

Pichitkul, Araya; Mitomo, Hitoshi

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Demand for internet: Empirical comparison between urban and rural subscribers in Thailand

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The 19th ITS Biennial Conference 2012
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Opening a Platform for All”**

18 - 21 November 2012, Thailand

**Demand for Internet: Empirical Comparison Between Urban and Rural Subscribers
in Thailand**

Araya Pichitkul/Prof. Dr. Hitoshi Mitomo

Graduate School of Asia-Pacific Studies, Waseda University

a_pichitkul@hotmail.com

DEMAND FOR INTERNET: EMPIRICAL COMPARISON BETWEEN URBAN AND RURAL SUBSCRIBERS IN THAILAND

1. INTRODUCTION

ICT industry plays a crucial role in enhancing the economic growth and development of the nation. There are positive impacts of internet penetration on gross domestic product (GDP). The study of Telenor Group (2011) suggests that 10 percent increase in internet penetration would raise GDP by 1 to 2.5 percent. Moreover, internet penetration would enhance business activities and boost government revenue by 1 percent and 8 percent respectively. The internet is regarded as efficient mode of communication, since it provides tremendous amount of information, minimizes distance and extends education and employment opportunities (Cyberethics, 2011). The internet was first implemented in Thailand in year 1987. Up to the year 2010, the number of Thai internet users had increased tremendously to 22 million in 2010 (NBTC, 2010, p.150). Although the percentage of internet user is growing rapidly, the internet penetration rate in Thailand is low which accounts for 26.3 percent (Internet World Stat, 2010). The problem of digital divide has remained in Thailand between those who use the information technologies and those who do not. According to National Statistics Office (2010, p.iii), digital divide largely exists between urban area and rural area. Moreover, the study by National Statistics Office (2010, p.iii) found that divide between urban and rural in term of internet usage has been widening over time. To solve digital divide problem, Thai government and telecommunications regulator have come up with several initiatives such as Universal Service Obligations, and Smart Thailand, to name a few, to stimulate demand for internet usage. To achieve the goals of policy makers, it is important to investigate the demand aspect of internet adoption. This study attempts to support current policies by analyzing behavior of internet subscribers particularly subscribers' responsiveness to the change in internet price and income. The focus of the study is to examine the differences in demand for internet between two groups of internet subscribers, namely, rural subscribers and urban subscribers.

This study is organized into five sections. Section 2 describes the overview of Thai internet market. In addition, the evidence from previous efforts examining the elasticity of demand for internet is presented. Section 3 discusses the methodology employed in the study. The session provides method of study associating with data

collection, econometric model, as well as variable descriptions. Model specifications in accordance with log linear model are outlined. Section 4 presents empirical results in the form of descriptive statistics and findings based on statistical model. The section attempts to provide the analysis and interpretations based on empirical results. Last session discusses the policy implications for relevant policy makers based on the empirical findings.

