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Elasticity of Demand for Cellular Phone Network Access in Malaysia

(Keanjalan Permintaan untuk Akses Rangkaian Telefon Selular di Malaysia)

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ABSTRACT

This study analyzes the elasticity of demand for cellular phone network access and the network effects in Malaysia. It uses quarterly data from 2003Q1 to 2011Q4 with 7 difference variables in two separate equations. The dependent variable is the penetration rate of cellular phone. From the analysis, we found that the penetration rates of cellular phone are strongly related to the factors highlighted in the study and all the variables are strongly significant. The F-test also suggested that the entity Fixed Effects Model (FEM) is the appropriate model and more preferred for this study. From the entity FEM analysis, all independent variables are significant. The price elasticity of demand, cross-price elasticity and income elasticity are elastic. The result also shows that the fixed-line is complementary and luxury goods to the cellular phone network in Malaysia and the networks externalities are strongly significant when we used number of subscriber as a proxy.

Keywords: Demand; elasticity; network; panel data

ABSTRAK

Kajian ini menganalisis keanjalan permintaan untuk akses dan kesan rangkaian telefon selular di Malaysia. Kajian ini menggunakan data suku tahunan 2003Q1 hingga 2011Q4 dengan mengemukakan 7 pemboleh ubah dalam dua persamaan yang berasingan. Pemboleh ubah bersandar ialah kadar penembusan bagi telefon selular. Daripada kajian, didapati kadar penembusan telefon selular berkait secara rapat dengan faktor-faktor yang dikaji dan semua pemboleh ubah adalah sangat signifikan. Keputusan ujian F juga mencadangkan bahawa entiti Model Kesan Tetap (FEM) adalah model yang sesuai and lebih baik untuk kajian ini. Daripada analisis entiti FEM, semua pemboleh ubah adalah signifikan. Keanjalan harga permintaan, keanjalan harga silang dan keanjalan pendapatan adalah anjal. Keputusan juga menunjukkan bahawa talian tetap merupakan barang penggenap dan barang mewah kepada rangkaian telefon selular di Malaysia dan kesan luaran rangkaian adalah amat signifikan apabila menggunakan jumlah langganan sebagai proksi.

Kata kunci: Permintaan; keanjalan; rangkaian; data panel

INTRODUCTION

An increase in access and usage of cellular phones over the years has made cellular phones one of the necessities in our daily lives. Because of its benefits people and people tend to have more than two numbers though they have no access to fixed-line. People also tend to access and use prepaid lines rather than postpaid network. Therefore, this study tries to identify the determinants that influence the demand of cellular phone network access for postpaid and prepaid market and the elasticity of the cellular phone network access in Malaysia. The elasticity of demand plays an important role in determining the use of mobile and fixed-line phone in Malaysia. It also enhances the growth of the telecommunications sector as well as controls the oligopoly power that exists in the telecommunications market to avoid the existence of future collusive behavior. The elasticity of demand also regulates the price and allocates of common costs (Afridi, Farooq, Ullah & Rahmani 2010; Dewenter & Haucap,2007; Karacuka, Haucap & Heimeshoff 2011). Several studies have been done in developed countries but less implemented in Southeast Asian including Malaysia. This study seek to measure the external effects on the cellular phone access by using number of subscriber and waiting list for fixed-line.

For the first time ever in the year 2000, the number of cellular phone service network subscription was more than the fixed-line network subscriptions in Malaysia. In the fourth quarter of 2008, the number of cellular phone service network subscription was equal to the Malaysian population (28 million). Of the average, every Malaysian had access to cellular phone service networks and most people do have more than two numbers for different network services provider but don't necessarily have any access to the fixed-line network. A total subscription for cellular phone service is expected to be on the increase, while total fixed-line subscription is expected to remain

relatively flat. Besides, the number of subscribers that use prepaid cellular phone network is greater than those that postpaid services. In the third quarter of 2011 for example, the number of prepaid subscription service network was 28.77 million compared to 6.93 million subscribers for postpaid services. The increasing trend of network services for prepaid is higher than the postpaid because the plans being offered are more attractive and the characteristics of telecommunication products that can compete with the fixed-line services such as data service offers and the existence of smart phones in the Malaysian market. The advancement in telecommunication will reduce the transaction cost by improving the quality of service in communication and directly enhance the level of productivity and efficiency of other sector of the economy (Brempong & Karikari 2007).

