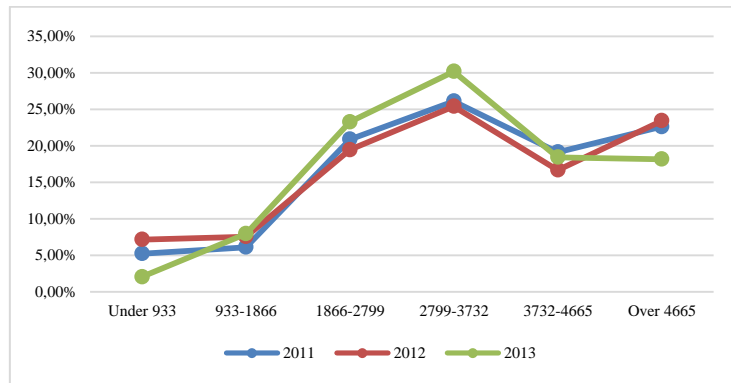
Table 3. Variable definition

Property	Variables	Definition	Scale
Smart TV adoption	S_tv1	[Media Device] Adoption of Smart TV in 2011-2013- TV1	Adoption:1, Non-Adoption:2
	S_tv2	[Media Device] Adoption of Smart TV in 2011-2013- TV2	Adoption:1, Non-Adoption:2
	S_tv3	[Media Device] Adoption of Smart TV in 2011-2013- TV3	Adoption:1, Non-Adoption:2

	S_tv4	[Media Device] Adoption of Smart TV in 2011-2013- TV4	Adoption:1, Non-Adoption:2
Switching cost	S_Brand1	[Media Device] Manufacturer - TV1	Samsung:1, LG:2, Daewoo:3, Sony:4, Panasonic:5, Philips:6, other Korean manufacturers:9
	S_Brand2	[Media Device] Manufacturer – TV2	Samsung:1, LG:2, Daewoo:3, Sony:4, Panasonic:5, Philips:6, other Korean manufacturers:9
	S_Brand3	[Media Device] Manufacturer – TV3	Samsung:1, LG:2, Daewoo:3, Sony:4, Panasonic:5, Philips:6, other Korean manufacturers:9
	S_Brand4	[Media Device] Manufacturer – TV4	Samsung:1, LG:2, Daewoo:3, Sony:4, Panasonic:5, Philips:6, other Korean manufacturers:9
Bundling service	B_service	[Telecommunications/Broadcasting subscription] Adoption of Bundling Service	Subscription:1 Non-Subscription:0
	B_bundle	[Telecommunications/Broadcasting subscription] Number of Services in the Bundle	Number: 1,2 3
Price effect	S_Fixed	[Telecommunications/Broadcasting subscription] Average Subscription Fee of Fixed Line Phone	
	S_Internet	[Telecommunications/Broadcasting subscription] Average Subscription Fee of Internet	
	S_PayTV	[Telecommunications/Broadcasting subscription] Average Subscription Fee of Pay TV	
Substitution effect	B_Cable	[Telecommunications/Broadcasting subscription] Pay TV Subscription – Bundling Cable TV service	B_service * P_Cable
	B_Satellite	[Telecommunications/Broadcasting subscription] Pay TV Subscription – Bundling Satellite TV service	B_service * P_Satellite
	B_IPTV	[Telecommunications/Broadcasting subscription] Pay TV Subscription – Bundling IPTV service	B_service * P_IPTV
Pay TV effect	P_Cable	[Telecommunications/Broadcasting subscription] Pay TV Subscription – Cable TV Service	Yes:1, No: 0
	P_Satellite	[Telecommunications/Broadcasting subscription] Pay TV Subscription – Satellite TV Service	Yes:1, No: 0
	P_IPTV	[Telecommunications/Broadcasting subscription] Pay TV Subscription – IPTV Service	Yes:1, No: 0
Control variable	H_member	[Household Information] Number of Household Member	1 person:1 ~ 10 persons :10
	H_urban	[Household Information] Urban/Rural Area	Urban Area:1 Rural Area:2
	H_income1	[Household Class] Average monthly income (Unit: 497 USD)	Under 497:1~Over 7944:17
	H_income2	[Household Class] Average monthly income (Unit: 993 USD)	Under 993 :1 ~ Over 4663:6

