Economic Development and Mobile Cellular Subscription

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Abstract

The World Bank reported that in 2018, there were around 7.9 million mobile cellular subscriptions in the world. Mobile cellular subscription grows rapidly. The growth of mobile cellular subscription follows a power model with a very large magnitude. This study aims to investigate economic factors of mobile cellular subscription growth. The data from the World Development Indicators of the World Bank were used in the study, covering 260 countries during 2005–2017. The dependent variable was the number of mobile cellular subscription and the independent variables were access to electricity and automated teller machines (ATMs). These two independent variables were used as proxies of economic development factors. The analysis used panel data empoloying the fixed effects model. The results of the study show that an increase of one percent in population access to electricity was associated with an increase of around 806,856 mobile cellular subscriptions in the world. Meanwhile, an increase of one ATM per 100,000 adults was associated with an increase of around 969,049 mobile cellular subscriptions in the world. These results imply the importance of economic development through access to electricity and ATM to improve mobile cellular subscription for better development.

Keywords

Economic growth, mobile cellular subcription, access to electricity, automated teller machines, panel data, fixed effects model.

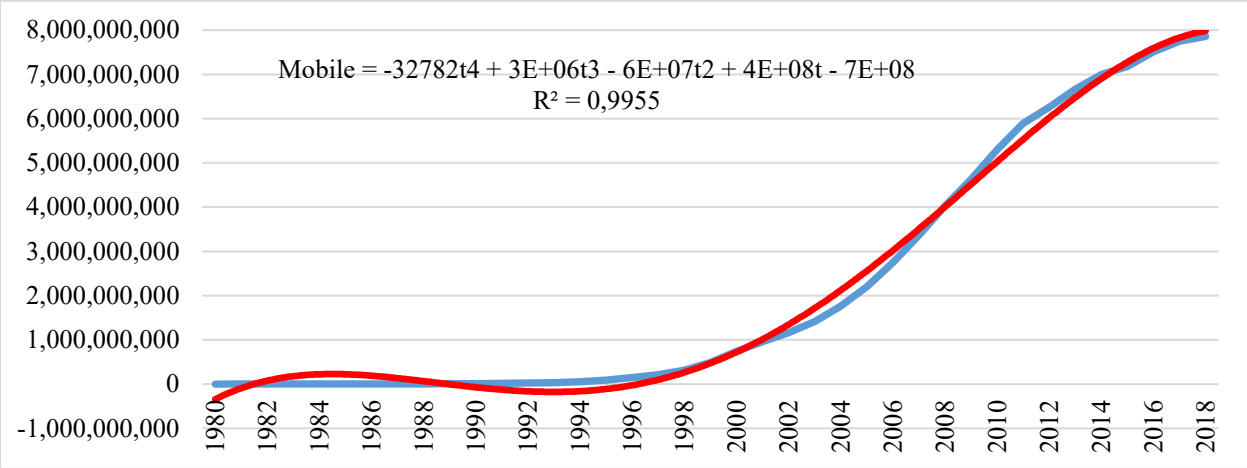
1. Introduction

Information and communication technology (ICT) has been an important part of human life and affects all people. It influences almost all parts of life not only economic aspects. Rajagukguk (2020[c]) studied an analysis of the impacts of ICT on transportation, on agricultural industry (Rajagukguk 2020[b]), and on world trade (Rajagukguk 2016[a]). Meanwhile, Samosir (2016) studied the impacts of ICT on economic growth, Samosir et al. (2020) examined the relationship between ICT and contraceptive discontinuation, and Samosir and Rajagukguk (2017) investigated the association between ICT and regional competitiveness. Further, Edquist et al. (2018) carried out a study based on panel data from 135 countries during 2002–2014. They found that ICT, in particular mobile broadband, had positive impacts on economic growth. An increase of 10% in mobile broadband was associated with an increase of GDP by 0.8%.

Mobile cellular subscription grows rapidly. The growth of mobile cellular subscription follows a power model with a very large magnitude. As it can be seen from Figure 1, the pattern of world mobile cellular subscription during 1980–2018 was power four polynomial model as follows.

$$Y = -32782.t^4 + 3.E+06.t^3 - 6E+07.t^2 + 4E+08.t - 7E+08 \quad \text{..... (1)}$$

with $R^2 = 0,9955$. It means that 99.5% of variation in world mobile cellular subscription during 1980–2018 could be explained by the model.



