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Willingness-to-pay for FTTH for secured and stable usage of OTT media streaming services

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Abstract

The objective of this study is to investigate the impact of OTT media streaming services on demand for FTTH. Our approach involves analyzing data that comprise the respondents' willingness-to-pay (WTP) for FTTH. The analysis decomposes the WTP by individual characteristics and OTT media service consumption as well as the connection problem experience and expectation of media consumption through the Internet. Respondents are allowed to express their willingness-to-pay for FTTH in a range in order to truly reflect their willingness and flexibility to pay. Coefficients from independent variables are interpreted as a change in the amount of willing-to-pay influenced by the marginal increase of significant variables. The result shows that consumers are willing to pay for FTTH for the secured and stable usage of OTT media streaming services especially movies through the Internet. This study contributes to the projection of market value and the marginal effect of OTT media streaming services on the expansion of the FTTH market. Policy implications are discussed to set regulations that increase broadband penetration at the right price incentives.

Keywords: Optical fiber, Willingness to pay, Over-the-Top (OTT), Media streaming services, Price regulation

1. Introduction

The delivery of services over the Internet which ride on Internet service providers' networks, defined as Over-the-Top (OTT) (BEREC, 2016; Knoblen, 2014; Mnakri, 2015). The continued growth in consumption of OTT services according to their new values created to societies is expected to intensify network bandwidth even more over the next few years (Ericsson, 2015a, 2015b). For Internet service providers (ISP), there is a strong impact on their traditional telecommunications revenues and traffic over the Internet (Baldry, Steingröver, & Hessler, 2014; Seixas, 2015). The primary and largest impact of OTT services is on the Internet traffic concerned with streaming media. In particular, OTT media streaming services such as YouTube, Netflix, and TV program on Internet have been rising and increasing demands for Internet capacity (Baldry et al., 2014; Detecon International GmbH, 2014; Ericsson, 2015b; Greenough, 2016; ITU, 2016; Parks Associates, 2015). While consuming a lot of bandwidth, however, it is no doubt that OTT services are stimulating penetration of the Internet (Knoblen, 2014). This study attempts

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to link these issues to shift in consumer preferences in order to identify the underlying factors that drive demand for higher Internet capacity towards the services.

The objective of this paper is to investigate the impact of OTT media streaming services on consumer's demand for fiber-to-the-home (FTTH). The optical fiber broadband is recognized to provide the highest capacity and speed among broadband services. Governments in many countries have made large investments in developing a broadband infrastructure to deliver high-speed Internet access to end users. However, consumer will not migrate to the more advanced network technology without some push or intervention (Rixen & Weigand, 2014).

Many literatures identify prices as one of key success factors to increase broadband adoption suggesting that governments can use to increase broadband penetration by lowering its price. However, most of those papers do not identify how much is the right price to boost the market. A better understanding of the demand of non-adopters' willingness-to-pay will make it possible for policy makers to regulate and bound the right price to stimulate the technology utilization (Carare, McGovern, Noriega, & Schwarz, 2015). This present paper concerns OTT as a push of the demand for higher Internet capacity. It mainly extends the framework from previous studies that have typically focused on the impact of demographic variables such as age, income and education (Carare et al., 2015) as well as online experiences (Ida & Sakahira, 2008; Rosston, Savage, & Waldman, 2010; Sunada, Noguchi, Ohashi, & Okada, 2011) on consumer's intention to adopt and willingness-to-pay (WTP) for high-speed Internet service.

This study takes Thailand as a case study. The total bandwidth usage in the country is growing rapidly and a lot of OTT services currently available to consumers. In 2015, Thailand is in the top 10 markets worldwide for numbers of hours spent on watching YouTube with 70% growth in hours of content uploaded and 50% of Internet users use YouTube everyday (Yozzo, 2015). Moreover, through many telecommunications policies and frameworks initiated by the Thai government, optical fiber network will be heavily invested. In the near future, fixed broadband infrastructure and services will shift from ADSL to fiber-to-the-home (FTTH) countrywide in order to provide bandwidth to meet increasing demand. Since broadband market in Thailand has been concentrating very much on mobile broadband rather than fixed broadband, it is critical to carefully examine the demand for optical fiber as a mean of internet access for individual users. A better understanding of the demand for FTTH towards non-adopters' intention and willingness-to-pay will contribute as a guideline for policy makers in regulating and bounding the right price to stimulate the FTTH utilization.

