



Telecommunication Costs Incurred Expenses Society Effect of Technology Adoption

Beban Biaya Telekomunikasi yang Dikeluarkan Masyarakat Pengaruh dari Adopsi Teknologi

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ABSTRAK

Salah satu target Rencana Pita Lebar Indonesia tahun 2014-2019 adalah memberikan akses bergerak kepada 52% populasi di wilayah pedesaan dengan data rate hingga 1Mbps. Target harga layanan pita lebar tertinggi adalah 5% dari rata-rata pendapatan bulanan pada akhir tahun 2019 agar layanan pita lebar dapat terjangkau oleh masyarakat luas. Rencana pita lebar dengan target harga dan minimal data rate tersebut tidak akan tercapai tanpa adanya perubahan teknologi. Teknologi yang mendukung terpenuhinya t tersebut antara lain teknologi 3.5G dan 4G LTE. Dalam rangka upgrade teknologi tersebut, operator mengeluarkan biaya yang cukup besar. , perlu adanya biaya yang cukup besar yang dikeluarkan oleh operator. Biaya tersebut sangat berpengaruh pada besar biaya yang akan dibebankan kepada pelanggan. Oleh karena itu, perlu dikaji seberapa besar biaya yang ditanggung pelanggan seluler setelah adanya teknologi baru. Penelitian ini bertujuan untuk mengetahui apakah biaya yang dibebankan kepada masyarakat sudah sesuai dengan yang ditetapkan oleh pemerintah dalam Rencana Pita Lebar Indonesia. Teknik penelitian menggunakan pendekatan data kuantitatif yang dianalisis dengan ekonometrika. Hasil penelitian menunjukkan bahwa berdasarkan data pengeluaran telekomunikasi rumah tangga maupun data ARPU, biaya yang dibebankan kepada pelanggan sudah memenuhi persyaratan yang telah ditetapkan dalam Rencana Pita Lebar Indonesia yaitu kurang dari 5%.

ABSTRACT

One of the Indonesia Broadband Plan in 2014 – 2019 is that it can be provided mobile data reaching 52% rural areas with data rate up to 1 Mbps. In order to be affordable, so that maximum price is 5% of the average monthly income at the end of 2019. That data rate cannot be achieved without upgrading the technology. The technology of 3.5G and 4G are among others technology that can support high data rate. In order to upgrade technology, it needs a considerable cost from mobile operators, while it can influence the cost that will be charged to the customer. Therefore, this paper studied how much the cost for data users after adopt new technology. This study aimed to know whether social cost is appropriate to Indonesia Broadband Plan. This research used a quantitative approach with econometrics analysis. The result showed that based on data of Household Expenditure with Budget for Telecommunications and ARPU, the cost charged to the customer has been complied with Indonesia Broadband Plan is less than 5 %.

1. Introduction

Technology continues to change from year to year. Such changes cannot be separated from customers' demand in using the service. The users today are more likely to use data services than voice service. Data services offer the use of a variety of applications, such as games, chat, e-mail, and so forth.

The data service could first be met with the presence of General Packet Radio Service (GPRS) technology, the technology of 2.5G generation with data speeds up to 144.4 kbps (Smith, 2003). Furthermore there was 3G technology i.e. Wideband Code Division Multiple Access (WCDMA) with characteristic data speeds up to 2 Mbps for users with a speed of 0 km / h, and 384 kbps for walkers, and 144 kbps for users moving at high speed (Smith, 2003). Then the fourth-generation technology with higher data speeds than the previous one came, reached 150 Mbps for downlink (Qualqomm, 2014). The application of new technology will increase the burden on the infrastructure side of the mobile operator. Operators must build new infrastructure or upgrade the system so that new technology can be applied. Based on data from Telkomsel, the costs required to implement the 4G technology is \pm 500 million for the first e-NodeB (Research SDPPI, 2015). The increasing cost for building new infrastructure will certainly affect the costs charged to the customer. Based on the document of Indonesia Broadband Plan in 2014-2019, in 2019 national broadband development target was planned to provide fixed access in urban areas as much as 71% households and 30% population with a data rate up to 20 Mbps, as well as mobile access to entire population with data rate up to 1 Mbps. As for rural areas, broadband can reach 49% households and 6% population with a data rate up to 10 Mbps as well as mobile access to 52% of population with a data rate up to 1 Mbps (Bappenas, 2014). The price of broadband services is targeted at maximum of 5% of the average monthly income at the end of 2019 in order to be affordable by the public (Bappenas, 2014).

