

Tokyo University of Foreign Studies

The Impact of ICT on Economic Growth

Analysis on 11 Trans-Pacific Partnership
Negotiating Countries

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Abstract: Nowadays, Information and Communication Technology (ICT) is necessary for not only our lives, but for development for every country. In this research, eleven Trans-Pacific Strategic Economic Partnership Agreement (TPP) negotiating countries are investigated by using a linear regression model for the years 2000-2013. Each country is investigated first, and after that there will be investigation of pooled data. Since there were not sufficient research done for ICT impact on economic growth in TPP countries, this paper will partially cover the works for unexplored areas.

Keywords: ICT, TPP, Linear Regression Analysis, Economic Growth, Emerging Economies, GDP

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1. Introduction

When communicating with each other, learning a new subject, or making a reservation, we cannot ignore the existence of Internet or Information and Communication Technology (ICT) these days. It is obvious that ICT is becoming one of the most essential parts of our lives. Most of us, including myself, cannot live without these technologies because of the convenience and amazing innovation that always brings us new experiences. As a result, it can be considered that ICT can have an economic impact nowadays, and this thought became the beginning of this research.

In this section, the purpose of this research and ICT situations are introduced from multiple angles, in order.

1.1. Purpose and Flow of This Research

The purpose of this research is to examine an economic impact of ICT, both in developed and in developing countries with a linear regression analysis. The more detailed purpose will be written in the section titled “3. Objective and Value-Added.” The research will start with a description about the specific reason why ICT would be the topic. The research will continue with explanations about interesting terms related to ICT and a broad description of Trans-Pacific Partnership (TPP). Lastly, we will look at the ICT situations in each of the eleven countries—member countries of TPP and countries in negotiation. After the introduction, several literature reviews will be done, and a more detailed objective and value-added look into this research are explained. The model and method used to conduct this research are introduced, and estimated results are given. Next, the actual results and analysis are given. Finally, the conclusion discusses future suggestions and ideas in regards to ICT.

1.2. The Hot Topic: ICT

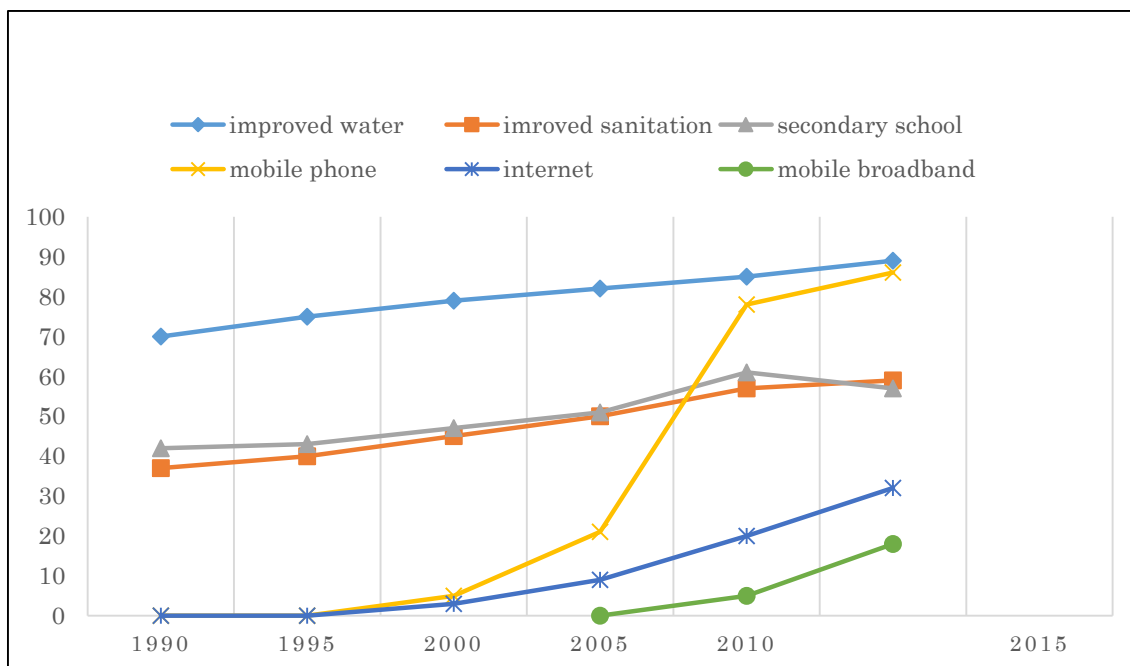
The World Development Indicator (WDI) is paying a large amount of attention to the Internet. WDI publishes the “World Development Report”

once a year, which picks up major themes of development and analyzes those themes. The main theme in the 2016 Concept Note of World Development Report was “Internet”. It has been announced that the internet would be a force for development and change, especially for the poor in developing countries. The report was exploring the internet’s impact on economic growth, social and economic opportunity, and on the efficiency of public service delivery.

Also, the report indicates that the rapid diffusion of digital technologies to developing countries is unprecedented. For example, it took Indonesia 160 years to reap the benefits of steamships after their invention, 60 years for Kenya to have electricity, and 15 years for Vietnam to introduce computers. It is not the same for each country to be familiar with digital technologies.

The number of smartphone owners in developing countries now exceeds that in the developed world, even if basic mobile phones still dominate. More households in developing countries own a mobile phone than have access to electricity or improved sanitation facilities (Figure 1). The penetration of fixed-line internet has been relatively slow, but the use of mobile broadband is accelerating. With the price of smartphones declining rapidly, it is possible that an additional one billion people will gain access to the internet by 2020, greatly widening access to a vast pool of information and ideas. While almost everyone in high income countries now has constant internet access, the greatest impacts of the digital transformation for most people in low and middle income countries are still in the future.

Figure 1. Diffusion of Six Factors



Note: ICT and infrastructure indicators (mobile phone subscriptions, internet users, mobile broadband subscriptions, improved water, and improved sanitation) are per 100 individuals. Net secondary school enrollment is the percent of the relevant age group that is enrolled.