Source: World Bank (2021) (Author's compilation).

Figure 1. World mobile phone subscription: Data and Polinomial Trend 1980–2018

Pantelimon et al. (2020) argued that the rapid increase in mobile cellular use, such as mobile commerce, suggests the use of mobile device (telephone, tablet, and other portable device) to sell and buy products on line. They found the association between mobile commerce and gross domestic product (GDP) in western Europe countries, including Germany, and East European countries, including Romania, during 2014–2019.

This study focused on mobile cellular subscription as part of ICT. Why? It is because the use of mobile phone has been acknowledged as an ICT indicator HH105.12 (Partnership on Measuring ICT for Development, 2016). The proportion of individuals that have a mobile telephone fosters women empowerment. The use of mobile phone in developing countries, in particular among women, enables women to access each other through sharing and borrowing, gender security, ability to get a job, bank account, and access to microfinance or financial institution. Mobile phone improves economic and professional opportunity particularly for entrepreneur and self-employed workers. Mobile phone ownership offers greater opportunity on women privacy and empowerment.

Haftu (2019) studied the impacts of mobile phone and internet on income per capita in 40 countries in Sub-Sahara Africa during 2006–2015. The results of the study show that mobile phone penetration was associated with GDP significantly. Increase access to mobile phone has an important role in reducing poverty through increase of income per capita.

The importance of mobile phone ownership raises a question in this study. What are the factors that influence mobile cellular ownership?

A number of studies have been carried out to examine the effects of electrification on mobile phone with the end objective to improve the quality of life (e.g. Wood 2006; Manchester & Swan 2013; Vinuthna et al. 2019; Ezeoha et al. 2020; Jacucci et al. 2009; Tran et al. 2015). Tran et al. (2015) conducted a study about the relationship between demographic determinants and mobile phone ownership among 35,306 individuals in rural Bangladesh during 2008 and 2011. They found that the ownership of mobile phone was associated with age, literacy, education, employment, access to electricity, and household wealth.

Global demand on electricity and mobile phone increased rapidly as an impact of modern (Manchester & Swan 2013). The need of electricity increases along with the need of mobile phone. Manchester & Swan 2013 reported that there were 500 million mobile phone users without access to electricity. However, charging the mobile phone demands electricity. Therefore, electricity is positively associated with mobile phone use for welfare improvement. An innovative approach is needed to meet the need of 1.3 billion people with lack of electricity (Alstone et al. 2015). Improvement in access to basic electricity services directly meet sustainable development goals (SDGs) for quality of life. One way is to support mobile phone use.

Economic growth, in this case measured by GDP, is associated with mobile phone use (Edquist et al. 2018; Haftu 2019; Pantelimon, et al. 2020, Gruber & Koutroumpis 2011; Williams 2013). Taher & Masatsugu (2010) conducted a study in 50 countries using the data from World Bank during 1990–2007. They found that GDP per capita income, competition policies, telecom infrastructure, and technological innovations influences mobile phone subscription.

Automated teller machine (ATM) is associated with internet banking both partially and simultaneously (Gumilang & Azib 2019). Ganeshkumaran & Balamurugan (2018) also found that ATM and internet banking had positive effects on mobile phone subscription. ATM is linked to mobile communication where ATM network provides all information on working condition of ATM on mobile phone users. Internet and mobile phone, and ATM together improve the consumer's convenience and reduce costs and maintain profitability of banking industry (AbdEl.Aziz et al. 2014). Further, ATM and mobile phone were positively associated and bring profit because it reduces time in withdrawing money from ATM (Hajare et al 2008). Furthermore, traditional ATM has limitation and this limitation can be overcome if that ATM is connected to mobile phone. Therefore, ATM is positively associated with mobile phone use (Karunanayake et al. 2008). A number of applications to overcome the limitation of ATM. Even today mobile phone can function as payment terminal.

Based on the discussion above, therefore the general objective of this study is to analyze the association between economic development and mobile cellular subscription. The specific objectives include to examine the effects of electrification and ATM on mobile cellular subscription. It is hypothesized that mobile cellular subscription is positively associated with economic development, electrification, and ATM.