Statistically, the mobile telecommunication networks sector in Malaysia is dominated by Maxis, Celcom and Digi. Thus, in this study, we used the Average Revenue per User (ARPU) for postpaid, prepaid and fixed-line as a proxy for price. The ARPU is one of the important indicators of market share price for investors who wish to invest in the telecommunications sector and also used to compare the efficiency and profitability of the telecommunications firm. A part from that, rising standards of living and economic growth also reflect the availability of telecommunication services, in which the cellular phone is seen as a necessity in daily life. Studies in developed countries shows that the cellular phone service is one of the complementary goods while in developing countries, cellular phones are classified as substitutes to fixed-line (Banerjee & Ros 2004; Vogelsang 2010). Therefore, this study will evaluate whether the cellular phones are substitutes or complementary goods; normal, necessity or luxury goods in Malaysia by measuring the price elasticity, income elasticity and cross-price elasticity of cellular phone network access in Malaysia.

LITERATURE REVIEW

Based on theory of telecommunication demand, most of the studies used price of calls as one of the important variable and measure the price elasticity (Lee & Lee 2006). But the way researcher defined the price of calls as a variable is different from one researcher to another. For example, Garbacz and Thompson (2002) used a price of monthly usage (Ahn & Lee 1999; Garbacz &Thompson 2007; Iimi 2005;) or monthly charge (Ahn & Lee 1999; Brempong & Karikari 2007; Madden & Neal 2004) a price of installation or connection fee (Doganoglu & Grzybowski 2007; Garbacz &Thompson 2007; Rodriguez-Andrés & Pérez-Amaral 1998; Sung & Lee 2002) and price of long distance as a proxy to price of calls. Other than that, Dewenter and Haucap (2007) used average call price, and the study by Wang, Tang and Pan (2010) used three different prices, namely price of mobile services, communication tool and local fixed voice in China. Meanwhile, Briglauer, Schwarz and Zulehner (2009) preferred to used average revenue per user (ARPU) as a proxy and real average revenue per minute or ARPM (Afridi, et al. 2010).

A study by Garbacz and Thompson (2002) found that price has little effect or no effect and it's inelastic (Banerjee & Ros 2004; Doganoglu & Grzybowski 2007). The result is quite similar to the results of the research done by Iimi (2005) where price does not have much significant impact though the elasticity of price is high (Garbacz & Thompson 2007). In Korean markets, the price elasticity is approaching unit elastic at a pre-competition, and inelastic at the post-competition (Lee & Lee 2006). Besides, pricing of services are not effective enough and not competitive because the service operators can enter and exit freely to provide services cheaply, hence market prices for cellular phone services are determined by the governmental regulations in Korean market (Lee & Lee 2006). According to Garbacz and Thompson (2002), if the price is determined by the authorities, there is no close substitute for telephone service, and the quantity of demand for telephone service is determined by household income, the price of direct services and subscriber characteristics.

For demand of usage, a study by Dewenter and Haucap (2007) in Austria and Afridi et al. (2010) in United Kingdom found out that in the short-term and long-term, the price elasticity of demand for access is not elastic, where the postpaid market is more elastic than prepaid market. But some studies in Turkey indicates that the price elasticity of postpaid market is lower than prepaid market in the short-term, while in the long run, there is no significant difference on the elasticity between the short-term and long-term (Karacuka, Haucap & Heimeshoff 2011). According to Karacuka, Haucap and Heimeshoff (2011), the price elasticity mobile traffic as a proxy for price of calls is negative where the price elasticity for prepaid users is lower than aggregate market. For postpaid market, the price elasticity is lower than aggregate market and prepaid because the major subscribers for postpaid market are those involved in the business. From demand of access perspective, the price elasticity is high and thus, there is a long run elasticity of demand for telephone lines in Spain (Rodriguez-Andrés & Pérez-Amaral 1998). However, Briglauer, Schwarz and Zulehner (2009) found that in the long run, the price elasticity of the demand for call is elastic but not elastic for a short-term in Austria. On the other hand, studies by Ahn and Lee (1999) found that the effects of price are not so significant revealing the price effect on demand for access to mobile phone networks as well as showing the price elasticity is inelastic (Madden & Neal 2004; Sung & Lee 2002).