Source: World Bank, World Development Indicators (WDI), International Telecommunication Union (ITU)

1.3. Internet’s Contribution to Overall GDP: iGDP

“iGDP” is an interesting term related to ICT. The definition of this term comes first. This term stands for the “Internet’s contribution to overall GDP”. The calculation of iGDP uses the expenditure method of calculating GDP. It totals all the activities linked to the creation and use of Internet networks and services and includes four major categories: private consumption, public expenditure, private-sector investment, and trade balance. This term was made by McKinsey & Company, after a few directors of this company had made a bar chart of major countries and some countries from Africa in 2012. (Appendix A) The blue bars are developed and emerging countries, the purples are African countries. When looking at the mean value,

Africa seems to be low (1.1%), but the company conjectures that Africa's iGDP will grow to at least 5 to 6 percent by 2025, matching that of leading economies such as Sweden, Taiwan, and the United Kingdom. However, if the Internet achieves the same kind of scale and impact as the spread of mobile phones in Africa, iGDP could account for as much as 10 percent, or \$300 billion, of total GDP while producing a leap forward in economic and social development. The Internet's greatest impact in Africa is likely to be concentrated in six sectors: financial services, education, health, retail, agriculture, and government. Technology-related productivity gains in these sectors could reach \$148 billion to \$318 billion by 2025, and large populations stand to benefit as a result. (Manyika, Cabral and five more, 2013) It is obvious now that even Africa cannot ignore the presence of the internet/ICT. In this research, African countries are not covered for analysis but still, the current situations and estimates of Africa are thought to be of help.

1.4. Trans-Pacific Strategic Economic Partnership Agreement (TPP)

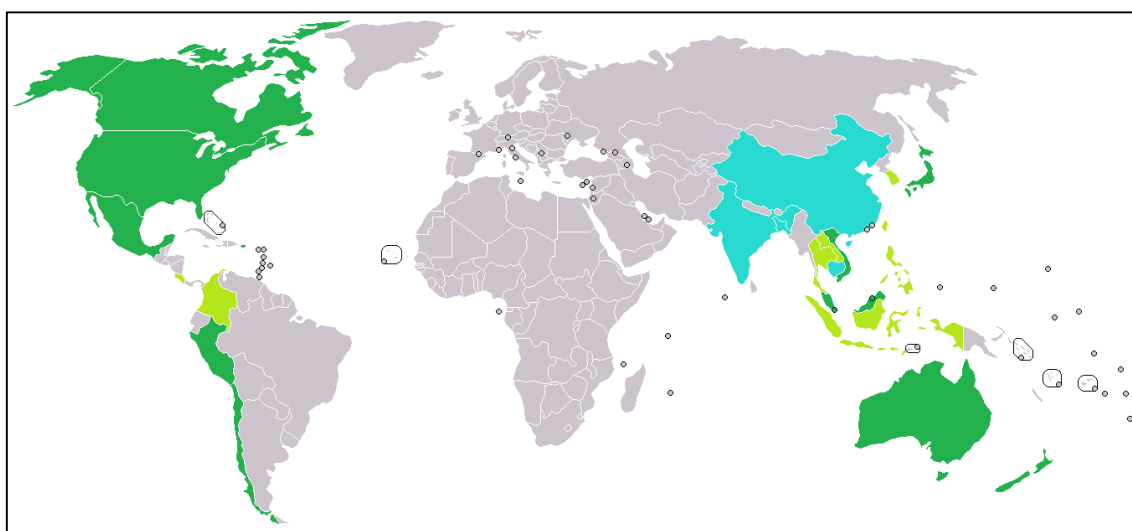
Trans-Pacific Strategic Economic Partnership Agreement (TPP) is a high standard, comprehensive regional Free Trade Agreement (FTA) among twelve countries: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, the United States, and Vietnam. (Figure 2) The negotiations started in 2008, when the P-4 nations (Brunei, Chile, Peru and Singapore which signed an FTA in 2005), were joined by the eight additional nations. Furthermore, there are some countries who have announced an interest in joining this agreement such as Korea, Thailand, and Indonesia.

There are twenty-one areas being argued in the TPP agreement. (Table 1) As a matter of course, it is a free trade agreement, so six of them are related to trade. Surprisingly, the ICT related fields: *telecommunications* and *electronic-commerce (e-commerce)* are also included. The rule for mobile phone and internet access is regulated in the *telecommunications* field, and

the rule for mail-order business is in the *e-commerce* field. These rules are going to be loosen basically than the present, so international expansion of the large companies would become easier. On the other hand, developed countries can take away the businesses of developing countries.

TPP is also aiming at the integration of the service industry such as current manufacturing. These days, global supply chain of goods has been common: Nike does not own a factory and does offshore outsourcing, Apple built iPads by procuring parts from all over the world to Taiwan's factory and the products are shipped. The key factor of the integration of the service industry would be ICT and TPP is said to be an ideal step for this.

Figure 2. Potential members of the Trans-Pacific Partnership



- : Currently in negotiations
- : Announced interest in joining
- : Potential future members

Source: Wikipedia

Table 1. Twenty-one Fields in Negotiation

Market Access for Goods	Temporary Entry
Rule of Origin	Financial Service
Trade Facilitation	Telecommunications
Sanitary and Phytosanitary Standards (SPS)	Electronic-Commerce
Technical Barriers to Trade (TBT)	Investment
Trade Remedies (Safeguard)	Environment
Government Purchasing	Labor
Intellectual Property	Institutional Issues
Competition Policy	Conflict Resolution
Cross-Border Service	Cooperation
	Cross-Cutting Issues

: Fields related to trade

: Fields related to ICT

Source: Ministry of Economy, Trade and Industry (METI), 2013

1.5. ICT Diffusion

In developed countries, internet diffusion is 78% while developing is 32% in 2012. (Figure 3) Looking at internet utilization ratio, the proportion of internet utilization among diffusion rate, by regions: Europe 3/4, North and South America 2/3, Asia Pacific Ocean region 1/3, Africa 1/5. Note that Africa's ratio grew double in two years.

Broadband has the highest growth rate as an internet connection method. (Figure 4) Looking at diffusion by regions: Europe 64%, North and South America 59%, CIS countries 49%, Arab countries 25%, Asia Pacific Ocean region 23%, Africa 19%.