2. AN OVERVIEW OF INTERNET MARKET AND LITERATURE REVIEW

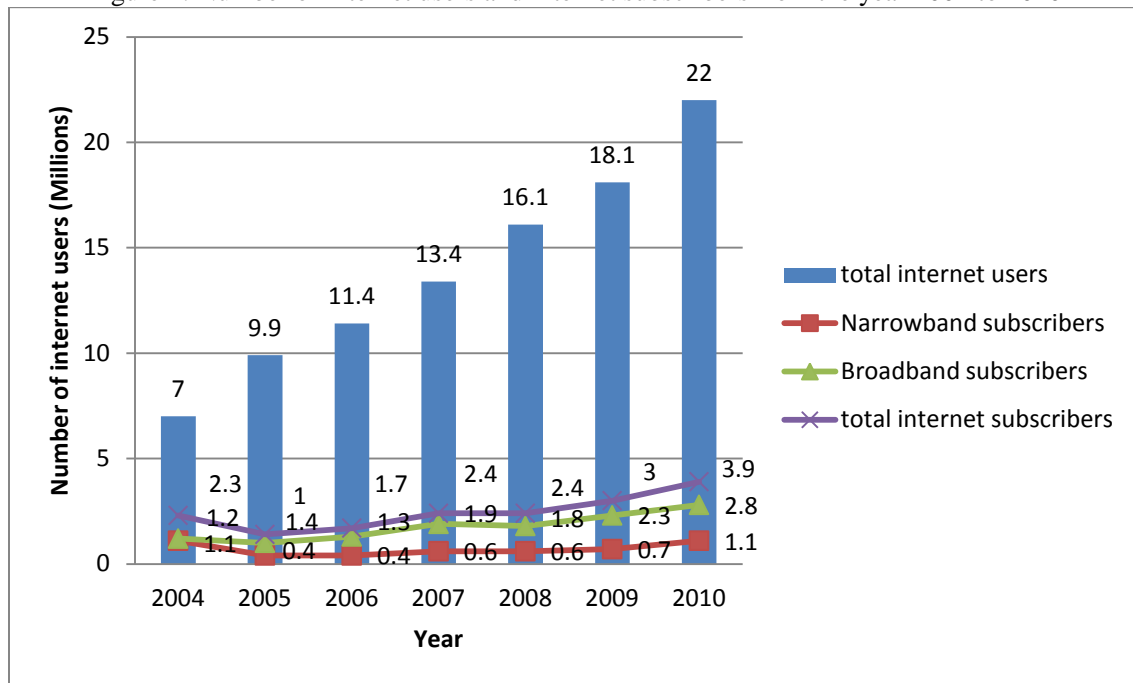
2.1 An Overview of Internet Market in Thailand

The internet was first implemented in Thailand in year 1987. In the early years of internet development, the use of internet was limited for educational purpose among educational institutes. The commercial internet service was not available until the year 1995 (Palasri et al., 1998, p.14). Internet Thailand Company was the first commercial internet service providers (ISPs) (Palasri et al., 1998, p.27). In the past, telecommunication industry in Thailand was monopolized by two state enterprises which are the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT). TOT had control over domestic telephone industry whereas CAT monopolized international internet gateway (IIG) (Nikomborirak and Cheevasittiyanon, 2008, p.6). The two state owned enterprises seek the private partnership for network investment under concession contract. Under concession contract of Build-Transfer-Operate (BTO), the internet service providers (ISPs) are required to build network facilities and transfer the ownership of all networks to TOT and CAT (Nikomborirak and Cheevasittiyanon, 2008, p.6). In addition, ISPs must pay certain percentage of their revenue to the incumbents (TOT and CAT) in exchange for specific time period to provide the internet services to the end users (Satitsamitpong et al., 2009 p.6). Under monopolized international internet gateway (IIG), domestic ISPs who wanted to connect to international internet gateways were required to connect via CAT's network (Tangkitvanich 2001, p.6). These ISPs were charged with high price subjecting to the pricing guideline set up by CAT (Tangkitvanich 2001, p.6; Palasri et al., 1998, p.27). Consequently, ISPs who faced with cost burden set up high internet price for customers.

According to Constitution of the Kingdom of Thailand B.E.2540 and the Act on the Organization to assign radio frequency and to regulate Broadcasting and Telecommunications Service B.E.2543 (A.D.2000), National Telecommunications Commission (NTC) was established in 2004 as an independent telecommunication regulator. At present, the NTC was replaced by the National Broadcasting and Telecommunication Commission (NBTC) with its

extended authority based on the Act on Organization to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services B.E. 2553 (2010). Primary missions of the NBTC are to assign frequency as well as regulate telecommunication businesses and broadcasting businesses (NBTC, 2010, p. 20). The establishment of the NBTC has led to the liberalization of Thai telecommunications industry. The NBTC has employed licensing system in which telecommunication operators must obtain telecommunications business licenses to be able to operate in the market. Up to 2010, the total of 105 internet business licenses has been granted to ISPs (NBTC 2010, p.83) in which 86 licenses are internet service providers where as 19 licenses are internet gateway providers. The internet business licensees can be categorized into 3 main types including type 1, type 2 and type 3. To illustrate this, type 1 licensees refer to ISPs who provide internet service to the public and do not own the network. Type 2 licensees refer to ISPs who provide internet service to specific groups of consumers and either have or do not have their own network. Type 3 licensees refer to ISPs who provide internet service for the public and have their own network. It is notable that in providing internet service, ISPs may operate more than one function. For example, the internet operators may acquire a role as internet service provider and network provider simultaneously. At present, the structure of internet market has changed from the monopoly structure toward more competitive market environment. Price per minute of internet service had declined overtime from 1.30 Baht in 2007 to 0.86 Baht in 2010 reflecting the considerable decrease in internet price of 33.85 percent (NBTC, 2010, p.153).