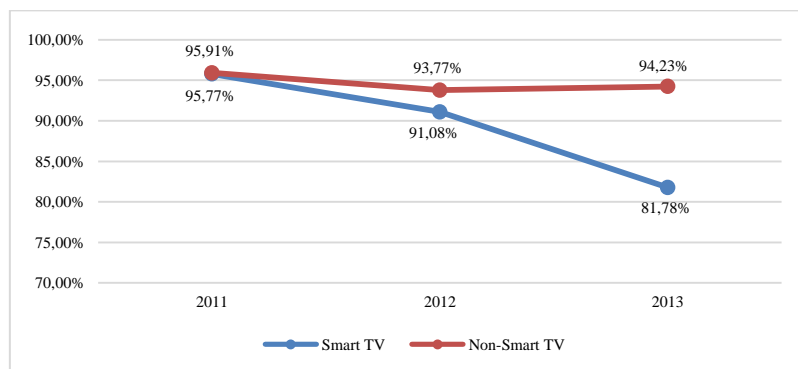
Figure 3. Average monthly income group with adoption of smart TV

(Unit: 993 USD/One million KRW)



The adoption rate of smart TV is the highest in the income bracket 2799-3732, and the bracket 1866-2799 is following. The rate is the lowest in the bracket under 933. The 3732-4665 and the over 4665 group have smallest number of samples, so it may affect the smart TV adoption ratio of these two group. To measure the effect of each income bracket, we apply quantile regression.

Figure 4. Number of subscription in the bundling service – Smart TV vs. non-Smart TV



The ratio of user who subscribes one bundled service was almost the same percentage in 2011, both smart TV users and non-smart TV users. From 2012 to 2013, the decreasing pattern in the proportion of smart TV adopters subscribes bundled service. On the other hand, the proportion of non-smart TV adaptors who subscribe bundled service shows slight variation.