The data utilized in the analysis is retrieved from FTTH-non-adopters in Thailand through interview-based questionnaires. Respondents are allowed to express their willingness-to-pay for FTTH in a range in order to truly reflect their willingness and flexibility to pay. In addition, this study also asks respondents whether the mobile broadband prevents them to adopt optical fiber broadband in order to deepen the understanding on the respondent's preference.

2. Relevance literatures

There are several framework aspects among literatures on factors influence high-speed Internet adoption and migration. Most of the studies focus on broadband in general and have typically focused on the impact of demographic variables on consumer's demand for high-speed Internet access. Representative literatures such as Kwak, Skoric, Williams, & Poor (2004), Flamm & Chaudhuri (2007), Dwivedi & Lal (2007), Dwivedi, Lal, & Williams (2009), Sim, Tan, Ooi, & Lee (2011), and Srinuan & Bohlin (2013) indicate that age, income and education level have significant impacts on consumer's intention to adopt and migrate to broadband services. However, Carare et al. (2015) find that income has a lack of predictive power which implies that non-adopters are faced with a variety of barriers to broadband adoption. This present paper tries to develop predictive variables. Percentage of monthly expenditure per income might have a better ability than pure income to explain consumer's demand.

Another related body of research aims to estimate willingness-to-pay highlighting the importance of service characteristics in term of reliability and speed. Savage & Waldman (2005) use conjoint analysis to identify important Internet services attributes for consumers in considering Internet access and willingness-to-pay. Through choice experiments, in contrast, Rosston et al. (2010) estimate a random utility model of household preferences for broadband Internet service. The work indicates that household valuations for broadband service increase with online experience including experience with different Internet connection speeds; number of years online; experience with different Internet-related devices.

Our approach involves analyzing data that comprise the respondents' willingness to pay for higher Internet capacity. Ida and Sakahira (2008) includes motion-picture-viewing, as an independent variable to examine the intention to adopt broadband. Sunada et al. (2011) employ the Nested Logit and Mixed Logit models to specify the broadband access demand. The work conducts simulations to figure out the impact of FTTH coverage expansion on household switching probability from previous ADSL and ISDN access modes. The finding indicates that usage intensity plays a significant role in switching to FTTH if the service becomes available.

However, little is known about the impact of OTT media streaming services on the FTTH-non-adopters' willingness to adopt and pay for FTTH. Extending an analytical framework from previous studies, this paper concerns the effect of OTT media streaming and expectation on future media consumption through the Internet as well as individual characteristics and user's experience of and Internet connection problems on WTP for FTTH subscription. These models will help us to deeply understand the underlying factors that influence the demand for higher bandwidth, especially the impact of OTT services, which further drive consumers' demand for FTTH.

3. Methodology

This study adopts an empirical approach which is based on the data of consumer's demand for optical fiber broadband connection. The model of this study will decompose the willingness to pay by OTT media streaming consumption as well as individual characteristics, user's experience of connection problems, and expectation on future media usage through the Internet in the next 1 to 3 years.

An interview-based questionnaire was carried on with 500 respondents during July 2016. The survey was conducted at main regional airports, bus and train stations in order to cover representative of Thai people from all age groups, genders, income levels, and regions - Northern, Northeastern, Central, Southern, Bangkok and the vicinities. Data was retrieved from respondents who agree in exchange with payment after the complete of all the questions.

The survey asks several key questions that allow to the investigation of the FTTH-non-adopters' willingness to adopt and pay for FTTH service. The questionnaire consists of individual's profile, telecommunications service experiences, OTT services consumption, and intention to adopt and willingness to pay for FTTH. Individual's profile consists of gender, age, education, occupation, monthly income, and monthly expenditure, living region. It combines telecommunications service experiences such as current usage of Internet connection and connection problems experience including connection drop, upload/download delay, unstable video quality during media watching, and sound or video distortion during video call. These experiences and problems are separated into those from mobile broadband and fixed broadband services. It also includes the problem of the reduction of Internet speed due to reaching the upper limit of the use of mobile broadband package.

The consumption of OTT media streaming services is indicated by daily time spent for movie watching and download, and TV program and video on demand. This part also identifies current and expected within 3 years of consumption channel. For movie, respondents indicate their intention to watch movie through the Internet more than traditional channels in the next 1 – 3 years. For TV program on demand, respondents indicate their consumption channel between television and Internet on the scaling of 0 to 4. "0" (zero) indicates their preference in using only television while "4" indicates preference in using only Internet. For video clip, respondents indicate their consumption channel between mobile and fixed connection on the scaling of 0 to 4. "0" (zero) indicates that they totally prefer for using only mobile while "4" indicates preference in using only fixed network.