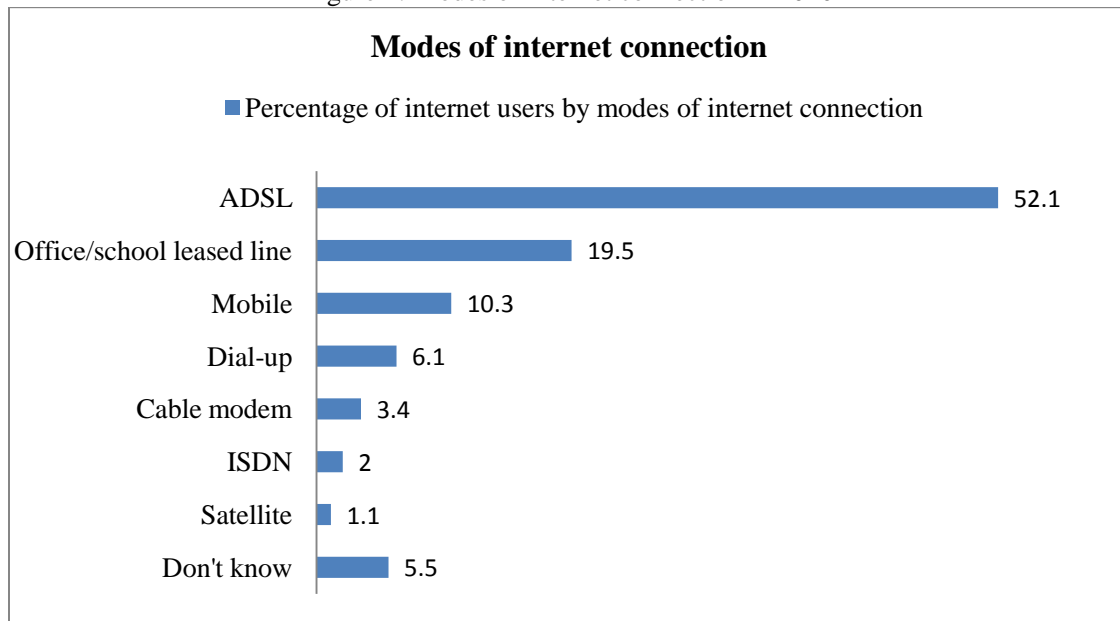
Figure 1: Number of internet users and internet subscribers from the year 2004 to 2010



Source: National Broadcasting and Telecommunications Commission (2010, p.150)

As shown in figure 1, the number of internet users had increased substantially from 7 million in 2004 to 22 million in 2010. In term of internet subscribers, the total number of internet subscribers in 2010 was 3.88 million. According to figure 1, internet subscribers are divided into narrowband and broadband subscribers. In 2010, 1.05 million of total internet subscribers were narrowband internet subscribers whereas 2.82 million of total internet subscribers were broadband subscribers. The penetration rate per 100 inhabitants of narrowband and broadband had been increasing over time and reached 1.6 and 4.2 respectively in 2010 (NBTC, 2010, p.160). However, the growth rate of broadband internet subscribers is relatively higher compared to narrowband subscribers. This indicates the fact that broadband technology, such as ADSL has become essential means of communication due to its attractive capacities such as faster data transmission speed and always on connectivity, to name a few.