Broadband plan with a minimum target of 10 Mbps data rate will not be achieved without significant changes in technology. One of technologies that supports the fulfillment of the data rate is the 4G LTE technology. For Development of new technologies, substantial costs should be incurred by the operator. These costs affect the costs that will be charged to the customer. Therefore, this study examines how much cost is charged to mobile customers after their new technology. This study aims to determine whether the costs imposed on users is in conformity with what set by the government in Indonesia Broadband Plan.

2. Literature review

2.1. Definition of econometrics

Econometrics consists of two words, namely economic and metrika. Economics is an economic activity, i.e. human activities to meet their needs through the efforts, sacrificing resources as efficiently and effectively as possible to get a goal as optimally as possible. While Metrika is a measurement activities. So that econometrics is a measuring activity of economic activities (Rini Handayani, SE., 2013). Econometrics can also be interpreted by applying statistical methods to measure and assess the economic hypothesis that is related data (Dougherty, 2014). Econometric model is used in business, finance, economics, administration, consulting and other fields. Econometric model used routinely for tasks ranging from description to analysis of policies and ultimately take important decisions (Diebold, 2016).

Econometrics is much more than a statistic that uses economic data, although it is closely associated with the statistics.

- Econometrics should realize that economic data could not be obtained from well designed experiment. Whereas, econometric generally takes observational data given.
- Econometrics should deal with special issue and something that arises regularly on economic data such as trends, cycles and seasonal.
- Econometrics is sometimes prone to non-causal predictive modeling, which requires correlation or rather a conditional expectation, and sometimes evaluates the impact that involves causational issues deeper.

2.2. Methodology of econometrics

Econometrics is used to analyze economic problems. Prior to the analysis, the correct methodology is needed. The process includes (Gujarati, 2004):

- 1) Determine the theories and hypotheses
- 2) Determine the mathematical models and theories
- 3) Determine the statistical or econometric models
- 4) Get the data
- 5) Estimate the parameters of econometric models
- 6) Test the hypothesis
- 7) Forecast or predict
- 8) Use the model for controlling or policy purposes

2.3. Graphics of econometrics

Econometric analysis would be easier if the data can be described in graphics. The graph consists of univariate and multivariate analyzes. Examples of the univariate graph is the time series and histograms (Figure 1), while the example of bivariate graph are scatterplot multivariate and scatterplot matrix is shown in Figure 2 (Diebold, 2016).

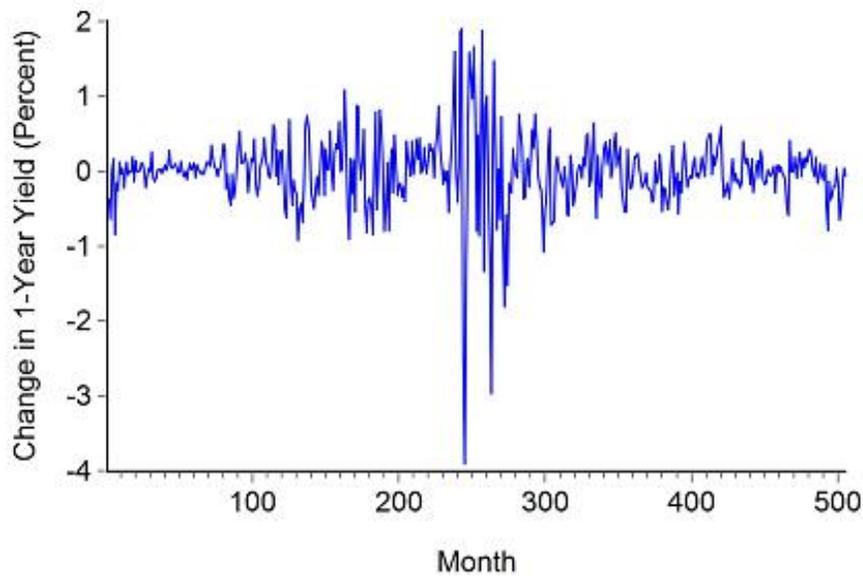


Figure 1. Level and bonds change in a few years (time series)