Figure 3. Internet Diffusion

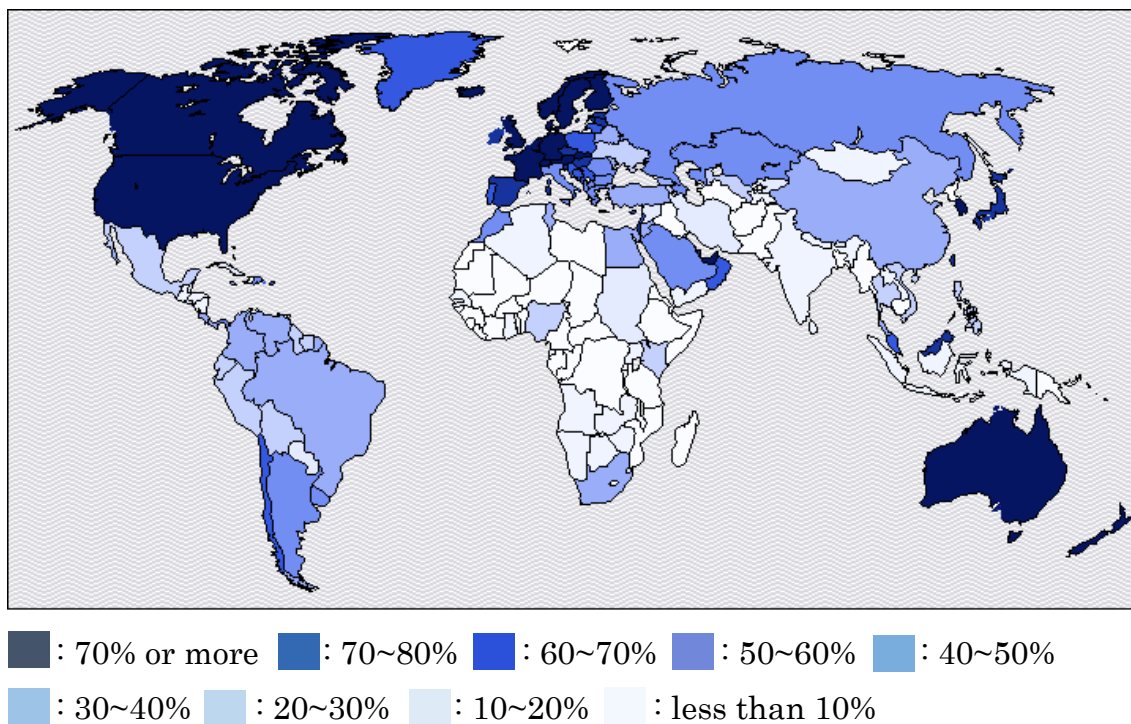
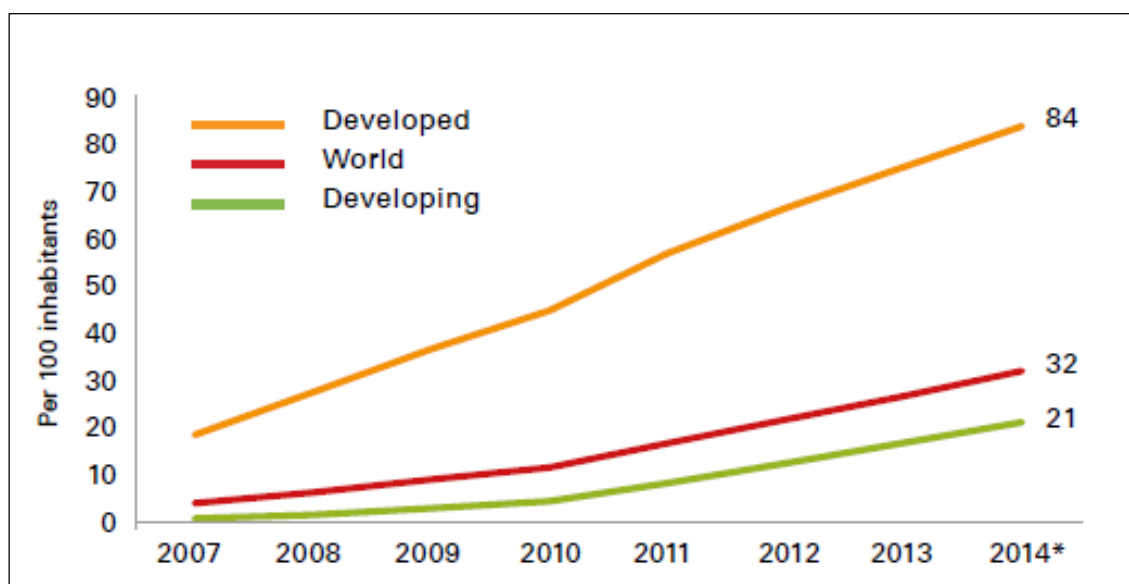


Figure 4. Broadband Network Utilization Ratio



Note: *Estimate

Source: ITU/ICT Indicators Database, 2014

1.6. ICT in Developed Countries

The ICT diffusion has risen rapidly both in developed and developing countries. It is usually said that economic growth can be achieved through increased or improved use of labor and capital or through a rise in multi-factor productivity (MFP). However, OECD (2001) found out that a factor that has been driving growth in some developed countries is ICT (Schreyer, 2002). Additionally, network industries account for between one-tenth and one quarter of economy wide investments (OECD, 2009).

In this research, targeted countries are divided in two groups: developed or not. Although there are many definitions of developed countries, Japan, Australia, New Zealand, United States, and Canada would be defined as developed by the OECD high-income countries definition. (Appendix B) To look the whole grouping, refer to Table 2. From now on, the each recent topics of ICT in five countries aforementioned will be introduced.