Data and Methods

This study used data from the World Development Indicators of the World Bank that covered 260 countries in the world during 2005–2017. The outcome variable was the number of mobile cellular subscription (per 100 people). Meanwhile, the main independent variable was GDP per capita (current US$) and the control variables were access to electricity (% of population) and automated teller machines (per 100,000 adults). These two independent variables were used as proxies of economic development factors.

The data in this study were analyzed using univariate, bivariate, and multivariate analyses. Summary statistics were produced for univariate analysis. These include the number of observation, mean, standard deviation, minimum, and maximum of variables in the study. Scatter diagrams between the outcome variable and covariates were displayed for bivariate analysis. For multivariate analysis, panel data empoloying the random effects generalized least square (GLS) regression was used in the analysis of the relationship between economic development and mobile cellular subscription.

2. Results and discussion

The results of univariate analysis were presented in Table 1. It can be seen that there was a great inequality in mobile cellular subscriptions across countries in the world, ranging from the lowest of only 0.26 per 100 people to the highest of 212.64 per 100 people. Access to electricity also varied greatly from none to universal. Economic development achievement differed significantly where GDP per capita ranged from a lowest of only 151.68 current US$ to a very high of US$118,824. The number of ATM differed greatly too from none to 373 per 100,000 adults.

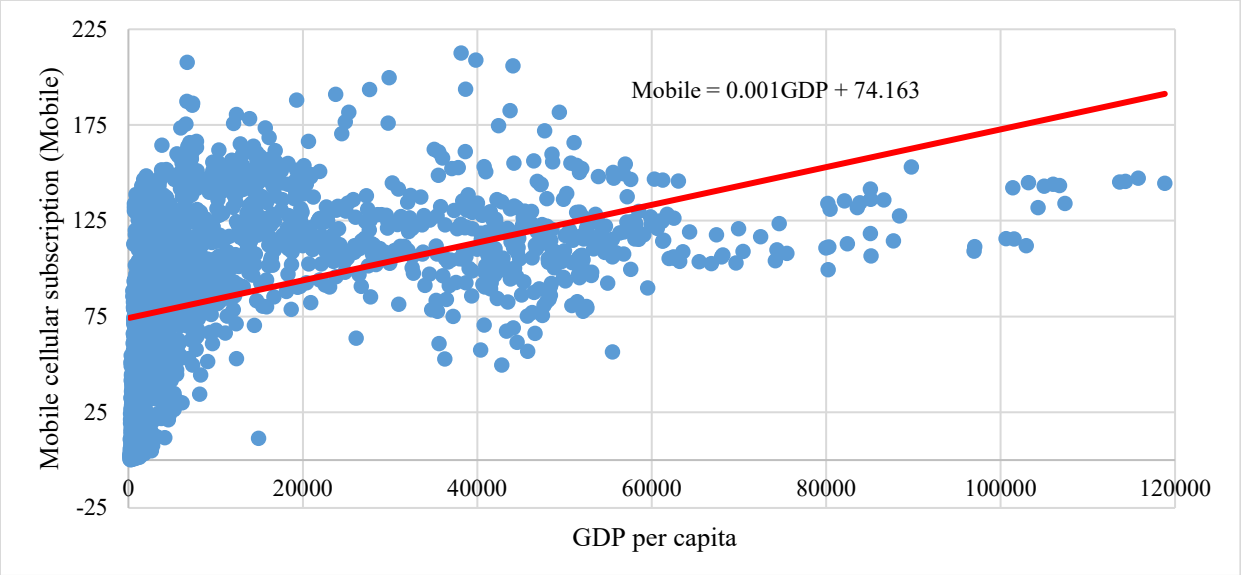
The results of bivariate analysis are displayed in Figure 2–4. It can be seen that there was a positive correlation between GDP, electrification, and ATM and mobile cellular subscription. It means that the higher the GDP per capita,

electrification, and ATM, the higher the mobile cellular subscription. An increase of one current US$ in GDP per capita, 1 electrification per 100 people, and one ATM per 100,000 adults was related to an increase of mobile cellular subscription by, respectively, 0.001, 0.91, and 0.41 mobile cellular subscription per 100 people.