Figure 5. Adoption rate comparison within the offered bundling services

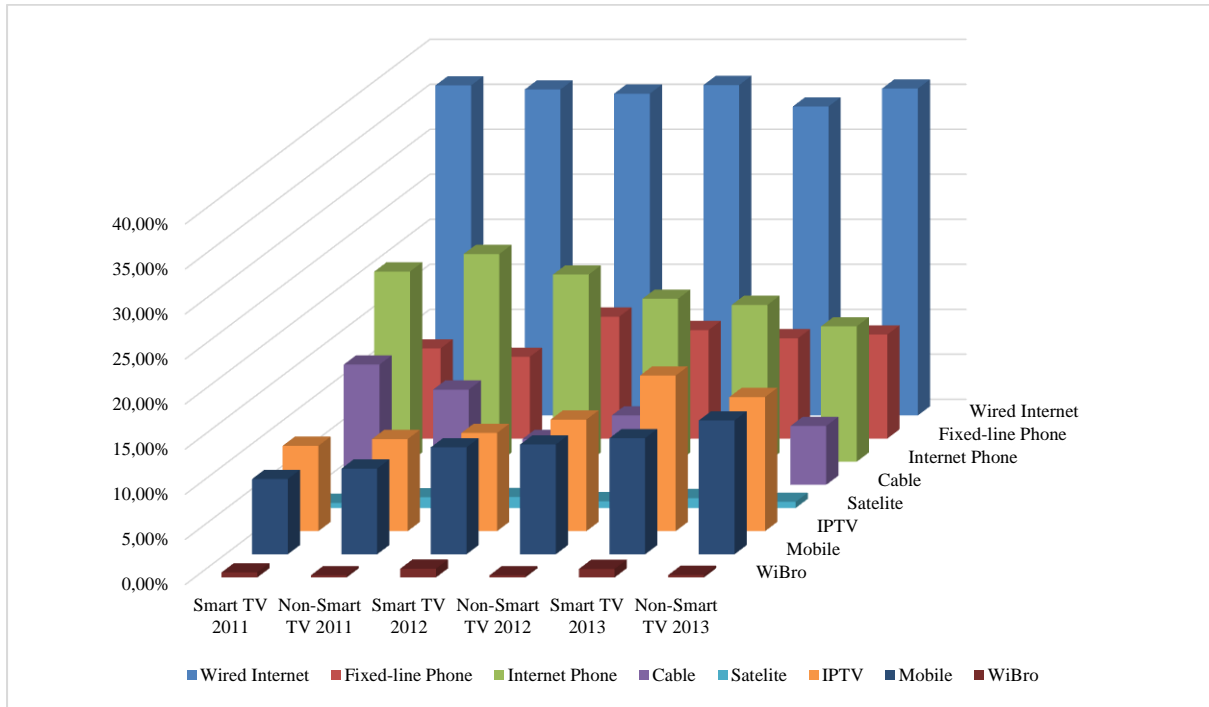


Figure 5 shows which bundling service the most frequently adopted through comparison between the adoptions is of smart TV by year. Around 35% of consumer subscribes wired internet service in a bundle, followed by internet phone (17.40%) and IPTV (17.23%) among smart TV adoption household in 2013.

5.2 Three stage least square (3SLS) panel data regression

The empirical model consists of three year panel dataset to identify a set of time-invariant criteria including observable demographic characteristics to construct data. Equation 'Y = ZB + ε' represent that Y is the dependent variable for switching behavior and disturbance ε assume for the $E(\varepsilon\varepsilon') = \Sigma$ and $E(\varepsilon) = 0$. The first stage of 3SLS needs the endogenous variable which represent both endogenous as well as the exogenous. y_{it} is switching behavior in the matter of type of smart TV brand and actual adoption of smart TV. $\hat{Z}_i = X(X'X)^{-1}X'Z_i$ designates the set of all exogenous variables as X and \hat{Z}_i contain the instrumented value for all the regressors. Σ Estimator can be formed from the residuals of 2SLS estimates of each equation of system. Measurement errors in the error terms are not correlated with X, because X does not vary over time (Verbeek & Vella, 2005), ε_{it} is

uncorrelated with the explanatory variable, regional data controls account for unobservable price variation. It maintains the full system of coefficient and allows constraints to be applied when the residuals are computed. Our model applies three-stage least square regression that these equations could be related through their error-terms with the SUR-regression. Theil (2000) proposed the 2SLS and 3SLS with simultaneous equation model. Where linking the equations by their error-terms in the regression increases the efficiency of the results and uses all information available. Zellner and Theil (1962) means the first and second stage are the same as for 2SLS and they add a third stage to compute the GLS estimator and construct the new covariance matrix Σ . When estimating a system by SURE, these iterated estimates will be the maximum likelihood estimates for the system and restriction parameterization for many linear systems under full 3SLS (Greene, 2012; Davidson & Mackinnon, 1993).

Prince and Greenstein (2011) adopt the methodology that the choice model considering price, lagged variables - purchase of service, bundling status and three services - and demographic information. Applying the solution from Moffitt (1993), the endogeneity concerns from lagged variables are removed. The latter 3 variables are the averages for Y, T, and B in group g at time t . Moffitt (1993) provide information about Y_{gt-1} , X_{it} , T_{it-1} , and B_{it-1} with 2SLS approach in order to remove endogeneity concerns. Therefore the most concise way to represent a system of equation for 3SLS requires in full matrix (Greene, 2012). Endogenous variables in our model are S_tv1 Brand_swc B_bundle and exogenous variables are B_service S_Fixed S_Internet S_PayTV B_Cable H_member H_urban H_income1 in overall.

$$\begin{aligned}
 Y_{1it} &= \beta_{10} + \beta_{11}X_{it-1} + \beta_{12}B_{it} + \beta_{13}T_{it} + u_{it} \\
 Y_{2it} &= \beta_{20} + \beta_{21}X_{it} + \beta_{22}B_{it} + \beta_{23}T_{it} + u_{it} \\
 Y_{3it} &= \beta_{30} + \beta_{31}X_{it} + \beta_{32}B_{it} + u_{it}
 \end{aligned} \tag{1}$$

Where

- α_i ($i=1 \dots n$) is the unknown intercept for each entity (n entity-specific intercepts).
- Y_{it} is the dependent variable (DV) where i = household id and t = time.
- X_{it} , B_{it} , T_{it} represents subset of independent variables (IV) for bundling effect, price effect as substitution, socio-culture effect
- β_{11} , β_{21} , β_{31} is the coefficient for that IV,

– uit is the error term

Let Y_{1it} be a binary variable that equals one if household i choose to adopt the smart TV in time t (SMTV) and zero otherwise. In the syntax for 3SLS, y_{2it} is variable for Smart TV brand (Brand_swc) and y_{3it} is variable for the adoption of smart TV in equation (1). X_i consists of bundling choice (B_service) and number of subscribed bundling service (B_bundle), price effect with variable (S_Fixed S_Internet S_PayTV), bundling in other substitute pay TV (B_Cable) and control variable is for regional size (H_urban), number of people in the household unit (H_member) and level of household income bracket(H_income1). Total number of observation is 1337 household samples within 2011 and 2013. The data are analyzed using STATA/SE 12.1. With 3SLS seemingly unrelated regression equation takes the three equations with each representative switching variable.