1.6.1. Australia

- Completion of the transition to digital terrestrial broadcasting (December, 2013)
- Turnbull former communication phase became prime minister, National Broadband Network (NBN)*¹ also started the FTTN commercial service (October, 2015)

1.6.2. New Zealand

- About one quarter of the ultra-high-speed broadband network initiative plan are achieved (March, 2014)

1.6.3. Japan

- Established as an Aeon Group company in 2009, Aeon Agri Create currently operates 15 farms across Japan, by applying ICT to farming started with visualizing various tasks at the agricultural production sites (November, 2014)
- Since FY2010, the Ministry of Internal Affairs and

Communications (MIC) has been implementing the Future School Promotion Project to encourage collaborative learning through the use of ICT. In the Japanese education market, tablets in use were worth 26 billion yen in 2013, and are predicted to reach 75.9 billion yen in 2018 (IDC Japan estimate) (March, 2015)

- EC*2 market for the B2C is predicted to rise 25 trillion yen by the year 2021 (November, 2015)

1.6.4. United States

- Broadband promotion measures called "National Broadband Plan" by the Obama Administration (February, 2009)
- Federal Communications Commission (FCC)*3 adopting a new net neutrality rules (March, 2015)
- IPv4*4 address in North America almost being run out (July, 2015)
- Comments wanted to transfer of Internet supervision rights proposal of the United States government by National Telecommunications and Information Administration (NTIA)*5 (August, 2015)
- State and local governments who consider the introduction of the "Internet tax" (September, 2015)

1.6.5. Canada

- Broadband connection supporting policy "Connecting Canadian" (September, 2014)
- Coverage trend of LTE*6 services (October, 2014)

1.7. ICT in Developing/Emerging Countries

The potential of ICT to facilitate economic development, especially in low-income countries, has attracted considerable attention as well. Several commentators (ex. Pohjola, 2001) have argued that the development of new technologies, in terms of proliferation and accessibility, should be integral to country-level development strategies and that ICT investments are essential

in the process of enhancing living standards. (Torero, 2006) The following will be same as the developed countries, picking up several topics related to ICT of each countries.

1.7.1. Chile

- For the first country in the world to legislate the net neutrality (July, 2010)

1.7.2. Malaysia

- New Cabinet set up a Ministry of Communication and Multimedia (June, 2013)
- Mobile network improvement in East Malaysia (February, 2015)

1.7.3. Mexico

- “National Digital Strategy” by Peña Nieto President (November, 2013)
- Number of subscribers to fixed-line phone is about 2,059 ten thousand, 16.8% is the fixed-line telephone penetration rate, and these are downward trends (December, 2013)

1.7.4. Peru

- Internet usage rate is 39.2 percent, and this indicator is low compared to other South American countries (2013)
- Broadband accounts for 80% of the total subscribers in Lima metropolitan area (2013)
- Penetration rate of the mobile communication almost reaches 100%, but it is only remarkable in capital area and still prefecture located in the coastal areas are low (2013)

1.7.5. Singapore

- LTE service of three major operators cover 99% of the country (March, 2015)

- Big growth of online shopping market (May, 2015)

1.7.6. Vietnam

- Progress of terrestrial broadcasting digitization roadmap (July, 2013)
- Regulations for Internet services and content (August, 2013)
- Rebalancing and infrastructure expansion of 3G mobile phone communication charges (November, 2013)

2. Literature Review

Although there were no works which covered ICT's economic impacts and the TPP countries, there were several works on the topic of the impacts of ICT investment in different countries.

Colecchia (2002) examined the contribution of ICT capital to economic growth in nine OECD countries. Main findings were (1) Despite different positions in the business cycle, all nine countries underwent a marked increase in the rate of investment in ICT capital goods. (2) Over the past two decades, ICT contributed between 0.2 and 0.5 percentage point per year to economic growth, depending on the country. During the second half of the 1990s, this contribution rose to 0.3 to 0.9 percentage point per year. Thus, the United States has not been alone in benefiting from the positive effects of ICT capital investment on economic growth, and it has not been alone in experiencing an acceleration of these effects. However, effects have clearly been largest in the United States, followed by Australia, Finland, and Canada. (3) The analysis indicates that the existence of a large ICT-producing industry is neither a necessary nor a sufficient condition to successfully experience the growth effects of ICT. ICT diffusion plays a key role and depends on the right framework conditions, not on the existence of an ICT-producing sector.

Morawczynski and Ngwenyama (2007) explored the impact of investments in ICT, education and healthcare on human development measures in five African countries. The investment in all three factors had an impact on measures of GDP. ICT investments were found to be the most important predictors to GDP growth. Additionally, investments in all three factors had positive impacts on literacy rates.

Talking about broadband internet access, Scott (2012) found out that a 10% increase in broadband penetration is correlated with a 1.35% increase in GDP for developing countries, and a 1.19% increase for developed countries. This suggests that in general, broadband is a valuable investment for spurring economic growth. Badran (2012) tackled the issue of the impact of

new technology such as high speed internet access or broadband on the economic growth in twenty-two emerging and Arab countries during the period (1998-2008). The findings of the empirical model are consistent with the expectations of highly positive impact of broadband per hundred inhabitants on the economic growth in these countries even during the financial crisis. Results show that one percent increase in broadband penetration would lead to 0.005 % increase in the growth rate of the emerging and Arab countries covered by this study. Although the impact was not as high as the study from the World Bank indicated, the results was consistent with the finding of them.

3. Objective and Value-Added

The objective of this thesis is to examine the economic impact of ICT in twelve TPP countries from years 2000-2013. Brunei is a TPP negotiating country, but because of the insufficient data, it is not included at this time and investigating countries would be eleven in total. There are two reasons why TPP countries are targeted in this research. One reason is that there are both developed and developing or emerging countries included in negotiating member countries. It is possible to analyze and compare with both countries' standpoint. It may be one of the value-added point of this research, but another reason would be that there were not so many researches done for TPP countries. The economic impact of ICT has been written about a lot, but a paper which looks at the economic impact of ICT on TPP countries have not seen yet. This agreement may have more changes from now on, and it also has been attracting attention from many kinds of stakeholders. ICT and TPP are both said to have a big impact on the future and this paper would be meaningful by choosing these hot two topics.

The value-added of this research would be composed from two parts: the countries to investigate which is already explained above, and the addition of different variables from Badran's (2012) model. She only looked at the economic impact of broadband. However, this paper will add five

different explanatory variables related to ICT instead of broadband variable. By this, the model will become broader and will be able to investigate with different types of ICT related variables. Furthermore, this model is applicable for other countries to investigate.