The income elasticity less than one or inelastic and shows cellular phone services as a normal goods with a

positive sign of relationship (Afridi, et al. 2010; Wang, Tang & Pan 2010;). Kwak and Lee (2011) found that the income effect is very minimal, and cellular phone services is considered as luxury goods for the public in Korean market (Lee & Lee 2006). Meanwhile, the income elasticity in developing countries is high based on Garbacz and Thompson (2007) study. Next, the external effects have played a small role and have a positive relationship with the demand for cellular phones (Banerjee & Ros 2004; Iimi 2005), and the size of network has a significant impact on the demand for calls (Lee & Lee, 2006). Besides, the size of cellular network has an impact to expanding the network subscription and cause the growth in fixed-line networks and cellular networks (Brempong & Karikari 2007; Madden & Neal 2004). The subscribers tend to switch carriers because of the negative external effects such as low quality service and the existent of substitution effect (Kwak & Lee 2011). According to Banerjee and Ros (2004), the external effects or those who had bad experience with fixed-line network will change to cellular phones.

METHODOLOGY

The theory of telecommunication demands was presented and developed by Taylor (1994). According to the theory, to create demand for the telephone, we need to distinguish the types of demand in telecommunication. There are two types of demands that need to be known and distinguished in telecommunication demands, which is the demand for access and demand for usage to network. Demand for access to network only involves one party, while demand for usage involves two parties. The demand function for use is derived from individual demand functions for calls where:

$$Q = Q(\pi, p, r, N, Y) \tag{1}$$

where Q is the total number of calls; π is the price of calls; p is the price of other goods and services; r is the cost of access; N is the number of subscribers; and Y is aggregate income. The difference between demand function for use and that for access is that the demand function for access takes into account the number of population in determining the demand for access to telephone service network (Taylor, 1994):

$$\frac{N}{M} = \Phi(\pi, p, r, N, Y, R) \tag{2}$$

where M is the size of population and R is a dummy variable whether to make calls or not to make calls. The price of calls and cost of access have a negative relationship with the total number of calls. While, aggregate income has a positive relationship with the dependent variables. The prices of other goods and services as well as number of subscribers have direct relationship with the dependent variable. The models for aggregate demand function of the cellular phone network access designed based on equation (1) and (2) are as follows:

$$\frac{N}{M} = f(\pi, p, r, N, Y) \tag{3}$$

The model in equation (3) has been improved by using cellular phone penetration rate (PR) as the dependent variable and the average revenue per user (ARPU) for postpaid and prepaid market as a proxy for the price of calls, cost of access and price of other goods and services as the dependent variables. The GDP per capita was used to measure the average income level. To measure the external effects, this study will used the number of subscribers (N) and waiting list (WL) for a fixed-line as a proxy and as two separates model to examine the degree of significance and to avoid serial correlation problem. This study focuses on elasticity of demand for network access, and thus, the R variable in equation (2) is not relevant for this study. To make a call or not to make a calls only happen once the subscribers have an access to cellular phone network. Therefore, the model equations to be estimated is as follows:

$$\begin{aligned} PR_{CP} = {} & \beta_0 + \beta_1 ARPU_{CP_{POST}} + \beta_2 ARPU_{CP_{PRE}} + \\ & \beta_3 ARPU_{FL} + \beta_4 N_{FL} + \beta_6 GDP + \varepsilon \end{aligned} \tag{4}$$

$$\begin{aligned} PR_{CP} = {} & \beta_0 + \beta_1 ARPU_{CP_{POST}} + \beta_2 ARPU_{CP_{PRE}} + \\ & \beta_3 ARPU_{FL} + \beta_5 WL_{FL} + \beta_6 GDP + \varepsilon \end{aligned} \tag{5}$$

where:

PR_{CP} = penetration rate for cellular phone (percentage)
$ARPU_{CP_{POST}}$ = average revenue per user for cellular phone for postpaid market (RM)
$ARPU_{CP_{PRE}}$ = average revenue per user for cellular phone for prepaid market (RM)
$ARPU_{FL}$ = average revenue per user for fixed-line (RM)
N_{FL} = number of subscribers for fixed-line (volume)
WL_{FL} = waiting list for fixed-line (volume)
GDP = gross domestic product per capita (RM)

This study used quarterly data from the year of 2003 to 2011. Three entities or major network providers for cellular phone service are involved in this study, namely Maxis, Celcom and Digi. To obtain the cross-price elasticity and the external effects, the comparison will be done on the fixed-line network provider, which is Telekom Malaysia. Therefore, the panel data in this study is a short panel and narrow data. This survey data are derived from the quarterly reports and annual reports of firms such as Maxis, Celcom, Digi, Telekom Malaysia, Malaysian Communications and Multimedia Commission (MCMC), Kuala Lumpur Stock Exchange (KLSE), Bank Negara Malaysia (BNM) and the economic

report. All the data will be deflated with the CPI. This study uses panel data by adapting balanced panel data where the number of observations is the same for all units. In this study we run the pooled OLS and FEM, and apply the semi-log functional form in the model equations (4) and (5), since the estimated coefficients are referring to elasticity. The regressand is in percentage value (penetration rate). Therefore, the slope of coefficient is refers to elasticity.

RESULTS AND DISCUSSION

From the Table 1, the central tendency of the variables are positive with PR and N_{FL} having the highest and lowest mean, respectively. PR and NF_{FL} also have the highest and lowest median, respectively. From the table, the PR has the larger dispersion or spread while N_{FL} has the lowest. The skewness denotes the existence of both positive and negative skewed in the variables. The positive-skewness indicate that the observed value of the variable have a long-tail to the right, large values or positively skewed distribution, while negative-skewed distribution indicate that the side of tail is to the left and they are non-symmetric. The Kurtosis or the distribution is peaked (leptokurtic) relative to the normal for $ARPU_{CPPRE}$, N_{FL} and WL. The remaining variable distribution is platykurtic relative to the normal such as PR, $ARPU_{CPPOST}$, $ARPU_{FL}$ and GDP. The panel unit root analysis also indicates that all the variables are strongly significant and stationary at first difference and integrated of order one, $I(1)$ for common unit root as well as individual unit root process.

To select an appropriate model between the pooled OLS regression and entity FEM, we use a partial *F*-test. For model 1, the *F*-value is 217.46 bigger than 99.5, the value of $F_{1\%,2,100}$ as well as the *F*-value for model 2 is 222.29 bigger than value of $F_{1\%,2,100}$. Therefore, we reject the null hypothesis and conclude that there are differences in individual intercepts or individual fixed effects and the data should not be pooled into a single model with common intercept parameters. The coefficient estimates generated by using the pooled OLS regression is biased and inconsistent. Therefore, the entities FEM for both models are preferred and more appropriate.

TABLE 2. The *F*-value Results for Pooled OLS vs FEM

Model	Model 1	Model 2
R^2_{FEM}	0.959238	0.957952
R^2_{POOL}	0.781958	0.771014
F-value	217.46	222.29

Next, Table 3 show the entity FEM results. For entity FEM, we use N_i dummies without intercept to reduce the consuming a lot of degree of freedom and probability of multicollinearity. The model developed for this study is N_i dummies without intercept. Based on entity FEM, the coefficient of determination in this regression, $R^2 = 0.9592$ or 95.9 per cent for model 1 and $R^2 = 0.958$ or 95.8 per cent for model 2. The result indicate that the variation of dependent variable can be explained by, $ARPU_{CPPOST}$, $ARPU_{CPPRE}$, $ARPU_{FL}$, GDP per capita as well as N_{FL} for model 1 and WL_{FL} for model 2. It means the estimated regression equation is fit to the sample data. The Durbin-Watson statistic is moderate, 0.9644 and 0.8720 for model 1 and 2 respectively. Through the FEM, each entity has its own intercept. The intercept for Maxis, Celcom and Digi are different for each other by using differential intercept dummy. The intercept for Maxis or D_1 is –25.5 and –88.4; –31.2 and –94.5 for Celcom or D_2; and –37.7 and 101.0 for Digi or D_3 in model 1 and 2 respectively.