Finally, consumer's preference of FTTH was asked after explaining optical fiber broadband network capacities. Respondents are required to make decisions whether they are willing to subscribe FTTH or not. For those who have intention to subscribe, they are asked their WTP. Those who are not using fixed network, the first answer is considered as a minimum of WTP while those who are currently using fixed broadband, their current monthly price is used as the minimum. With an increment of THB50 (approximately USD1.5), respondents are asked until they stop their WTP. Then, the last price is recorded as a maximum of WTP.

To understand which variables are significantly associated with an increased likelihood of intention to subscribe FTTH service, we estimated a Logit model defined as follows:

$$FTTH = f(\text{age}, \text{primary}, \text{secondary}, \text{tertiary}, \text{percentExpdIncome}, \text{movieHrs}, \text{TVhrs}, \text{MBproblem}, \text{FBproblem}, \text{FutureMovie}, \text{FutureTV})$$

The respondent of FTTH-non-adopters consists of two groups. First, respondents who indicated that they would be willing to subscribe FTTH service at a range of price they have considered, a center value of WTP calculated from maximum and minimum of WTP was used in the next model. Another group are those who indicated that they would not subscribe to FTTH at any price. The analysis assigned a WTP value of THB0 (\$0) per month to those unwilling to subscribe FTTH. The impact of OTT media streaming services and other variables on WTP for FTTH service was achieved by a Tobit model defined as follows:

$$WTP = f(\text{age}, \text{primary}, \text{secondary}, \text{tertiary}, \text{percentExpdIncome}, \text{movieHrs}, \text{TVhrs}, \text{MBproblem}, \text{FBproblem}, \text{FutureMovie}, \text{FutureTV})$$

The list of variables that were developed and included in the models is given in Table 1.

Table 1. Description of variables

Variable	Description	Mean
<i>WTP</i> (dependent variable)	Willingness-to-pay calculated by the center of a fuzzy number [min,max] where min = consumer's first answer of willingness to pay max = maximum willingness to pay	299.38 [257,342]
<i>wantFTTH</i>	=1, if the respondent has an intention to adopt FTTH; =0, otherwise	0.51
<i>Age</i>	Age of the respondent	33.79
<i>Primary</i>	=1, if the respondent's highest education is primary level =0, otherwise	0.03
<i>Secondary</i>	=1, if the respondent's highest education is secondary level =0, otherwise	0.19
<i>Tertiary</i>	=1, if the respondent's highest education is tertiary level =0, otherwise	0.77
<i>PercentExpdInc</i>	Percentage of monthly expenditure over income	74.18
<i>MovieHrs</i>	Daily hours spending of watching movie through Internet	1.52
<i>TVhrs</i>	Daily hours spending of watching TV program through Internet	1.35
<i>MBproblem</i>	=1, if the respondent's has an experience of mobile Internet disconnection, delay, and unstable moving picture quality; =0, otherwise	0.95
<i>FBproblem</i>	=1, if the respondent's has an experience of fixed-line Internet disconnection, delay, and unstable moving picture quality; =0, otherwise	0.78
<i>MobileOverUse</i>	=1, if the respondent has an experience of reaching upper limit of mobile internet package resulting in the reduction of internet speed; =0, otherwise	0.65
<i>FutureMovie</i>	=1, if the respondent intend to watch movie through the Internet in the next 1 – 3 years; =0, otherwise	0.78

Variable	Description	Mean
<i>FutureTV</i>	Consumer's intention to watch TV program between television and Internet in the next 1 – 3 years, range from 0 to 4 0 = their preference in 100% using television 1 = a combination of 75% using television and 25% Internet 2 = a combination of 50% using television and 50% Internet 3 = a combination of 25% using television and 75% Internet 4 = that he or she will totally watch movie through the Internet	2.60
<i>FutureVDO</i>	Consumer's intention to watch video clip on demand between mobile and fixed-line in the next 1 – 3 years, range from 0 to 4 0 = their preference in 100% through mobile Internet 1 = a combination of 75% through mobile and 25% fixed-line 2 = a combination of 50% through mobile and 50% fixed-line 3 = a combination of 25% through mobile and 75% fixed-line 4 = that he or she will totally watch movie through fixed-line Internet	2.17

4. Results

Excluding incomplete questionnaires, effective 483 respondents were obtained. Thus, the effective response rate was 96.60 per cent. However, data utilized for examining the influence of OTT services on consumer's willingness to pay for optical fiber broadband connection includes 473 respondents, excluding 10 current FTTH users.