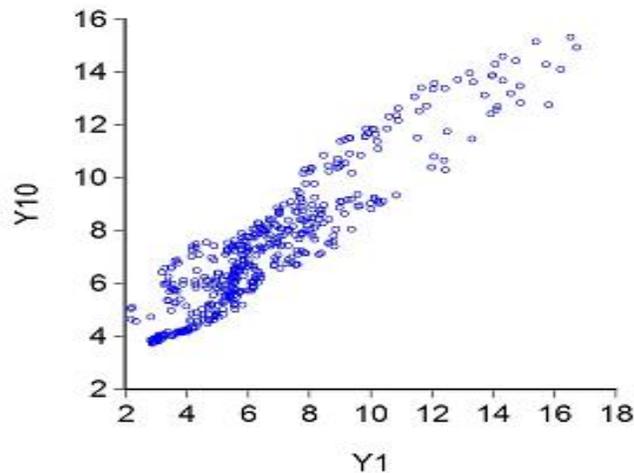


Figure 2. Bivariate Scatterplot, year-1 and year-10 the return of bonds one

Research on the social cost is Impact of 3G and beyond technology development and pricing on mobile data service provisioning usage and diffusion by Jarmo Harno. This study analyzes the business prospects of incumbent mobile operators in Western European countries. The result shows that the ARPU (Average Revenue per User) of voice service is going down because people tend to use data services. The core of this study discusses the different pricing models and suggests that the flat rate price of data services, coupled with certain conditions, supports in large-scale of taking data services. It encourages the use of data services and provides a competitive and sustainable business model for market participants operators at the same time. This study model indicates that the flat rate model combined with open access gives higher profits for the high-speed technology in rural areas compared to traffic-based payment (Harno, 2010).

3. Research Method

a. Research approach

This study uses a quantitative approach

b. Research sites

Research sites are in Jakarta and Depok. The choice of location is with consideration of the operator and the Central Statistics Agency (BPS) in the center of Jakarta. The literature study is conducted at the University in Depok.

c. Data collection technique

Data is obtained from the data requested to the operator, PPI directorate Control Directorate, Ministry of Communications and Information and the Central Statistics Agency (BPS). Data request to the operator is in the form of ARPU data, the number of 2G and 3G base stations, as well as the number of subscribers.

While the data obtained from the BPS namely telecommunications expenditure of households per month. The data obtained from the control directorate is the same with the data obtained from the operator.

d. Data Analysis Technique

Analysis of social costs used to calculate the costs incurred by the public to obtain telecommunications services in the form of voice and data services. Analysis was performed on 2 (two) types of social costs, namely:

- Telecommunications expenditure per household for voice and data services
- Average Revenue per User (ARPU)

Data were analyzed by using an econometric concept.

4. Result and Discussion

The social cost of this research is limited to telecom expense per month and ARPU. The social costs with adoption of 4G technology could not be analyzed yet because the implementation of these new technologies began in early 2015 so that the necessary data could not be obtained. Therefore, the social costs was obtained by using data of 2G technology (in this case is voice service) and 3G (data). The analysis in this study uses econometrics to obtain fees charged to customers. The software used for the simulation is Eviews.