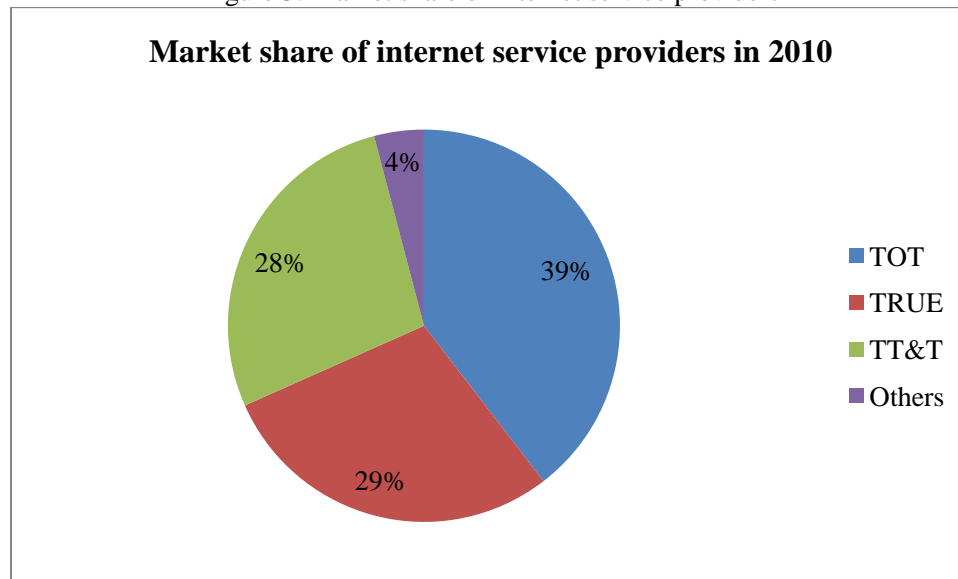
Figure 2: Modes of internet connection in 2010



Source: National Electronics and Computer Technology Center (NECTEC) (2010, p.59)

As shown in figure 2, Thai internet users use different modes of internet connections to access to internet. The majority of Thai internet users used ADSL (Asymmetric Digital Subscriber Line) as the mode of internet connection. 19.5 percent of internet users accessed internet through leased line from office or school. 10.3 percent of internet users used mobile to connect to the internet since it facilitates greater mobility in utilizing internet. EDGE (Enhanced Data Rates for Global Evolution) and GPRS (General Packet Radio Service) can be considered as mobile internet technologies that are widely used in Thailand. For narrowband technology, Dial up and ISDN (Integrated service digital network) accounted for 6.1 percent and 2 percent of internet users respectively.

Figure 3: Market share of internet service providers



Source : National Broadcasting and Telecommunications Commission (2010, p.155)

As shown in the pie chart, three major internet service operators in Thailand are TOT, TRUE and TT&T. TOT, TRUE and TT&T initially are fixed line providers which set up internet subsidiary companies. These providers enjoy cost advantages in providing internet service over small internet providers because they have lower or even zero network renting cost due to the concession contract (NBTC, 2010, p.63). TOT has the largest market share in internet service of 39 percent. TOT provides internet service throughout Thailand. The market share of TRUE and TT&T are almost equal. To illustrate this, TRUE and TT&T acquire the market share in internet service of 29 percent and 28 percent respectively. TRUE provides internet service to Bangkok and metropolitan areas whereas TT&T provided the internet service to rural areas of Thailand. Besides, other small internet providers accounted for 4 percent of market share in internet service.

2.2 Literature Review

Previous studies have been conducted by employing different approaches and different kinds of data in order to identify the price and income estimate of demand elasticity. Price is one of the most influential factors that affect internet adoption as it reflects the affordability of internet service. Many studies find that price has inverse relationship with internet adoption (Chaudhuri et al., 2005, p.14; Kridel et al., 1999, p.35). To point out, the increase in price typically lowers the rate of internet adoption. Goel et al.(2006, p.979) and Kridel et al. (1999, p.35) attempt to