THE DETERMINANTS

From the analysis, the $ARPU_{CPPOST}$ and $ARPU_{CPPRE}$ are negatively related to cellular phone PR and significant (Afridi, et al. 2010; Karacuka, Haucap & Heimeshoff 2011). We also found that the $ARPU_{CPFL}$ is negatively related to cellular phone PR and significant (Garbacz & Thompson 2007; Wang, Tang & Pan 2010; Ahn & Lee 1999). Meanwhile, the N_{FL} has an effect and negatively related to cellular phone PR (Madden & Neal 2004; Lee & Lee 2006; Doganoglu & Grzybowski 2007). In contrast, the WL_{FL} is positively related to

TABLE 1. Descriptive statistics

	PR	ln $ARPU_{CPPOST}$	ln $ARPU_{CPPRE}$	ln $ARFL_{FL}$	ln GDP	ln N_{FL}	ln WL_{FL}
Mean	27.245	4.6582	3.7871	3.9411	8.5574	1.4801	3.5418
Median	26.495	4.6333	3.8176	4.1062	8.5858	1.4738	3.6636
Maximum	47.120	5.2164	4.1844	4.4816	8.9221	1.5369	4.1589
Minimum	6.9900	4.2792	0.9711	3.3823	8.1912	1.3938	2.5649
Std. Dev.	10.077	0.2369	0.3226	0.3894	0.2074	0.0261	0.3794
Skewness	-0.0149	0.5305	-6.1814	-0.1508	-0.0609	-0.2151	-1.1295
Kurtosis	2.2479	2.3708	54.975	1.3377	2.0606	5.0719	3.3999

TABLE 3. The Entity FEM Results

Variable		Model 1	Model 2
D_1 = Maxis	α_1	-25.5	-88.4
	se(β)	(22.739)	(21.502)
	t-value	-1.1229	-4.1132***
D_2 = Celcom	α_2	-31.2	-94.5
	se(β)	(22.690)	(21.438)
	t-value	-1.3754	-4.4095***
D_3 = Digi	α_3	-37.7	-101.0
	se(β)	(22.689)	(21.447)
	t-value	-1.6614*	-4.7113***
In $ARPU_{CP_{POST}}$	β_1	-4.08	-6.41
	se(β)	(1.6743)	(1.6971)
	t-value	-2.4352***	-3.7762***
In $ARPU_{CP_{PRE}}$	β_2	-3.40	-3.32
	se(β)	0.7604	(0.7778)
	t-value	-4.4676***	-4.2732***
In $ARPU_{CP_{FL}}$	β_3	-8.00	-7.32
	se(β)	1.1584	(1.2226)
	t-value	-6.9094***	-5.9878***
In N_{FL}	β_4	-29.6	
	se(β)	9.4470	-
	t-value	-3.1327***	
In WL_{FL}	β_5		1.67
	se(β)	-	(0.6592)
	t-value		2.5406***
In GDP	β_6	19.4	21.8
	se(β)	1.7163	(1.9355)
	t-value	11.298***	11.308***
R^2		0.9592	0.958

Note: ***, ** and * indicate significance at 1%, 5% and %, respectively.

the cellular phone PR (Banerjee & Ros 2004; Iimi 2005; Brempong & Karikari 2007). Lastly, the GDP is positively related to cellular phone PR and significant (Ahn & Lee 1999; Sung & Lee 2002; Brempong & Karikari 2007; Chabossou et al. 2008; Wang, Tang & Pan 2010; Afridi et al., 2010).