4. Model and Method

4.1. Model

Badran (2012) built an empirical model (1) relying on a log-linear approximation around the steady state of an augmented Solow model, where the control for additional variables to determine further factors that impact growth in the twenty-two emerging countries included in the sample for the time period 1998-2008, including the broadband penetration rate and competition level in telecom sector and FDI as percent of GDP.

$$\Delta \log y_{it} = a_0 - a_1 \log y_{it-1} + a_2 \log Educ_{it} + a_3 \log \left(\frac{TI}{y} \right)_{it} + a_4 \log \left(\frac{\Delta I}{y} \right)_{it} + a_5 \log(G)_{it} + a_6 \log(BB)_{it} + a_7 \text{CompInd} + a_8 \log \left(\frac{FDI}{GDP} \right) + a_9 Z_i + \varepsilon_{it} \dots\dots\dots(1)$$

Where i index is for the countries, t index stands for time; y is per capita income; Educ is consisted of two, primary and secondary school enrollment ratio; TI/y is telecom investments as percent of GDP; ΔI/y is the difference between gross capital formation and investment in telecom as percent of GDP; CompInd stands for Competition Index, and is calculated using the Principle component analysis; G, is population growth rate; BB is broadband penetration per hundred inhabitants; yit_1 is the level of per capital income in previous year; FDI/ GDP is foreign direct investment as percent of GDP; z it refer to the unobserved variable that varies from country to another but does not change over time. The data source are from World Bank, WDI, and ITU.

Based on this model with some modification—taking off the log, changing GDP per capita income to GDP per capita growth, and the broadband related variables replaced with ICT related variables, model (2) would be the linear regression individual model to examine the ICT impact on GDP in each eleven TPP countries.

$$Growth_{it} = b_0 + b_1 Growth_{it-1} + b_2 Educ_{it} + b_3 (G)_{it} + b_4 \left(\frac{FDI}{GDP} \right) + b_5 (IU)_{it} + b_6 (MS)_{it} + b_7 (HTEx) + b_8 (ICTEx) + b_9 (ICTIm) + \varepsilon_{it} \dots (2)$$

i: Countries

t: Time

$Growth_{it}$: GDP per capita growth (annual %)

Educ: School enrollment (preprimary, primary, or secondary) (% gross)

G: Population growth rate (annual %)

FDI/GDP: Foreign direct investment as percent of GDP

IU: Internet users (per 100 people)

MS: Mobile cellular subscriptions (per 100 people)

HTEx: High-technology exports (% of manufactured exports)

ICTEx: ICT goods exports (% of total goods exports)

ICTIm: ICT goods imports (% total goods imports)

<Data source: WDI Database for the period (2000-2013)>

It would be more intelligible to see the impact of economic growth when the explained variable is GDP per capita growth (annual %), so it is changed from GDP per capita income. In the prior model, it put a log to examine the explanatory variable elasticity of y (per capita income), but this research aims to observe the one unit increase of each variable how much impacts GDP per capita growth, so the log is taken.

The removed explanatory variables are: broadband penetration per hundred inhabitants, telecom investments as percent of GDP, the difference

between gross capital formation and investment in telecom as percent of GDP, and competition index. Competition index was developed by Badran whether broadband is monopolized or not. The other three are also related to broadband and telecommunications, since the economic impact of broadband infrastructure was the main discussion in the prior research. However, this research focuses on various kinds of impacts of ICT related variables. Therefore, the removed variables are replaced with internet users (per 100 people), mobile cellular subscriptions (per 100 people), high-technology exports (% of manufactured exports), ICT goods exports (% of total goods exports), and ICT goods imports (% total goods imports). Since the target countries are the member countries of TPP, three out of five variables are related to trade. The former two, internet users and mobile cellular subscriptions, would be the ICT related population variables. By these five new variables, this model covers the human and trade areas which both are important factors for FTA.

Furthermore, model (3) is adapted for pooling linear regression model. Some countries does not have fulfilling data for each step of educations, so education variable is removed in model (3). Dummy and technology (time) variables are added instead, and y_{it-1} is also removed because of the latter variable. Since both developed and developing/emerging countries exist, dummy variable is developed or not. The other variable descriptions are same with model (2).

$$Growth_{it} = b_0 + b_1(G)_{it} + b_2\left(\frac{FDI}{GDP}\right) + b_3(IU)_{it} + b_4(MS)_{it} + b_5(HTEx) + b_6(ICTEx) + b_7(ICTIm) + b_8Z_i + b_9(Tec\hat{h}) + \varepsilon_{it} \dots \dots \dots (3)$$

4.2. Method

First, each country is investigated individually by using model (2). In regards to the data contents, Singapore is an exception, as it is analyzed without education variables. Since higher education is said to be a positive contribution to GDP for a long time, and also, education is not the prior

variable, which grade of education (preprimary, primary, or secondary) data is not fixed. Two out of three grades are composed in each country. Preprimary and primary are mostly used, but New Zealand uses primary and secondary, Malaysia uses preprimary and secondary.

As a next step, pooled data is investigated by model (3). The reason for extra investigation after pooled data, is obvious looking at Table 6—no reaction of dummy variable (whether a country is developed or not), so eleven countries are grouped in two: developed and the others (Table 2), and model (3) with dummy variable deleted would be used for extra investigation. Additionally, results for pooled data of eleven countries with dummy variable excluded is in Appendix D.3.

Table 2. Eleven Countries Divided by Two Groups

Developed	Others (Developing/Emerging)
Australia, Canada, Japan, New Zealand, United States	Chile, Malaysia, Mexico, Peru, Singapore, Vietnam

5. Discussion of Model

The expectations of the impact of the independent variables on GDP per capita growth are as follows:

- *The level of education*, whether preprimary, primary or secondary, is expected to have a positive impact on economic growth, as these variable represent investment in human capital.
- *The population growth rate* is expected to have a negative sign, as the increase of population will cause many kinds of social problem; increase of unemployment rate, price increase, arising environment issues (ex. water pollution), food shortage. These issues will give a bad economic influence.

- *The foreign direct investment (FDI)* is surmised to have a huge positive impact on economic growth, since many researches have already proved that FDI stimulates the economy of that country and would be the ignition agent of the development.

- All new added explanatory variables: *the number of internet users, mobile cellular subscriptions, high-technology exports, ICT goods exports, ICT goods imports* are supposed to have positive sign. Especially, bigger impact on GDP is expected in developing/emerging countries.