find the demand for internet through elasticity estimation. They find that demand for internet in OECD and US's market was price inelastic. Price elasticities were between -0.6 and -0.7 and between -0.18 and -0.38 respectively. In contrast, Goolbee (2001, p.11) finds the price elasticity for broadband to be highly elastic between -3.76 and -2.15. The study of Glass and Stefanova (2010, p.70) estimated the sensitivity of broadband demand examining price, speed and video offering. The study employs the probit model based on panel data. This study reports that demand for broadband has become even more price inelastic overtime. For demand substitutability among different kinds of internet services, Rappoport et al. (2001, p.15) calculates cross price elasticity between dial up and cable modem and concludes that cable modem is substitute for dial up service. Ida and Kuroda (2004) used multinomial logit models to analyze the demand substitutability of four alternatives in Japan's BB services. The study concluded that ADSL service is independent of other services because ADSL is less sensitive to price change compared to FTTH and CATV. Income is among the most cited variables that explains the divide in internet adoption (Chaudhuri et al, 2005, p.13; Schleife, 2010, p.181; Rappoport et al 2001, p.13; Noce and Mckeown 2008, p.471). People with high income are more likely to adopt the internet. This is because high income individuals acquire relatively low cost of internet access compared to low income individuals (Whitacre 2005, p.32). Previous studies have examined income elasticity. For example, Prieger and Hu (2008, p.163) and Glass and Stefanova (2010, p.79) report the value of income elasticity for broadband service to be inelastic which equal to 0.62 and 0.60 respectively. These findings are different from the study of Goel et al. (2006, p.979) who finds income elasticity to be elastic with the estimate of 1.4 to 1.7.

Although the findings from previous studies are very important, these previous studies are insufficient to explain demand between two groups of internet subscribers. This is because none of these studies consider the impact of different residential locations of internet subscribers which can possibly affect the demand for internet. To the author's knowledge, there is no study that compares the internet demand between urban and rural areas. Therefore, this study aims to fulfill the gap by examining the differences in price and income elasticities of demand for internet between urban and rural subscribers in Thailand context.

3. METHODOLOGY

The data used in this research is based on random sampling survey provided by NBTC. The nationwide survey and interviews were conducted by Thammasat University during May and July in 2010. The questionnaire was distributed across 5 regions of Thailand including Central region, Northern region, North-eastern region, Southern region and Bangkok. Purposive sampling was undertaken by selecting 2 provinces from each region in accordance with distribution of population. The 9 selected provinces are Lopburi, Rayong, Khon Kaen, Ubonratchathani, Chiang Mai, Phitsanulok, Satun, Songkhla and Bangkok. The questions that are used in the questionnaire survey include modes of connections, internet expenditures, minutes of internet usage, as well as socio-economic information of the respondents. There were 2,000 respondents participating in the survey including internet users and non internet users. Since the study attempts to focus on the response of internet users to price change, non internet users were removed from the study. Moreover, free internet users were also removed from the analysis because free internet users reported their internet expenditure as zero Baht. Besides, respondents, under 15 years of age, are excluded from the analysis due to their inability to afford internet expense. As a result, 683 samplings are used for data analysis.

The analysis consists of cross sectional data based on individual unit. The cross sectional data refer to the actual data collected at the specific point in time. Individual unit of analysis offers greater advantage over aggregate level data as it permit greater variation for each variable. Hence, more accurate parameter estimations are likely to be obtained (Train, 1986, p.3). To meet the objective of the study, the econometric model called log-linear model is used.

3.1 Log-linear model: elasticity measurement

This study aims to examine whether there are differences in price and income elasticities between urban and rural internet subscribers, since price and income are regarded as important factors that determine the demand for internet. The author assumes that the different perception toward the value of the internet among urban and rural subscribers leads to the different price and income elasticities between the two groups of internet subscribers. For simplicity, the study assumes that the demand curve is linear. The log-linear model is used to measure the price and income elasticities of demand for internet service of urban and rural internet subscribers. According to Gujarati (1995, p.165), log-linear model can be written as:

$$\ln(Y_i) = \ln\beta_1 + \beta_2 \ln X_i + \varepsilon_i \quad (1)$$

The equation (1) can be rewritten as

$$\ln(Y_i) = \alpha + \beta_2 \ln X_i + \varepsilon_i \quad (2)$$

According to equation (2), “ln” represents the natural log. The elasticity estimate can be obtained by taking the log transformation of both dependent (Y_i) and independent variables (X_i). Coefficient β_2 measures the percentage change in Y_i in response to percentage change in X_i . Therefore, if Y_i denotes quantity of goods demanded, and X_i represents price of goods, β_2 can be regarded as price elasticity of demand (Gujarati, 1995, p.166). The model specification of price and income elasticities for internet service based on log linear model can be written as follows;