4.1. Analysis of Social Costs from Telecommunications Expense View

The cost of the social viewed from telecom expense is influenced by the price of voice services, the price of the data, the capacity of 2G and 3G technology. Telecommunications expenditure data is obtained from data on average household consumption for telecommunications by province from the year 2011 - 2013 (telecommunications statistics, 2013). The capacity of 2G and 3G technology is obtained from the following equation:

2G capacity x = the number of 2G BTS x 2G data rate (9.6 kbps)(1)

3G capacity x = the number of 3G BTS x 3G data rate (384 kbps)(2)

The number of 2G and 3G BTS as well as the price of voice or data services is obtained from mobile operators and control Directorate, DG Implementation of Post and Information Technology, Ministry of Communications and Information Technology.

4.1.1. Telecommunications expenditure on the price of voice services and data services, simulation results from the telecommunications expenditure data, voice and data service prices are shown in Figure 3. In this study, it is assumed that the simulation results will be invalid if the probability is less than 10%. It is seen that the simulation results show the probability of the price of voice and data services is over 10%, so the prices of voice and data services do not affect the telecom expense.

Dependent Variable: SPENDING
 Method: Least Squares
 Date: 08/09/15 Time: 10:58
 Sample: 1 198
 Included observations: 198

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PVOICE	53.26515	96.06865	0.554449	0.5799
PDATA	14161.94	17774.51	0.796756	0.4266
C	28112.51	101481.9	0.277020	0.7821
R-squared	0.003396	Mean dependent var		96023.47
Adjusted R-squared	-0.006826	S.D. dependent var		48291.50
S.E. of regression	48456.04	Akaike info criterion		24.42974
Sum squared resid	4.58E+11	Schwarz criterion		24.47956
Log likelihood	-2415.544	Hannan-Quinn criter.		24.44990
F-statistic	0.332217	Durbin-Watson stat		0.996147
Prob(F-statistic)	0.717737			

Figure 3. Simulation Results of Telecommunication Expense for Voice and Data Services Price

4.1.2. Telecommunications Expense on 2G Capacity The simulation results of telecom expenses on 2G capacity can be shown on Figure 4.

According to Figure 4, it is seen that the probability of 2G capacity is less than 10% so the capacity of 2G affects telecom expense.

Dependent Variable: SPENDING
 Method: Least Squares
 Date: 08/09/15 Time: 11:00
 Sample: 1 198
 Included observations: 198

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAP2G	-10451.03	3020.801	-3.459689	0.0007
C	173546.7	22655.16	7.660362	0.0000

R-squared	0.057554	Mean dependent var	96023.47
Adjusted R-squared	0.052745	S.D. dependent var	48291.50
S.E. of regression	47000.67	Akaike info criterion	24.36376
Sum squared resid	4.33E+11	Schwarz criterion	24.39698
Log likelihood	-2410.012	Hannan-Quinn criter.	24.37721
F-statistic	11.96945	Durbin-Watson stat	1.009621
Prob(F-statistic)	0.000664		

Figure 4. Simulation Results of Telecommunications Expense on 2G Capacity

Mathematical equations on the simulation results are as follows:

$$Y = \beta_0 + \beta_1 X_1 \dots\dots\dots (3)$$

Y = the average household consumption for telecommunications

β_0 = fixed fees charged to the public (households)

β_1 = charges slope

X1 = 2G capacity (2G data rate)

$$Y = 173546.7 - 10451.03 X_1 \dots\dots\dots (4)$$

Based on the equation above, it is known that the fixed costs charged to the public when using 2G technology is for Rp.173.546,7. Slope shows negative, thereby telecom spending will drop even 2G BTS is reproduced or 2G capacity is enhanced. It shows people are more likely to use more advanced technology that is 3G technology. With 3G technology, people can use the service for free through voice applications that are already available.