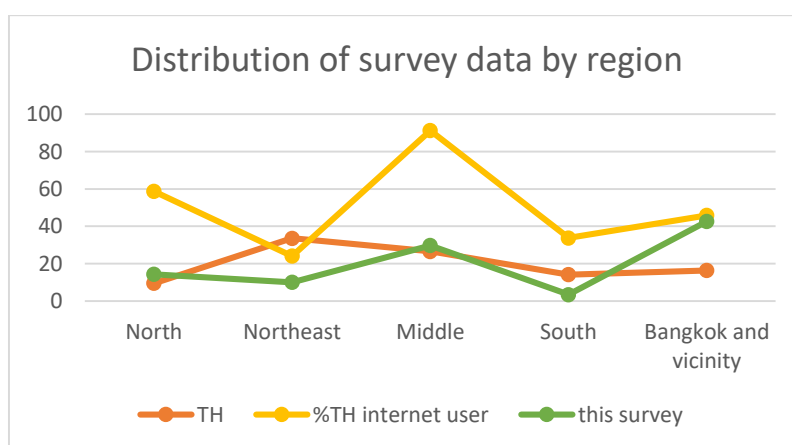


Figure 1: Distribution of respondents by region

Although the number of data was only 473, the average age of the respondents was 33.79 years old, which was very similar to the average age of the Thai, 33.25 years old, in the 2015 reported by the Thailand's National Statistical Office. Moreover, the distribution of respondents by region was in accordance with the percentage of Internet users in each region, as shown in figure 1.

Table 2. Regression results

Variable	Results for Logit model	Results from Tobit model
	Coefficient	Coefficient
Age	0.02805***	3.24917**
Primary	12.92261	248.1241
Secondary	14.45463	430.8386*

Tertiary	13.62759	339.4497
PercentExpdInc	0.00668*	0.29644
MovieHrs	0.15494**	25.24463**
TVhrs	0.07884	11.96899
MBproblem	1.90969***	194.1012***
FBproblem	0.08071***	105.7711***
MobileOverUse	0.14749	27.09722
FutureMovie	0.52033**	71.8849**
FutureTV	0.03467	3.16215
FutureVDO	0.02004	5.19953
Constant	-18.5653	-600.8255**

Dependent variable Stated willingness to adopt (0/1). Reported WTP calculated by the center of a fuzzy number [min,max] where
min = consumer's first answer of willingness to pay
max = maximum willingness to pay.

Note: * Significant to 90%.
** Significant to 95%.
*** Significant to 99%.

4.1 Intention to adopt FTTH

The first analysis concerns the impact of OTT media streaming services consumption, as well as individual characteristics, user's experience of connection problems, and expectation on future media usage through the Internet of FTTH-non-adopters on their stated intention to adopt FTTH. Approximately half of the reporting respondents indicated that they would consider subscribing to FTTH. The reasons for non-adoption are shown in Table 3.

Results shown in Table 2 indicate that respondents who spend more time on movie through Internet and intend to watch movie through the Internet in the next 1–3 years are more likely to adopt FTTH. Moreover, experience of Internet disconnection, delay, and unstable moving picture quality in both mobile and fixed-line appear to be strong predictors of non-adopters' willingness to subscribe to FTTH. Interestingly, older respondents are more likely to subscribe to FTTH than the younger. This result can be explained by the young's preference on mobile rather than fixed-line Internet. The result also shows that percentage of monthly expenditure over income is not a strong predictor of willingness to subscribe. Respondents with higher percentage of monthly expenditure over income are more likely to subscribe.

Education, experience of reaching upper limit of mobile internet package, expectation to watch TV program through Internet, and expectation to watch video clip via fixed-line Internet are not predictors of respondents' intention to adopt FTTH.