5.3 Quantile regression model

Additional quantile regression adjust and estimate the conditional quantile function for panel data in Koenker and Bassett (1978), $F_{\tau}(\cdot | X_i)$ is the conditional density function. Underestimating trend using existing ordinary least square regression based trend analysis is one of limitation. So it assumed that there is the conditional linear regression in equation (2). To have the minimization solution in equation (2), the quantile regression does not fit the law of iterated expectation (Koenker and Bassett, 1978).

$$E_{\tau}(Y_i | X_i) = F_{\tau}(X_i) = X_i \cdot \tau, \forall \tau \in [0, 1] \quad (2)$$

The equation (3) delivers from the equation (2). The Koenker and Bassett (1978) shows the solution of conditional quantile analysis with counterfactual quantile regression.

$$\hat{\beta}(\tau) = \underset{\beta}{\operatorname{argmin}} \frac{1}{N} (\sum_{i: y_i \geq X_i b} \tau |y_i - X_i b| + \sum_{i: y_i < X_i b} (1 - \tau) |y_i - X_i b|) \quad (3)$$

$\hat{\beta}$ estimated from the equation of in the percentile scale of τ . In this study, we shows the result 10, 25, 50, 75, 90 percentile scale to forecast from the estimation result of quantile analysis.

$$Q_t(Y_i) = F_{\tau}^{-1}(\tau) \leftrightarrow \int (\int_0^1 1(F_{\tau}^{-1}(\tau) X_i \leq Q_t) d\tau) dF_x = t \quad (4)$$

5.4 Durbin Wu-Hausman test for model specification

To do model specification between 3SLS and OLS, Durbin Wu-Hausman test has been used. Consider the model $y = \beta X + e$, where y is the dependent variable and X is vector of regressors, e is the error term, β is a vector of coefficients with β_{OLS} for OLS regression and β_{3SLS} for 3 stage least square regression. Under the null hypothesis, both of these estimators are consistent, but β_{3SLS} is efficient (the smallest asymptotic variance), at least in the class of estimators containing β_{OLS} . Under the alternative hypothesis, β_{OLS} is consistent, whereas β_{3SLS} isn't.

$$H = (\beta_{3SLS} - \beta_{OLS})'(Var(\beta_{OLS}) - Var(\beta_{3SLS}))^+(\beta_{3SLS} - \beta_{OLS}) \quad (5)$$

Davidson and Mackinnon (1993) states that Wu-Hausman statistic is denotes the Moore-Penrose pseudo inverse. If we reject the null hypothesis, it means that β_{3SLS} is inconsistent that can be used to check for the endogeneity of a variable. Hausman checked the null hypothesis that the covariance between an efficient estimator and the difference of an efficient and inefficient estimator is zero. In our model, H_0 : difference in coefficients not systematic. $\chi^2(8) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 17.33$. $Prob > \chi^2 = 0.0268$. That shows the efficient estimate with the smallest asymptotic variance in 3SLS estimator.