THE ELASTICITY OF DEMAND

The results showed that the regression coefficient or the elasticity of $ARPU_{CP_{POST}}$ is –4.08 for model 1 and –6.41 for model 2. Meanwhile, the ARPU for prepaid is significant at 1 per cent for both models. The results showed that the elasticity of $ARPU_{CP_{PRE}}$ is elastic for all models with regression coefficient or the elasticity of $ARPU_{CP_{PRE}}$ is –3.40 for model 1 and –3.32 for model 2. For both segment markets, a small price changes will lead to large changes in quantity. For this market, the demand is very sensitive to price changes. As mentioned, if Celcom and Digi network failed in carrying out the cartels or collusive arrangements, the price of network access will be determined by Maxis as a whole. This is because Maxis network is viewed as price leadership in the telecommunications market for cellular line because of its ability to control more than 40 percent of the telecommunications market. For example, if the Maxis network change the prices to a high level, all cellular network players will also increase the price level. Besides, the probability for telecommunications firms in Malaysia to form collusive behavior is very low. This is because the value of elasticity is too high, and therefore the telecommunications firms will not participate in any collusive behavior as it is more profitable. A small price changes can cause a higher increase in quantity and revenue for firms without relying on other firms.

Meanwhile, the Maxis network is more likely to dominate the postpaid market share compared to Celcom network, which dominated the prepaid market in this research analysis. Between these two telecommunications firms, the Digi network lies in the middle between the postpaid markets dominated by Maxis; and the prepaid markets dominated by Celcom. The Digi network clearly adopt the principle of game theory and price leadership in marketing strategy and competition continue offering competitive price for continuance of services offered. However, the structure of telecommunications market in Malaysia is an oligopoly, hence an increase in total revenue for this type of market is not totally dependent on price changes. A more important factor for the oligopoly firm is non-price competition such as advertising campaigns to attract more number of subscriptions. Thus, the elasticity is very high is because the price is not too important and doesn't play a dominant role in the oligopoly market.

The results also showed that the postpaid market is more elastic than prepaid market for both models. This is because most of the postpaid subscribers are business customers. Therefore, it is difficult to avoid the business calls and they care less about the actual price because the company pays the bills. The postpaid market users are also tied to an agreement and a contract. But for the prepaid market, most of the subscribers are students or the younger generation. These groups are more sensitive on the fluctuation of price and decreasing in income. Next, the cross-price elasticity of demand for $ARPU_{FL}$ is –8.00 for model 1 and –7.32 for model 2. Lastly, the income elasticity is 19.4 for model 1 and 21.8 for model 2.

THE TYPE OF GOODS

The analysis indicates that the fixed-line is complementary goods to the cellular phone network in Malaysia (Ahn & Lee 1999; Banerjee & Ros 2004; Lee & Lee 2006; Wang, Tang & Pan 2010) based on the negative sign obtained on $ARPU_{FL}$ variable. If the price of fixed-line falls, people are willing to subscribe more of it and increase the quantity of demand, and at the same time they will subscribe the cellular phone network access irrespective of whether the price falls or not. This is because of the income effect

for same services but different type of services form. There are negative relationship between the fixed-line and cellular phone network access in Malaysia.

Besides, the result also indicated that the cellular phone networks are luxury goods (Wang, Tang & Pan 2010; Afridi et al., 2010) in Malaysia based on the positive sign obtained with high level degree of elasticity. But study conducted by Aguero (2008) indicated that the findings must be interpreted carefully because telecommunications cannot be treated like other luxury goods. For luxury goods, as people become wealthier, they will buy more of them and a larger percentage of income's spent on these goods. In other words, as the total expenditure increased, more money was spent on telecommunications services, and greater importance in the budget was accorded to, indicating that telephone was a luxury good.

A study by Csaba (2008) indicated that the term "new luxury" is used to explain the contemporary market for luxury. From their analysis depicts three distinct types of new luxury goods; accessible super-premium, old luxury brand extensions and mass prestige. According to this analysis, the super-premium have comparatively high price and they are accessible to a majority of consumers because they are relatively inexpensive and are "low-ticket" product classes. For old luxury brand extension are used about lower priced models or sub-brands offered by established purveyors of luxury goods, which bring items in high ticket product categories such as prestige automobiles. The mass prestige goods take a middle road between mass and prestige, commanding a premium price, yet selling considerable quantities and thereby defying conventional wisdom about the relationship between price and demand, and profitability of the particular product markets (Csaba 2008).