The telecommunications expenditure of a household would be reduced in line with 2G capacity expansion, for more details see Table 1 and figure 5 below:

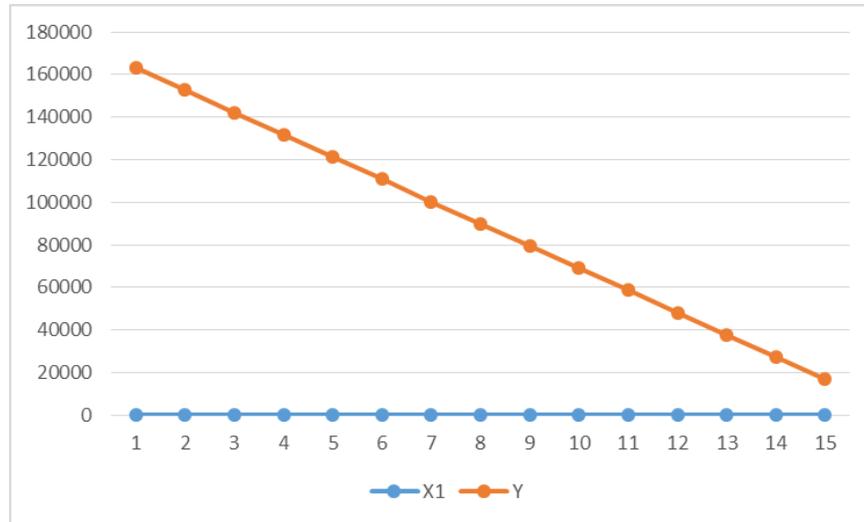


Figure 5. The amount of Telecommunications Expense on 2G Capacity

Figure 5 shows that even though 2G capacity is added through the addition of 2G BTS, the average of telecom expense is going down. Each additional unit of 2G capacity, telecom spending will be reduced by Rp.10.448, -. This shows that people are not interested anymore with 2G services.

4.1.3. Telecom Expenses on 3G Capacity

The simulation results of telecom expenses on 3G capacity is shown in Figure 6. The figure shows that the capacity of 3G affects on telecommunications expenses because the probability is less than 10%.

Dependent Variable: SPENDING
 Method: Least Squares
 Date: 08/08/15 Time: 06:50
 Sample: 1 198
 Included observations: 198

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAP3G	319.5220	92.35570	3.459689	0.0007
C	73216.78	7390.057	9.907471	0.0000
R-squared	0.057554	Mean dependent var		96023.47
Adjusted R-squared	0.052745	S.D. dependent var		48291.50
S.E. of regression	47000.67	Akaike info criterion		24.36376
Sum squared resid	4.33E+11	Schwarz criterion		24.39698
Log likelihood	-2410.012	Hannan-Quinn criter.		24.37721
F-statistic	11.96945	Durbin-Watson stat		1.009621
Prob(F-statistic)	0.000664			

Figure 6. Simulation Results of Telecommunication Expenses on 3G capacity

The cost equations for telecommunications are as follows:

When the data rate is increased by one unit, then the household consumption for telecommunications will increase by Rp. 319.52. Household consumption for telecommunications becomes Rp.73536. Table 2 shows the effect of the data rate increase on household expenditure.