6. Analysis result

The major finding of Prince and Greenstein (2011) is bundling appears to increase switching cost, and it makes reduction of churn in the telecommunication industry. The effect of bundling about churn is shown only during the turbulence period therefore broadband service becomes a substitute of pay-television service as the result of analysis. Chen (1997) compares price, profit of firm, and social welfare when paying customers to switch is allowed (PCT) to when that is not allowed (UNIF). Both firms' profit is lower under PCT. Under UNIF, a firm occupying higher market share charges higher price. But under PCT prices of both firms are independent to market shares. The more consumers switch service provider under PCT than that of under UNIF, so deadweight loss in society is larger, either. When the switching costs become low, Shi et al. (2006) shows the large network provider which charged a very high fixed fee reduces the price to its competitors' level. In addition to that, it offers larger on-net price discount than small network providers. Consequently, the larger network provider gains market share from the small networks. This study implies the reduction of switching costs raises the overall consumer surplus through decreasing imposed total fixed fee, although the effect may not be sustainable in the long run. Shaffer and Zhang (2000) says in a symmetric market paying consumer to switch is the optimal, but in an asymmetric market the optimal strategy is to give discount to the consumer group that has relatively higher price elasticity. It is independent of market shares and brand loyalties. By the result of Lee et al. (2012), the switching cost of smart TV is not negatively involved in the performance expectancy and the effort expectancy, but the social influence. Moreover, consumers regard the service interface and the user interface as important parts. Interestingly, the smart TV-related experiences have no effect on all three factors.

Table 4. Seemingly unrelated regression analysis result

		Switching Behavior					
		Smart TV Adoption – TV1		Switching Cost – Smart TV Brand		Total Number of Bundling Service	
		Estimate	P> z	Estimate	P> z	Estimate	P> z
	Constant	1.996229	***	124.4548		1.068239	***
Smart TV	S_tv1 (Smart TV Adoption)					1.259474	*
Bundling	B_service(Bundling Service Binary, Lagged)	0.0114201		-59.39487			

Effect	B_bundle (Total Number of Bundling Service)						
Bundling Pay TV Effect	B_cable (Cable TV Service Bundling)	-0.0458061	***	111.7702	**		
	B_satellite (Satellite TV Service Bundling)						
	B_IPTV (IPTV Service Bundling)						
Price Effect	S_Fixed (Subscription of fixed line phone)	-0.0019665	**	6.531215	**		
	S_Internet (Subscription of Internet)	-0.0021654	**	4.578914			
	S_PayTV (Subscription of Pay TV)	-0.0013018		3.437703			
	Brand_swk (Switching Cost of Smart TV Device)					-0.0004255	*
Control Variable	H_member	-0.0211099	***	52.6991	**		
	H_urban	0.0537425	***	-139.8637	*		
	H_income1	0.0000179		-0.0501934			
No of Obs.			1927		1927		1927
R-sq, RMSE			0.0192		0.017		-0.2185

* Statistically Significant level at *** 1% ** 5% * 10%

The research question in this paper arise the effect of bundling on the switching behavior to smart TV. To analyze factors such as subscription of bundling service or pay TV service that affect the adoption of smart TV, we divide them into four parts – service bundling effect, price effect as substitute, price effect, and demographic effect dealt as socio-cultural with previous studies. The result gives five findings on the research question.

First, there are (.0114201) positive effect with insignificant level on adoption tendency of smart TV (S_tv1) with respect to having the service bundling over triple play service and quadra-play service in general. As shown in the data from 2011 to 2013, the lock-in effect of bundling service hinders the adoption of smart TV, inducing to maintain discounts on the bundle. One bundling service has 2-year or 3-year contract with a telecommunication provider and pay TV service provider. The kind of bundle including mobile services offers \$360-\$400 discount per year. Then the second hypothesis examines the effect of lock-in according to the number of services in the bundle.

Secondly, there are (1.259474) positive effect in the relationship between the number of subscription in bundling services (B_bundle) and adoption of smart TV. Then, what is the more influencing factor between the number of subscription in bundling services and the subscription of pay TV services, as complement/substitute goods of smart TV. The third hypothesis analyzes the effect on the adoption of smart TV in consideration of the effect of pay TV subscription; divided into cable TV(B_cable), satellite TV(B_satellite), and IPTV(B_IPTV). In the model, B_cable variable is used for the pay TV subscription for

reducing the duplication effect.

Third, the household which don't subscribe pay TV service alone or pay TV service in bundle tends to switch smart TV. Non-subscriber of cable TV is also likely to switch smart TV. As a result of the third hypothesis, the substitution effect between smart TV and pay TV is examined in the consumers' selection Households that are non-subscription households of pay TV or cord cutter have higher adoption rate of smart TV. The new TV platform adoption is affected from the amount of pay TV subscription as S_PayTV variable (-.0013018) as well as the amount of telecommunication and broadcasting subscription among different amount of subscription groups. The survey data include the household information whether households subscribe telecommunication and broadcasting service or not and how much household spend these services (S_Fixed, S_Internet). Respondents choose a bracket of subscription how much they spend per month. These amounts of subscription data reveal the negative effect of the monthly expense for telecommunication and broadcasting service subscription over the adoption of smart TV.