- Finally, for pooled data analysis, *dummy variable whether developed or not*, and *technology variable* that explains the time lag are added. Technology variable is expected to show the positive reaction, as the effects of ICT are thought to appear in a few years of delay, especially in developing/emerging countries. Not immediately, but the impacts will surely grow with each passing year. In model (2), y_{it-1} is identical variable as technology variable.

These discussions are common whether the country is developed or not. Table 3 and 4 summed up all the estimation written above.

Table 3. Expected Results of Explanatory Variable (By country)

Variable	Definition	Expected Results
y_{it-1}	One year time lag of GDP per capita growth	(+)
Educ	School enrollment (preprimary, primary, or secondary)	(+)
G	Population growth rate	--
FDI/GDP	Foreign direct investment as percent of GDP	++
IU	Internet users	(+)
MS	Mobile cellular subscriptions	++
HTE _{ex}	High-technology exports	(+)
ICTE _{ex}	ICT goods exports	(+)
ICTI _m	ICT goods imports	++

Table 4. Expected Results of Explanatory Variable (Eleven Countries Pooled)

Variable	Definition	Expected Results
G	Population growth rate	--
FDI/GDP	Foreign direct investment as percent of GDP	++
IU	Internet users	(+)
MS	Mobile cellular subscriptions	++
HTE _{ex}	High-technology exports	++
ICTE _{ex}	ICT goods exports	(+)
ICTI _m	ICT goods imports	++
Tech	Technology (Time)	++
Z (Dummy)	Developed or not	(+)

6. Results and Analysis

Although the results for linear regression analysis for each of the eleven countries (Appendix D) showed different effects, the coefficients are sufficed in most of the analyses that were performed. Only Japan and Mexico ended up with poor results because the data was collected over a short period of time. The results for the pooling data analysis also showed that the equation was appropriate in explaining the impact of ICT on GDP. In the following section, the first half would be the consideration of each country's results. After that, each variable would be analyzed for pooled analysis. Throughout Tables 5-8, double signs means that the absolute value of t Stat was 2 or more, single sign means that t Stat was somewhat suffice (absolute value 1.7—1.99), signs in parentheses means that t Stat was not adequate.

Table 5. Results by Country

Variable	Australia	New Zealand	Japan	United States	Canada
y_{it-1}	++	(-)	(-)	-	(-)
Educ(Pre)	(+)	N/A	(-)	++	(-)
Educ(Prim)	++	(-)	(+)	-	(+)
Educ(Sec)	N/A	(+)	N/A	N/A	N/A
G	--	(-)	(+)	(+)	--
FDI/GDP	(+)	(+)	(+)	(+)	(+)
IU	--	(-)	(+)	+	(+)
MS	+	(-)	(+)	++	+
HTE _x	+	(+)	(+)	(-)	(-)
ICTE _x	(-)	(-)	(-)	++	(+)
ICTIm	(-)	(+)	(-)	-	(-)

Variable	Chile	Malaysia	Mexico	Peru	Singapore	Vietnam
y_{it-1}	(+)	--	(-)	--	(+)	--
Educ(Pre)	(+)	(+)	(-)	--	N/A	(-)
Educ(Prim)	(-)	N/A	(-)	++	N/A	--
Educ(Sec)	N/A	(+)	N/A	N/A	N/A	N/A
G	(-)	++	(+)	++	(-)	++
FDI/GDP	++	++	(-)	(-)	(+)	(+)
IU	(-)	(-)	(-)	++	(-)	(+)
MS	(-)	(+)	(+)	(+)	++	(-)
HTE _x	+	++	(+)	--	(-)	(+)
ICTE _x	(-)	--	-	++	(+)	(-)
ICTIm	(+)	+	(+)	(+)	+	--

Table 6. Results for Pooled Data

Variable	t Stat
G	--
FDI/GDP	++
IU	--
MS	(-)
HTE _x	++
ICTE _x	--
ICTIm	++
Tech	(+)
Z (Dummy)	(-)

Table 7. Results for Group of Developed Countries

Variable	t Stat
G	(-)
FDI/GDP	(+)
IU	(-)
MS	(-)
HTE _x	(-)
ICTE _x	(-)
ICTIm	(+)
Tech	(-)

Table 8. Results for Group of Developing/Emerging Countries

Variable	t Stat
G	--
FDI/GDP	++
IU	--
MS	(-)
HTE _x	++
ICTE _x	--
ICTIm	(+)
Tech	++

As Table 7 shows, results for group of developed countries had no reaction converse to developing/emerging countries. From here would be the analysis of each explanatory variable. Although all t Stat signs are showed in Table 5-8, the columns that were filled with color, which had adequate t Stat, are mainly discussed.

- y_{it-1} showed positive only in Australia, Chile and Singapore. This shows that ICT related variables do not have time lag so much and the impacts could appear immediately. When thinking of education, for example, it is usually said that time lag for about four years is preferable because it takes time to penetrate after the investment on that field. However, it is easy to predict that the utilization of ICT goods and the number of employments which are related to ICT will spread quickly, by imagining that you got your latest smart phone for the first time of your life—first you are confused of manipulating it, but after few hours you are getting familiar with it and already opening app or sending a message to somebody.
- *School enrollment (preprimary, primary, or secondary)* varied by country. When focused on preprimary level, the United States was positive but

Peru appeared as negative. At primary level, Australia, Canada and Peru were positive but Vietnam was negative. Although country investigated with secondary level were only two (New Zealand and Malaysia), both of them appeared positive. These could be concluded that countries those who are highly developed or closer to developed are seemed to have a good influence on GDP, as they could more invest in education and make the educating environment better quality

- *Population growth rate* showed noticeably positive in Malaysia, Peru and Vietnam. Four out of six developing/emerging countries showed a good reaction though, in pooled result for developing/emerging countries, growth rate is negative sign. (Table 8) Three out of five developed countries ended up with a negative sign. It could be concluded that some of the developing countries who are in growing stage are necessary of increasing population and use this increase for even more power to step up. However population growth can be eventually adverse effect to GDP, looking from the result for Chile and Singapore, and this would be the reason why it goes negative in the result for group of developing/emerging countries. Developed countries are already suffering by the low birth rate and longevity, therefore this variable goes negative. These countries are on the stage that dealing with the problem of demographic composition.