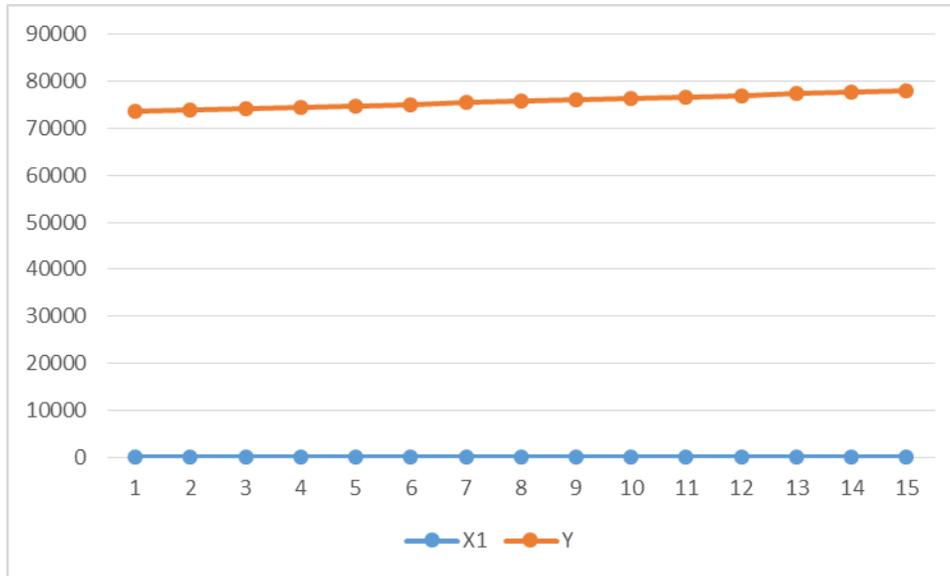


Figure 7. The amount of Telecommunication expenses on the 3G capacity

Figure 7 shows that the telecom expense is influenced by 3G capacity. The effect of the 3G capacity increase to the telecom expense increase is not very significant. Every one unit increase of 3G capacity, telecom expense rises by Rp.319,52. This shows that although people are more interested in using data services (3G), but spending for these services is not too big. The cause of these include a possibility that many operators provide data services at a low price to attract more customers and the ability of people to use data services on average is not less than Rp. 80,000 per month.

4.2. Analysis of Social Costs viewed from ARPU

Beside obtained from telecom expense per month, the social costs can also be obtained from the ARPU data. ARPU data used is ARPU per mobile operator from 2010 to 2014. The prices of voice and data services as well as the number of 2G and 3G BTS are obtained from cellular operators. The social cost is seen from the ARPU of each operator which has the following equation:

$$\text{Equation: } Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 \dots\dots\dots(6)$$

Y = ARPU

β_0 = fixed costs charged to the customer

$\beta_1, \beta_2, \beta_3, \beta_4$ = slope

X1 = the price of voice services

X2 = the price of data services

X3 = 2G capacity (low speed)

X4 = 3G capacity (high-speed)

Figure 8 shows the simulation results of the costs borne by the user on the price of voice and data services as well as the capacity of 2G and 3G.

Dependent Variable: ARPU				
Method: Least Squares				
Date: 08/05/15 Time: 07:07				
Sample (adjusted): 1 456				
Included observations: 456 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAP2G	-55663.89	16477.77	-3.378121	0.0008
CAP3G	950.1522	439.4615	2.162083	0.0311
PVOICE	46.18843	15.83267	2.917287	0.0037
PDATA	-4919.138	1674.755	-2.937229	0.0035
C	111862.4	14461.52	7.735177	0.0000
R-squared	0.049849	Mean dependent var	80317.38	
Adjusted R-squared	0.041422	S.D. dependent var	122022.0	
S.E. of regression	119468.1	Akaike info criterion	26.23039	
Sum squared resid	6.44E+12	Schwarz criterion	26.27559	
Log likelihood	-5975.529	Hannan-Quinn criter.	26.24820	
F-statistic	5.915335	Durbin-Watson stat	1.754239	
Prob(F-statistic)	0.000120			

Figure 8. Simulation Results of 2G and 3G Capacity as well as the price of voice and data services on ARPU

The simulation results in Figure 8 shows that each variable probability is less than 10% so that the variable 2G capacity, 3G capacity, the price of voice or data services affect the amount of ARPU. Equations obtained based on the simulation is as follows:

$$Y = 111862.4 + 46.18 X_1 - 4919.138 X_2 - 55663.89 X_3 + 950.15 X_4 \dots \dots \dots (7)$$

The equation shows that the telecommunications cost charged to the public is amounted Rp.111.862,4.

4.2.1. ARPU on Voice Service Price

ARPU Equation on the price of voice services obtained from equation (7) is as follows:

$$Y = 111862.4 + 46.18 X_1 \dots \dots \dots (8)$$

Based on these equations, the fixed cost charged to the customer is Rp. 111,862.4. Slope indicates that if the price of voice services is increased by 1 unit, the ARPU will rise by Rp.46,18. Figure 9 shows the amount of ARPU affected by price increase of voice service on each unit. In the figure, it is shown that although prices of voice service is increased, voice service ARPU tends to go up, but not too big. It shows that the use of voice services by customers is not too much possibly because people tend to use data services for communication.