THE NETWORK EFFECT

To measure the network effect, two variables were used as proxies such as the number of subscriber (N_{FL}) and the number of waiting list for fixed-line. In this study, model 1 use the N_{FL} as a proxy to measure the network externality. The regression coefficient of is –29.6 for entity FEM. The results also indicated that the network externality depends on the network provider's price strategy and people tend to switch carrier if having any negative experience with network provider. Next, the waiting list for the fixed-line or WL is a proxy for the network externality in model 2. The regression coefficient of the WL is 1.67. The results also indicated that the network externality by using number of WL for fixed-line as a proxy has reveal the network effect or externality in Malaysian telecommunication sector.

As an overall conclusion for both variables, the network effects play a significant role in Malaysian telecommunication sector. This is because the services of network telecommunication become more differentiated by increasing the value-added of services. The consumer utilities by subscribing the network also depend on the interconnection between other networks. Conversely, the waiting list also concluded that there are positive relationships with the PR but the effect of number of subscriber as a proxy is more dominant compared to the waiting list based on overall result and the significance through pooled OLS and FEM analysis.

CONCLUSION

From the analysis, we found that the entity FEM is more preferred and appropriate model for this study compared to pooled OLS based on partial *F*-test. From the entity FEM analysis, all independent variables are significant. The price elasticity of demand for $ARPU_{CP_{POST}}$ and $ARPU_{CP_{PRE}}$ are high elastic and significant. For this kind of market, the demand is very sensitive to price changes that occur. The $ARPU_{CP_{POST}}$ and $ARPU_{CP_{PRE}}$ in Malaysia have negative relationship. Therefore, the probability of telecommunications firms in Malaysia to form collusive behavior is very low as it is more profitable. A small price changes can cause a higher increase in quantity and revenue for firms without relying on other firms. But the structure of telecommunications market in Malaysia is oligopoly and the price is not too important and plays a dominant role. Other than that, the postpaid markets are more elastic than prepaid markets. Most of the postpaid subscribers are business customer, while students or younger generation mostly subscribe the prepaid line. The ARPU for fixed-line is also significant and the cross-price elasticity between $ARPU_{FL}$ and cellular phone network is elastic. Thus, the fixed-line is complementary goods to the cellular phone network in Malaysia and has a negative relationship. This study also found that the networks externalities are strongly significant when we used number of subscriber (N_{FL}) and waiting list (WL) as a proxy in entity FEM. The GDP per capita has a strong and positive relationship with the PR and high elasticity. The results also conclude that the cellular phone networks are luxury goods.

For a small market like Malaysia, the presence of three major cellular phone network operators, namely Maxis, Celcom and Digi competing directly against one another has caused the existence of oligopoly market structures. Although the probability of the existence of collusive behavior and monopoly power is low, this should be addressed because of the development of telecommunications sector gadgets, particularly the growing use of smartphones in the market that claim the increasing number of subscription for cellular service network. Therefore, a non-price competition factors such as supply of service plan and smartphones package as a complementary goods should be introduced in the local market. With high income elasticity and elastic,

government intervention are needed to control the price level and tighten the conditions of service, so that the services provided are more affordable, high quality and not burden to the consumers. Lastly, the introduction of service tax once when the consumer decided to have a cellular phone network access on the prepaid services must be considered. This will help to control the increasing number of cellular phone network access as well as to curb the problem of having more than one number of cellular prepaid services. It will also take into account the elasticity and demographic factors of prepaid service subscribers. Impose a tax on prepaid services when the subscribers make a reload is less agreed, because it burdens prepaid service subscribers.

We recommend that future studies use time series analysis to make a comparison with the panel data results as well as use individual or firm data to get more accurate results. We also recommend that future studies should expand the variable by adding a new variable such as advertising expenditure and non-price competition variable. This is because Malaysia telecommunication sector is more on the oligopoly system. In additions to that for future studies, we suggest that the study should analyze the relationship between the crime rate and the cellular phone penetration rate in Malaysia. They should examine the relationship between the increasing crime rate and the ease of nest of access to the cellular phone network. Finally, the studies could be expanded by taking into account the existence of smartphone in the market.

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