- *Foreign direct investment as percent of GDP* was almost positive in all countries except for Mexico and Peru. However, result for Mexico is not reliable since its data quantity was inadequate and also the t Stat of Peru was not sufficient. Especially, Chile and Malaysia were remarkable. Results for pooled data also backup that this paper could join in many articles that says FDI has a big impact on economic growth and at the same time, this result proved that FDI really is a positive explanatory variable for GDP.

- *Internet users* appeared remarkably positive in Peru, remarkably negative in Australia. By viewing 1.7.4., internet usage rate in Peru is 39.2 percent, and this indicator is said to be low compared to other South American countries, so it could be expected that Peru's economy will grow if they put an effort on increasing internet users. Three out of five developed country showed positive: Japan, United States and Canada. On the other hand, four out of six were negative sign in developing countries. Furthermore, the variable goes negative in the pooled data analysis. It may be concluded that the digital divide could occur and affects to the bad direction of economic growth, while number of people who can use internet increases.
- *Mobile cellular subscriptions* was highly positive in United States and Singapore. Other than New Zealand, Chile, and Vietnam, eight countries appeared in positive. It could be concluded that the number of mobile cellular subscriptions will contribute to GDP compared to internet users, because mobile cellular phone does not require difficult operation—you just talk to it.
- *High-technology exports* were especially positive in Malaysia and negative in Peru. Three developed, four developing/emerging countries, and pooled data analysis were positive. Since not computers but humans make good use of the information processing technology, outflow and dissemination of excellent human resources of knowledge and high technology will lead to technology promotion, which leads the country's development after all. Computer does processing and calculation, but who analyzes and make that processed information valuable is human. Therefore, it is obvious that high-technology exports can be contributive to economic growth.

- *ICT goods exports* variable was remarkably positive in United States and Peru, while negative in Malaysia. Three developed, four developing/emerging countries, and pooled data analysis were negative. For developing/emerging countries, it could be analyzed that domestic industries is still weak and cannot win in the worldwide market competition.

- *ICT goods imports* appeared strikingly negative only in Vietnam. Four developed countries were negative, but all developing/emerging countries other than Vietnam and result of pooled data showed positive. In developing/emerging countries, it could be concluded that even if their own industry is still weak, they could put a tariff on importing goods and protect their domestic companies. It is easier for companies to do business domestically than going out of your own country. This is why this variable is positive and the previous variable shows negative.

- *Technology* variable appeared positive in group of developing/emerging countries. It is obvious to say that when talking about developing/emerging countries, it need some time for positive influence on GDP. It maybe because of the basic knowledge or ability to adapt to new technology.

7. Concluding Remarks

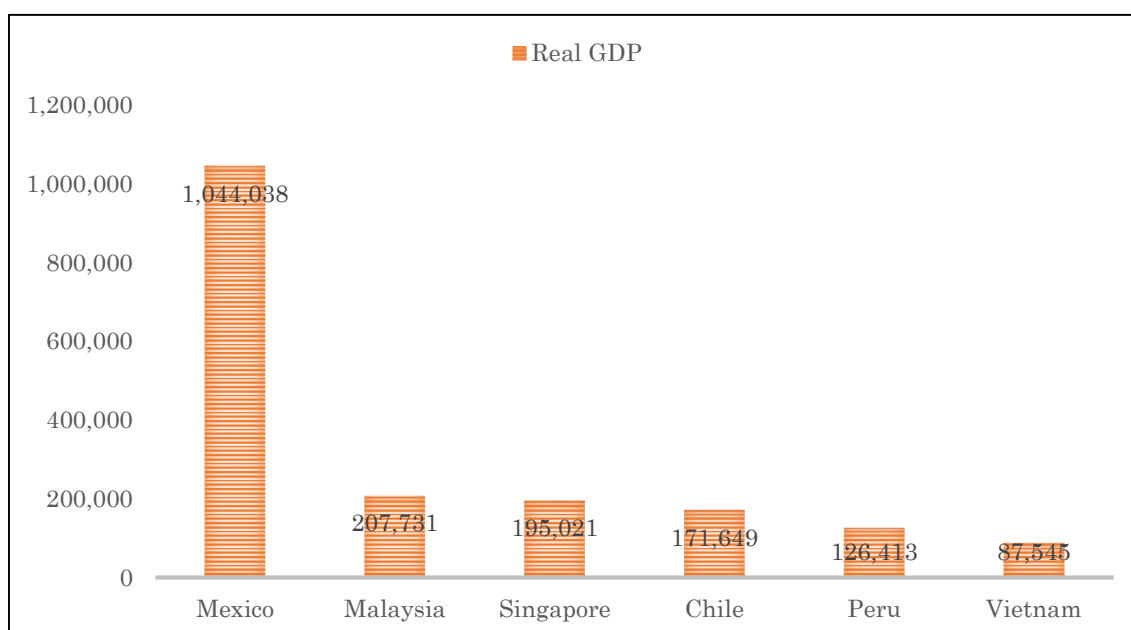
The purpose of this study was to examine the economic impact of ICT in eleven TPP countries from years 2000-2013 by linear regression analysis. Data used from WDI and analyzing from each eleven country to three groups of pooling data, the major finding was that ICT related variables have both positive and negative impact on TPP negotiating countries. Internet users showed negative in Australia and only this developed country had a negative correlation. New Zealand, Japan, Mexico, and Canada did not have a correlation of ICT related variables, but mobile cellular subscriptions and ICT goods exports were positive in United States. United States was the only developed country which ICT related variable had a positive effect. Malaysia indicated that high-technology exports was positive, on the other hand, ICT goods exports was negative. Peru had two positive correlation: internet users and ICT goods exports, but high-technology exports was negative. Mobile cellular subscriptions showed positive in Singapore. Vietnam had a negative correlation of ICT goods imports. When looking at the results for pooled data, high-technology exports and ICT imports were positive, but internet users and ICT exports had a negative impact. Group of developed countries had no reaction but group of developing countries had similar reactions with the eleven countries' pooled result. In summary, developing or emerging countries had a more active and positive reaction than the developed.

As written above, the second discovery would be that developed countries are no longer in a stage that relies on ICT impact compared to the developing or emerging countries. They own a lot of advanced technologies, but the result shows that ICT related variables (the number of internet users, mobile cellular subscriptions, high-technology exports, ICT goods exports, ICT goods imports) do not have a big influence on economic growth.