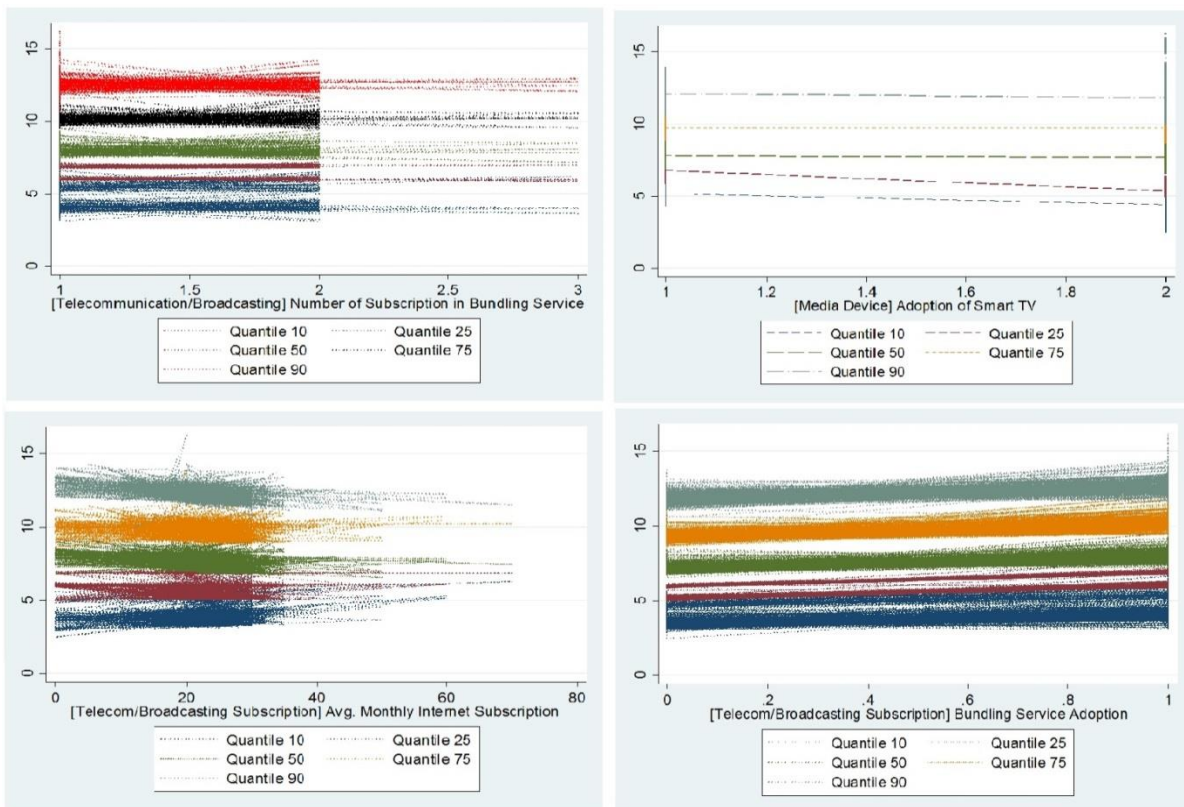
Fourth, the more a household spends for telecommunication and broadcasting service; it gives the more negative influence on the early stage adoption of smart TV as a new platform. Following explanations by bundling and subscription of pay TV service, demographic characteristics such as residential area, number of household member, and average monthly income describe the adoption of smart TV. Hypothesis 4 and hypothesis 5 confirm the effect of demographic characteristics. Households living in metropolitan areas (H_urban) show the higher adoption rate (.0537425) than that of households living in rural area. However it doesn't show the whether residential area gives more significant effect than households' income (H_income1). When analyzing the effect with households' average monthly income, we find the income doesn't give any meaningful effect (-.0501934) on the household's choice of the extra platform on the pay TV platform. As a result of additional quantile regression by dividing the entire income bracket into 10%, 25%, 50%, 75%, 90% with the data, \$1866-\$3732 (KRW 2 million to 4 million) income group, with the largest number of people among the groups, had the most frequent adoption of smart TV platform. The result find the specified income group also doesn't give significant effect (-1.331662 in 10%, -0.8481013 in 25%, -0.1828935 in 50%, 0.076923 in 75%, 0.2806708 in 90% of quantile) but most of groups shows on the household's choice of the smart TV platform on the pay TV platform.