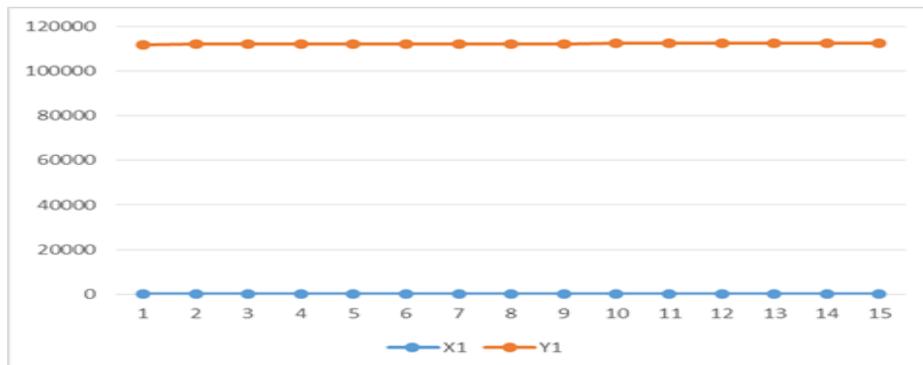


Figure 9. The amount of ARPU on the Increase of Voice Service Price

4.2.2. ARPU on Data Price

ARPU equation on the data is as follows:

$$Y = 111862.4 - 4919.138 X2 \dots\dots\dots(7)$$

Based on the equation above, it can be seen that the price increase data is very influential on ARPU. ARPU will decrease if operators raise the price of data services. This is likely due to the abundance of data service providers that the public has many options for using cheaper data services. Figure 10 shows a graph of the ARPU equation on the price of data services. In the figure we can see that the price increase of data will greatly reduce the use of data services, it is seen from the declining ARPU. Therefore should the operator not to raise data services if they do not want their income reduced.

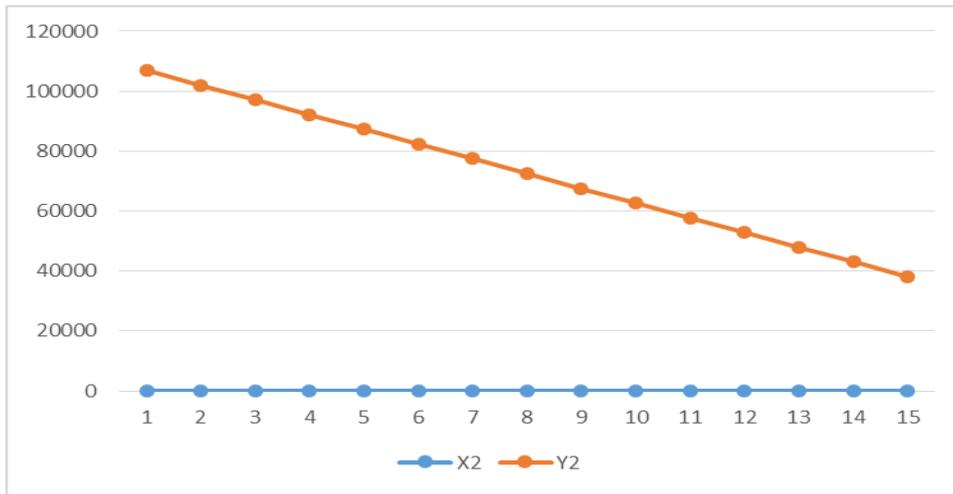


Figure 10. The amount of ARPU to data price increase

4.2.3. ARPU on 2G Capacity

For ARPU on 2G capacity, the following equation is obtained:

$$Y = 111862.4 - 55663.89 X3 \dots\dots\dots(8)$$

Based on the equation above shows that the addition does not increase the capacity of 2G ARPU value even tend to fall. This is because people are more likely interested in using 3G technology. The decrease is very significant that operators are expected to not add network or infrastructure of 2G. 3G technology ecosystems which include mobile phones, tablets, modems, and so forth have started to increase compared to 2G technologies. The tendency of people to use 3G services is also strongly influenced by the interesting applications that are emerging.