Table 3. Reasons for FTTH non-adoption

Reasons	Percentage of respondents who do not choose FTTH
1. Not use Internet so often	9.36

2. Current fixed-line technology is enough	40.85
3. Wi-Fi offload is enough	44.68
4. Current mobile technology is enough	58.30
5. Willing to pay more for mobile	3.40

4.2 Willingness-to-pay

We present the estimated impact of each variable on the reported WTP from the Tobit model where the values of the WTP were censored below 0 and above 2000. Coefficients from independent variables are interpreted as an increase in consumers' willingness to pay in Thai Baht (THB) influenced by each increasing unit of the significant continuous variable or the event of significant discrete variable occurring.

The results, as shown in Table 2, consistently support those of Logit model for most of significant factors. They suggest that current movie consumption as well as expectation to watch movie through the Internet rather than traditional channel in the next 1–3 years positively influence consumer's WTP. People who spend 1 more hour on movie through Internet are willing to pay THB25.24 (USD0.73) more for FTTH connection. Experience of Internet disconnection, delay, and unstable moving picture quality in both mobile and fixed-line show strong impacts on WTP. The more severe experience the instability of fixed-line network induces THB105.77 (USD3.05) of consumer's willingness to pay while the problem experience of mobile network also makes people want to pay THB194.10 (USD5.60) more. In addition, older respondents are willing to pay THB3.25 (USD0.09) more than the younger. Although a slightly impact, respondents who have secondary education are willing to pay THB430.84 (USD12.43) while other education levels have no impact.

These findings can be explained that TV program and VDO on demand in Thailand are usually not very long and people consume information and shallow entertainment. Therefore, they have no impact on respondents' demand for higher capacity of Internet. In contrast, people watch movies for their pleasure and appreciate the entertainment through quality. Therefore, stable usage drives respondents' intention to adopt and willingness to pay for FTTH for a higher capacity of Internet connection.

5. Discussion and Implications

The results of this study imply that movie over internet service is the only OTT media streaming service that directly drives consumers to pay for optical fiber broadband access. This study supports Knoblen (2014) that while OTT services are consuming a lot of bandwidth and increasing the traffic over the Internet, there is no doubt that they are stimulating the Internet utilization. Movie over internet service can directly contribute to the revenue of optical fiber broadband operators as well as the adoption and diffusion of the market.

The underlying factor that strongly effect people's decision to adopt FTTH service is experiences of problem of unstable Internet connection. This result in lines with the finding from Savage & Waldman (2005) and Rosston et al. (2010) that reliability and speed of internet connection are important functions for high-speed internet users. This adds to that media streaming services and their fast growing demand will induce the demand not only for mobile networks (Mnakri, 2015), but also optical fiber fixed-line network.

Demand for more bandwidth induced by OTT media streaming services, especially online movie, will drive to the migration to optical fiber broadband connection for a stable Internet connection. However, optical fiber broadband will not be fully penetrated countrywide in the near future since more than half of representative consumers prefer mobile network. For policy makers, the results imply that policy makers should support in optical fiber investment as both means of fiber-to-the-home and advanced mobile network backbone. For Internet service providers, a bundled package of FTTH with subscription for movie might be attractive. Moreover, when the development of applications and services that will consume a lot of bandwidth and require reliable connection are increasingly available to consumers, the investment in optical fiber network seems to be good and worthwhile because consumers would like to use and willing to pay for their secured and stable Internet usage.

6. Conclusion

The huge amount of media content online shows significant changes today. Behaviors of viewers are shifting towards services that are easy to use and respond well to their needs. These shifts motivate the development of cross-platform access and stimulate consumer's demand for higher bandwidth.

This paper investigates the impact of OTT media streaming services on demand for FTTH. The analysis examines the relationships between OTT media streaming consumption, individual characteristics, experience of connection problems, and expectation on future media usage through the Internet and willingness-to-pay for FTTH service. Given that little is known about non-adopters' intention to adopt and how much they would pay for FTTH, this paper presents an opportunity to understand non-adopters' demands in a way applicable to broadband adoption policies to stimulate the FTTH utilization.

By using membership function, the truly reflect the range of their feelings of willingness to pay, we find that consumers are willing to pay for FTTH for the secured and stable usage of OTT media streaming services, movie through the Internet. Assuming mobile broadband as a basement of connection, FTTH is an efficient off-load option to support movies consumption through the Internet.

The implications of this study suggest that movie over Internet services directly contribute to the revenue of FTTH operators. There is also a need of policy support in optical fiber network investment as both means of fiber-to-the-home and advanced mobile network

backbone in order to meet people's demand influenced by the more development of OTT applications and services in the future.

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