$$\ln Q = \beta_0 + \beta_1 (\ln \text{internet price}) + \beta_2 (\ln \text{income}) + \varepsilon_i \quad (3)$$

where Q = quantity of internet usage of internet subscribers

β_1 = price elasticity of demand for internet service

β_2 = income elasticity of demand for internet service

ε_i = stochastic error term

To compare the differences of price elasticity and income elasticity between urban and rural subscribers, the internet subscribers are divided into 2 groups which are urban internet subscribers and rural internet subscribers. Demand for internet services for both groups of subscribers depends on price of internet service and income of individuals. To estimate both types of elasticity, multiple regressions are employed based on the log linear model. The equations can be written as follows;

$$\ln Q_{\text{Rural}} = \beta_0 + \beta_1 (\ln \text{Internet price}_{\text{Rural}}) + \beta_2 (\ln \text{income}_{\text{Rural}}) + \varepsilon_i \quad (4)$$

$$\ln Q_{\text{urban}} = \beta_0 + \beta_1 (\ln \text{internet price}_{\text{urban}}) + \beta_2 (\ln \text{income}_{\text{urban}}) + \varepsilon_i \quad (5)$$

3.2 Elasticity measurement: Variables and hypothesis

Dependent variable:

Quantity of internet usage is used as dependent variable. Quantity of internet usage is measured by minutes of internet usage per month of individuals.

Explanatory variables

Price variable is measured by price per minutes which can be calculated as follows:

price per minute = monthly internet expenditure/minutes of usage per month

income = monthly income of internet subscribers

Table 1: Descriptive statistics for variables used in multiple regressions

Variable	Description	Mean	Std. Dev.
Quantity of internet usage _{Rural}	Minutes of usage per month of rural subscribers	4,566.89	6,000.89
Quantity of internet usage _{Urban}	Minutes of usage per month of urban subscribers	7,365.78	9,292.21
Internet price _{Rural}	Price per minute of rural subscribers	0.58	2.67
Internet price _{Urban}	Price per minute of urban subscribers	0.38	1.10
income _{Rural}	Monthly income of rural subscribers	9,994.81	8,939.58
Income _{Urban}	Monthly income of urban subscribers	14,171.16	10,950.09

Source: Author's compilation

4. EMPIRICAL RESULTS: COMPARISON OF INTERNET DEMAND BETWEEN URBAN AND RURAL

SUBSCRIBERS

Table 2 Socio-demographic information of the survey respondents

Socio-demographic information	
	Percentage (%)
(a) Gender	
Male	52.92
Female	47.08
(b) Age (Years)	
Less than 21	22.51
21-25	22.22
26-30	17.54
31-40	21.49
41-50	7.89
More than 50 years	8.33
(c) Income (THB)	
less than 2,500	5.56
2,501-10,000	19.74
5,000-10,001	31.43
10,001-15,000	16.23
15,001-25,000	16.23
25,001-35,000	6.43
35,001-50,000	4.39
(d) Education	
Undergraduate	38.89
Graduate	49.12
Post Graduate	11.99
(e) Region	
Bangkok	12.13
Central	25.58
Northeast	30.56
North	21.2
South	10.53
(f) Administrative district	
Urban	70.61
Rural	29.39

Source: Author Compilation

Table 3 and table 4 present the result on price and income elasticities of demand for internet employing log linear model.

Table 3: Price and income elasticities for urban subscribers

Price and income elasticities for urban internet subscribers				
Dependent variable =ln (minutes of usage per month)				
	Coefficients	Std. Error	t	sig
(Constant)	5.716	.444	12.870	.000
ln (Price per minute)**	-.822	.027	-30.243	.000
ln(Income)*	.083	.047	1.757	.079
Number of observation = 482				
Adjusted R2 = .654				

**,*:statistical significant at 1% and 10% respectively. SPSS was used for estimation purposes

Table 4: Price and income elasticities for rural subscribers

Price and income elasticities for rural internet subscribers				
Dependent variable =ln (minutes of usage per month)				
	Coefficients	Std. Error	t	sig
(Constant)	3.675	.762	4.825	.000
ln (Price per minute)**	-.748	.048	-15.562	.000
ln(Income)**	.294	.083	3.532	.001
Number of observation = 201				
Adjusted R2 = .549				