Table 5. Result of quantile regression

	.1 Quantile		.25 Quantile		Median		.75 Quantile		.9 Quantile	
	Estimate	P> t	Estimate	P> t	Estimate	P> t	Estimate	P> t	Estimate	P> t
H_income1_2013										
S_tv2013	-1.331662	0	-0.8481013	0	-0.1828935	0.256	0.076923	0.832	0.2806708	0.647
B_service_2013	0.6564201	0.019	0.8924051	0	0.6405823	0	0.8241759	0.005	0.6366579	0.205
S_Fixed_2013	0.02015	0.073	0.0063291	0.002	0.0090992	0.167	1.28E-09	1	-0.0135334	0.554
S_Internet_2013	0.018955	0.342	-5.01E-10	1	-0.0127389	0.107	0.0027473	0.883	-0.0200059	0.557
S_PayTV_2013	0.034358	0.169	0.0063291	0.102	0.044586	0	0.0549451	0.014	0.0517799	0.169
Constant	5.10646	0	6.677215	0	7.278435	0	8.494506	0	11.45278	0

* Statistically Significant level at *** 1% ** 5% * 10%

Figure 6. Quantile regression analysis result by 10, 25, 50, 75, 90 scale



The fifth findings show that each control variable by demographic measure is significant effect for smart TV adoption. Koenker and Bassett (1978) introduce quantile regression to extend the estimation of quantile functions models with quantiles of the conditional distribution of the target variable as functions of observed covariates. To forecast the graph of each variable using the quantile regression, we use the 10, 25, 50, 75, 90

percentile scale. The equation for the forecast, $\text{pred`quant} = _b[_\text{cons}] + _b[\text{smtv_adoption}] * \text{smtv} + _b[\text{S_fixed}] * \text{S_Fixed} + _b[\text{B_internet}] * \text{S_Internet} + _b[\text{B_payTV}] * \text{S_PayTV}$. From the result of quantile regression, the income bracket by each household shows a positive relationship with respect to the smart TV adoption in term. First there is more positive effect for household of the smart TV adoption living in the urban and metropolitan area than the rural area. KISDI media panel data using classical demographic measures such as income level, regional information of location, and household size. The most important control variable is the income level and household size to opt for a larger number of groups because it allows us to include important controls without completely eliminating variation in our averaged variables.

7. Conclusion and Implication

From the result, the economic analysis shows that individual behavior prefers the selection of certain contents with target time and target concern. The highest barrier among the new platform introduction is not the bundling strategy and lock-in effect itself. In addition, the bundling product is not better off strategy for smart device consumer. The telecommunication providers should concern the limitation of price mechanism with bundling package and tying the service category to maintain the current market share. It is not the same result from Prince and Greenstein (2011). It implies that services provided in bundle bring firms higher margin and bundling makes a kind of entry barrier on the industry because of 'locked in' customers. In summary, bundling helps to retain customers and to sustain market size of both fixed-line telephone and cable TV.

According to the result of Colgate and Lang (2001), the largest and the second largest factor of switching barrier are 'apathy' and 'negativity', respectively, both of which are related with the switching costs. This study implies as an empirical study about the reason why customers don't switch their incumbent provider, by validating and combining the impact of multiple variables. The 'negativity' factor that shows consumers' risk aversion is newly founded in this study. The main result of this study examines not the producer's profit domain but the consumer behavior and characteristics. What is the balance strategy between price discrimination and product discrimination in pay TV market? To discount more subscription rate is less off strategy than new platform technology production. The new

platform technology product is expecting smaller market segmentation for high-end demand than low-end demand. Therefore new platform technology product should focus on the cross-platform strategy with collaborating current dominant player in terms with pay TV and program providers. The effect of price is not same as the quality of service and quality of experience in overall.

Existed market dominant in pay TV has a strategy for tying their mobile product with broadcasting product with some additional charge. The new platform has a negative effect to be selected in 2011 to 2013 data. In addition, there is significant lock-in effect with more bundled package per household. It means that the hyper connector market environment, lots of media, network, and manufacture want to provide the platform service. Therefore the policy agency should keep an eye on the platform service with non-leveraging their existed market power to relevant market. Additionally the policy should not promote their competition level as substitution goods but by complementary goods. The promotion policy in pay TV market does not concern with competition with sustaining the number of subscriber but applying open innovation that collaborate with program providers.