Table 1. Summary statistics of variables in the study: Number of observation (Obs), mean, standard deviation, minimum, and maximum

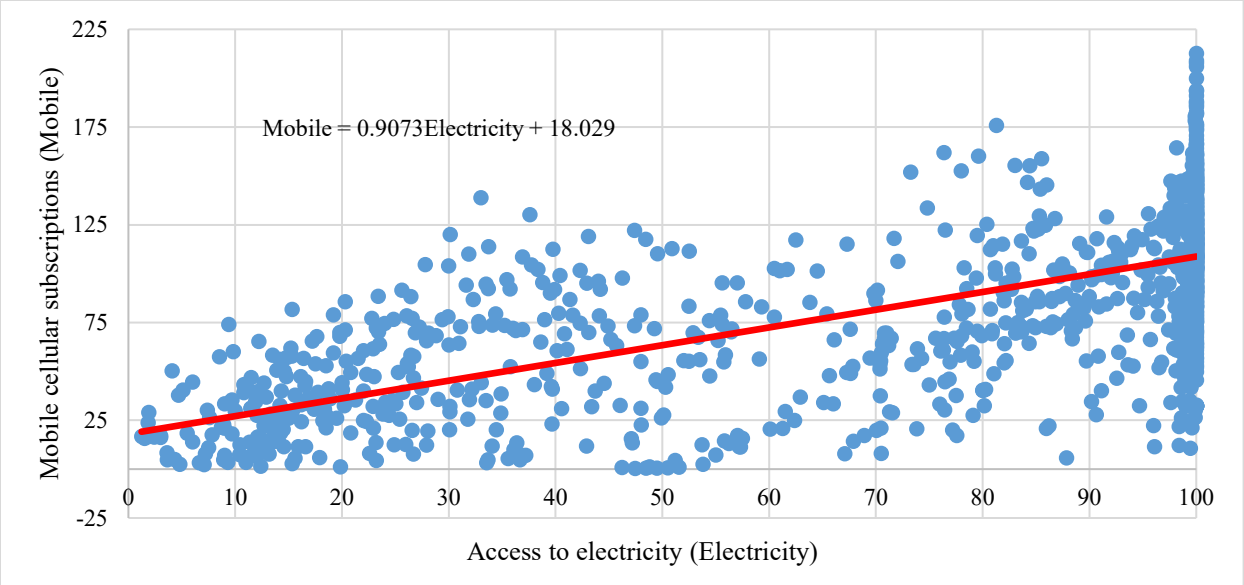
Variable	Obs.	Mean	Standard deviation	Minimum	Maximum
Mobile cellular subscriptions (per 100 people)	1,962	87.578	42.421	0.26	212.64
Access to electricity (% of population)	1,962	77.844	31.400	0.00	100.00
GDP per capita (current US$)	1,962	13,612.310	19,507.450	151.68	118,823.60
Automated teller machines (ATMs) (per 100,000 adults)	1,962	42.800	48.973	0.00	372.78

Source: World Bank (2021) (Author's compilation).



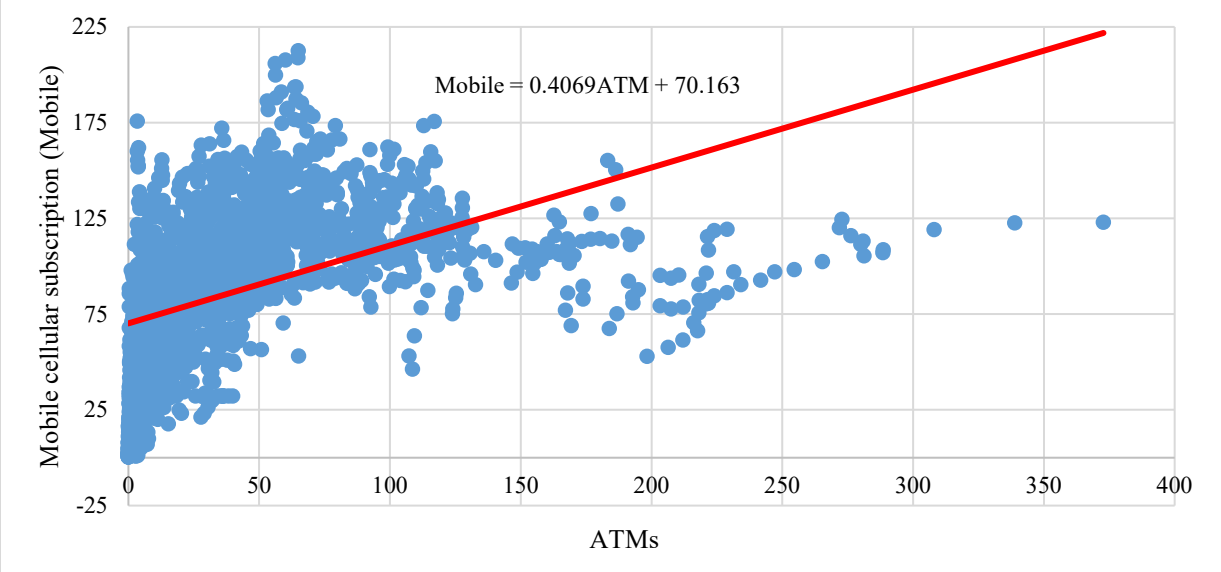
Source: World Bank (2021) (Author's compilation).