** : statistical significant at 1%. SPSS was used for estimation purposes

Source: Author compilation

Table 3 and table 4 present the result of elasticity estimation for urban and rural subscribers respectively. It can be seen that price and income parameters have expected signs and all the estimates are statistically

significant at 1 percent and 10 percent level. Higher internet price decreases the demand for internet service while higher income stimulates the demand for internet service. The R^2 of 0.654 and 0.549 of both estimations indicate a good fit of the model to the data. As shown in table 3 and 4, urban subscribers acquire slightly higher price elasticity of demand for internet compared with rural subscribers. The estimates of price elasticities for urban and rural subscribers are -0.82 and -0.75 respectively. The estimate suggests that 1 percent increase in price per minute of internet service, the demand for the internet (as measured by minutes of monthly internet usage) decrease by 0.82 percent and 0.75 percent for urban and rural subscriber respectively. The result estimate is consistent with the study of Goel et al. (2006, p.979) who found the price elasticity for internet subscribers in OECD countries equal to -.6 and -.7. Since the price elasticity of demand for internet is below unity (less than 1) in absolute term, the result implies that the price elasticity of demand for internet for urban and rural subscribers are price inelastic. To point out, the percentage decline in quantity of internet usage is less than the percentage increase in internet price. The urban subscribers are more responsive to price change compared to rural subscribers. This is because there is greater number of internet service providers operating in urban areas such as Bangkok and municipal areas compared to rural areas. Thus, a variety of internet services is more available in urban areas. Consequently, the urban internet users are likely to switch to other internet service providers when the internet price increases. For income elasticity, both urban and rural subscribers acquire the income elasticity estimate of less than 1. This indicates that the internet service is a normal goods in economic sense; internet subscribers tend to use internet more as income increases (Pindyck and Rubinfeld, 2001, p.32). Rural subscriber acquires higher income elasticity compared to urban subscriber. This means that rural subscribers are more sensitive to the change in income. This is due to rural respondents acquire lower average income compared to the urban counterparts. This result matches with the data from the survey which indicates that average income of rural subscribers and urban subscribers are 9,995 Baht and 14,171 Baht respectively. To illustrate, 1 percent increase in income of rural subscribers will lead to 0.29 percent increase in demand for internet service. For urban subscriber, 1 percent increase in income of urban subscribers will lead to only 0.08 percent increase in demand for internet service. This result is in line with the study of Prieger and Hu (2008, p.163) and Glass and Stefanova (2010, p.79) who reported the income elasticity estimate of less than 1 for broadband internet service. However, Prieger and Hu (2008, p.163) and Glass and Stefanova (2010, p.79) reported higher income elasticity compared to this study with

the estimate of 0.62 and 0.60 respectively. To conclude, income elasticity indicates that internet service is perceived as the necessary goods by both groups of internet subscribers.

5. POLICY IMPLICATION

According to the result on elasticity estimate presented in previous session, the result shows that demand for internet of rural and urban subscribers are price inelastic. This means that an increase in internet price does not substantially reduce the demand for internet for both types of internet subscribers. Nevertheless, the urban subscribers are more sensitive to price change compared to rural subscribers. This is because urban areas contain greater number of ISPs. Consequently, various kinds of internet services are likely to be more available in urban areas. To deal with this circumstance, the policy makers should find ways to increase the availability of internet services in the rural areas. Tax incentive can be regarded as an approach that encourage and induce ISPs to provide internet service to rural areas. In the long run, when internet service choices for rural subscribers increase, they are expected to response to the internet price more. In addition, since both types of internet subscribers regard the internet service as necessary to their lives, policy makers should encourage the competitive market environment to support the market mechanism and find ways to prevent ISPs from exercising natural monopoly power or anti-competitive behavior. The result also shows that rural subscribers are more sensitive to the increase in income compared with urban subscribers. To stimulate the demand for internet among rural subscribers, policy maker should provide job opportunities in rural areas. For example, the incentive such as online selling of local products should be given to rural subscribers as a way to increase the income of rural individuals.

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