4.2.4. ARPU on 3G Capacity

ARPU equation on 3G capacity is as follows:

$$Y = 111862.4 + 950.15 X4 \dots\dots\dots(9)$$

Equation model above shows that the addition of 3G capacity could boost ARPU value. The increase is not very significant, but enough to give advantage to the operators so it is advisable to operators to build data services infrastructure. The influence of ARPU toward 3G capacity is contained in Figure 12. In the figure, it can be seen that every one unit increase of 3G capacity, there is an increase of ARPU Rp. 950,00. It is seen that there is a positive response from customers to use data services as well as the trend of increasing operator revenues with the addition of 3G infrastructure. The factor is strongly influenced by a growing ecosystem of 3G technology, the reduction in the 2G, the more attractive data services applications, more attractive data

services than voice services, as well as the presence of data services that begins to replace the function of voice service.

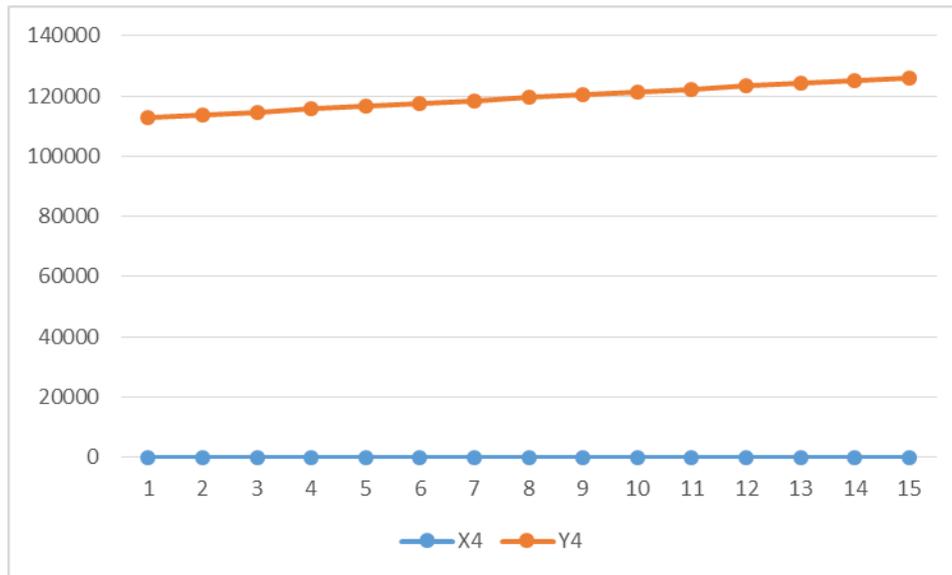


Figure 11. The amount of ARPU on 3G capacity

In accordance with the Broadband Plan of Indonesia, the price of broadband services is targeted to a maximum of 5% of the average monthly income at the end of 2019 (Bappenas, 2014). Based on 2015 GDP data, Indonesia's per capita income per month on average is Rp3.773.845 (International Monetary Fund, 2016) so that the maximum expected data services price is amounted to Rp. 188,692.3. The price of data services that is charged to the public by telecommunication expenditure data per month from the simulation results is Rp. 73216.78 so the price is below the services price set by the government. Similarly, simulation results of ARPU data show that the amount of telecommunication service price charged to customers is amounted to Rp. 111,862.4. The price is below the requirements set by the government.

5. Conclusions and Recommendations

5.1. Conclusions

Based on the results of this study, it can be concluded that the costs of the public telecommunications incurred, effect of the adoption of the technology, has already met the requirements set by the government (Broadband Plan of Indonesia in 2014-2019) that is less than 5% of the average income per month. The increase in the price of data services will not increase the amount of ARPU because people tend to use cheaper data services.

5.2. Suggestions

Household expenditure for voice services is greater than the data so that operator revenues from voice services is greater than the data. 2G network should not be fully migrated to 3G / 4G network. Nonetheless operators need to build 3G / 4G network and not to add the development of 2G networks because people now tend to use data services.

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