Figure 2. GDP per capita (current US$) and mobile cellular subscriptions (per 100 people)



Source: World Bank (2021) (Author's compilation).

Figure 3. Access to electricity (% of population) and mobile cellular subscriptions (per 100 people)



Source: World Bank (2021) (Author's compilation).

Figure 4. Automated teller machines (ATMs) (per 100,000 adults) and Mobile cellular subscriptions (per 100 people)

The results of multivariate analysis are given in Table 2. These include parameter estimates, standard errors, test statistic *z*, *p*-value, and confidence interval of the fixed effects regression model of determinants of mobile cellular subscriptions. It can be seen that all covariates in the model were positively, statistically, and significantly associated with mobile cellular subscription. It means the higher the GDP per capita, electrification, and ATMs, the higher the mobile cellular subscription.

GDP per capita is significant at 0.01 level. Other things being the same, an increase in one current US$ in GDP per capita was associated with an increase in 0.0002 mobile cellular subscriptions per 100 people. Meanwhile, access to electricity is significant at less than 0.001 level. Ceteris paribus, an increase 1% electrification was associated with an

increase of 0.668 mobile cellular subscriptions per 100 people. Further, ATMs is also significant at less than 0.001 level. After controlling for the effects of other factors, an increase of 1 ATM per 100,000 adults was associated with an increase of 0.168 mobile cellular subscriptions per 100 people.

In addition, time also affects mobile cellular subscription. During the study period there was an increase of 4.4 mobile cellular subscriptions per 100 people every year. It means that there will be more people with mobile cellular subscriptions in the future.

Table 2. Parameter estimates, standard errors, test statistic *z*, *p*-value, and confidence interval of the fixed effects regression model of determinants of mobile cellular subscriptions

Covariates	Parameter estimate	Standard error	Test statistic *z*	*p*-value	95% confidence interval	
Time	4.439	0.11	40.42	< 0.001	4.224202	4.654718
GDP per capita (current US$)	0.0002	0.0000793	2.64	0.008	0.000054	0.0003648
Access to electricity (% of population)	0.668	0.0450067	14.83	< 0.001	0.5793315	0.7557545
Automated teller machines (ATMs) (per 100,000 adults)	0.168	0.0283606	5.92	< 0.001	0.112172	0.2233434
Contant	-8,902.163	219.8975	-40.48	< 0.001	-9,333.154	-8,471.172

Source: World Bank (2020), own calculation

3. Conclusions and recommendation

The results of this study show that mobile cellular subscription will continue to increase. In addition, the results of this study supports the findings from the previous studies on the importance of economic development, electrification, and ATMs on mobile cellular subscription (e.g. Edquist et al. 2018; Wood 2006; Ganeshkumaran & Balamurugan 2018). GDP per capita, electrification, and ATMs had positive effects on mobile cellular subscription. Therefore, it is recommended that government of countries should enhance the achievement of economic development, access to electrification, and availability of ATMs to foster access to mobile cellular subscription in order to promote the improvement of the people's welfare in their country and to achieve the sustainable development goals.

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