The current market price of new platform does not show the significant effect on adoption by income group. But regional grouping investigate the difference the level of adoption in smart TV. Recent fair trade commission investigate the IPTV provider does not allow the equal quality of service to competitor. So the smart TV subscriber insists to restrain the network speed quality. Therefore if there is a market foreclosure and exclusive dealing between upstream and downstream firm. The policy agency should have a behavior regulation with monitoring their conduct in general. Small and mid-size broadcasting providers need to promote the incentive for investing for new technology. Overall, the selection of each household choose smart TV need to essential on the balance with not spreading their market power to relevant market entry for effective competition market.

The study does not suggest the detailed reason to switch the smart device based on previous study. In addition, the previous literature supports customer loyalty and customer satisfaction regardless of the lock-in effect. Extending this research, future research will continue on the structural equation modeling between the relevant cognitive behavior variables in the relationship between switching behavior and lock-in effect situation for the new platform market entrance.

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Appendix

Table 1. Summary statistics of bundling service, price effect, pay TV, income effect, and area effect from 2011 - 2013

Variable	Obs	Mean	Std. Dev.	Min	Max
S_tv1	7087	10.35671	290.7808	1	9999
S_tv2	844	25.62559	486.3608	1	9999
S_tv3	66	1.954545	0.2098951	1	2
S_tv4	8	2	0	2	2
S_tv2013	13922	0.0293061	0.1686693	0	1
S_tv2012	13922	0.0188191	0.1358908	0	1
S_tv2011	13922	0.0086913	0.0928244	0	1
S_Brand1	11381	7.752306	247.8768	1	9999
S_Brand2	3085	11.46483	311.6573	1	9999
S_Brand3	257	1.680934	1.211657	1	9
S_Brand4	16	1.375	0.5	1	2
B_service	13922	1.631662	0.482371	1	2
B_bundle	5128	1.063378	0.2523161	1	3
S_Fixed	11409	30.40363	407.3299	0	9999
S_Internet	9743	37.4006	377.9948	0	9999
S_PayTV	12471	31.62409	464.3507	0	9999
B_Cable	13922	2.011636	0.8209471	1	4
B_Satellite	13922	3.181655	1.010312	1	4
B_IPTV	13922	3.115142	1.152929	1	4
P_Cable	13922	1.265695	0.4417182	1	2
P_Satellite	13922	1.950223	0.2174924	1	2
P_IPTV	13922	1.868841	0.3375866	1	2
H_member	13922	2.942393	1.301196	1	10
H_urban	13922	1.16183	0.3683082	1	2
H_income1	13922	18.90432	359.1186	1	9999
H_income2	13922	15.38601	349.0977	1	9999

Table 2. The correlation table of bundling service, price effect, pay TV effect, income effect, and area effect in 2013

	B_service	B_bundle	S_Fixed	S_Internet	S_PayTV	P_Cable	P_Satellite	P_IPTV	H_member	H_urband	H_income1	H_income2
B_service	.											
B_bundle	.	1										
S_Fixed	.	-0.0074	1									
S_Internet	.	-0.0082	0.446	1								
S_PayTV	.	-0.0112	0.3364	0.5665	1							
P_Cable	.	0.0606	0.0024	0.0268	0.0236	1						
P_Satellite	.	0.0143	0.0076	0.0062	-0.0181	-0.2729	1					
P_IPTV	.	-0.0824	-0.0187	-0.0275	-0.0118	-0.8225	-0.1205	1				
H_member	.	0.0635	0.0011	-0.0036	-0.0257	-0.0007	-0.0023	-0.0119	1			
H_urband	.	-0.0353	0.0113	0.0153	0.024	0.0599	-0.0964	-0.0144	0.0111	1		
H_income1	.	-0.0107	0.1681	0.1878	0.1413	0.0077	-0.0154	0.0038	0.0218	-0.0156	1	
H_income2	.	-0.0101	0.1819	0.2031	0.1529	0.0127	-0.0181	-0.0001	0.0139	-0.014	0.9258	1