The aim of TPP is to develop collaboratively, and from the results of this study, developed countries have to be deliberate when making an investment in developing or emerging countries. The prior countries should be considered the semi-developed countries: Mexico, Malaysia, and Singapore.

These three countries have the top figure of real GDP in six developing or emerging countries. (Figure 5) Mexico is at the top amongst the six countries, and this may be the reason why Mexico ended up with poor results in this research. Mexico was much closer to the developed than the developing, so the ICT related variables did not show any reaction. Semi-developed countries are also called Newly Industrialized Countries (NICs). There are various theories, but Mexico and Malaysia are the countries which are always considered NICs by many authors and experts. Singapore is regarded as a developed country by some definitions, but this research uses the OECD high-income countries for classifying, so it is classified as semi-developed. Furthermore, the liberalization of trade in Mexico, Malaysia, and Singapore is urgently necessary. Semi-developed countries are able to be easily funded and they would be able to make the investment have a positive effect on the ICT field, since they have a more well-regulated economic system than developing countries. Although the supreme goal would be the development of all member countries of TPP, there should be a staged development of TPP.

Figure 5. Real GDP in Developing Countries



Note: Unit is per million US dollars.

Source: United Nations Statistics Division (2015)

Some suggestions for the future include changing the ICT related variable, which would be the top priority. To do so, accessing ITU's full database would be preferred. This would make the research more high qualified and it may perhaps show the correlation of ICT and economic growth in developed countries. Furthermore, the missed data of Brunei Darussalam could be compensated. Finally, this model will not be limited to these eleven countries, so focusing on other countries of different FTA or regions would be interesting to investigate.

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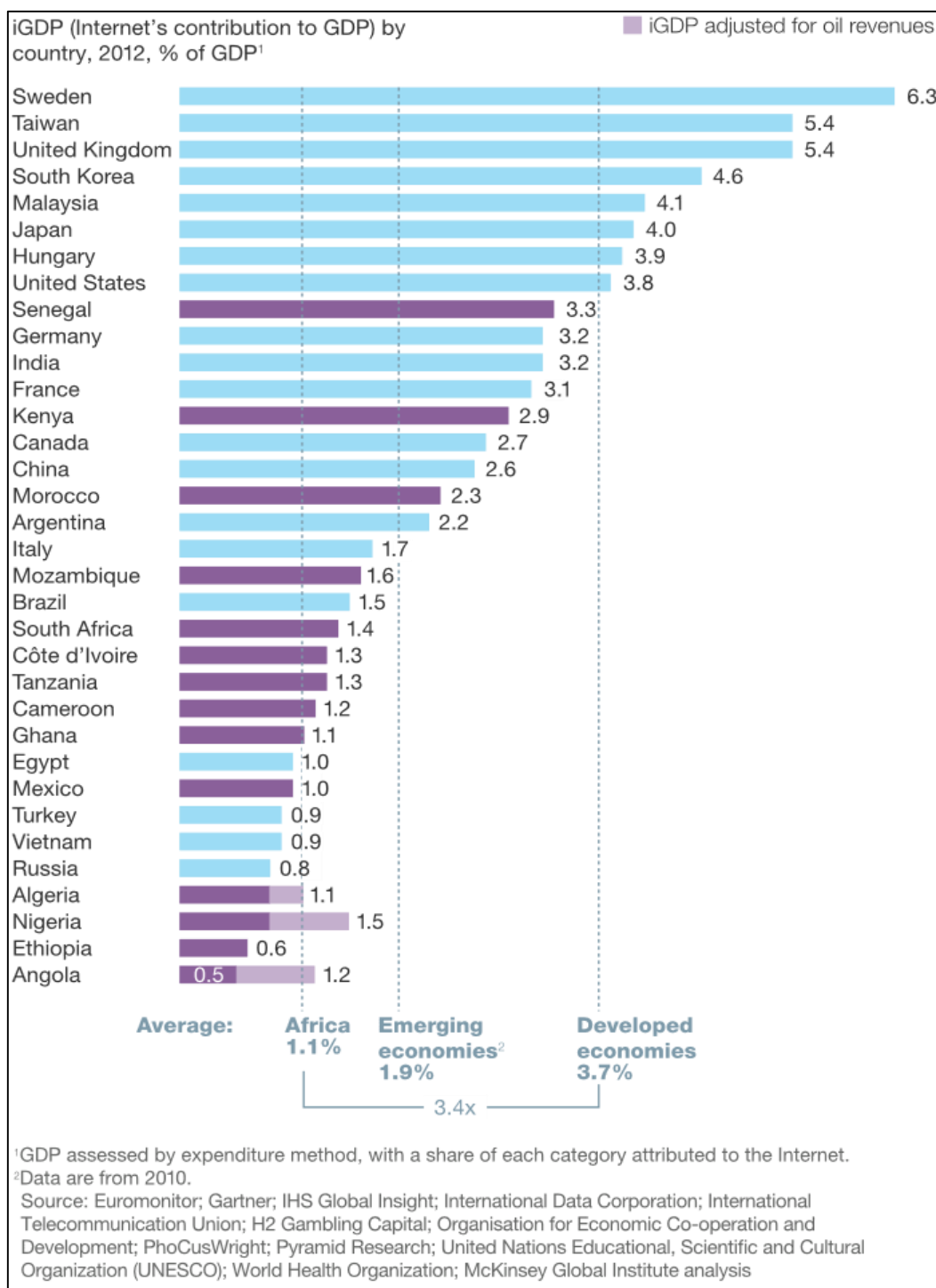
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9. Appendix

Appendix A. iGDP by Country (2012)



Source: McKinsey Global Institute's Report: "Lions go digital: The Internet's transformative potential in Africa"

Appendix B. Classifiers of Developed Countries

I	OECD high-income countries *used for the classifier in this research
II	Economically developed countries by the International Monetary Fund(IMF)
III	Human development index 0.9 or more
IV	OECD Development Assistance Committee
V	Economically developed countries by the CIA World Factbook
VI	The top 30 countries by High-Income Economy Economist Intelligence Unit by the World Bank

Appendix C. Terms Explanation

The explanation of the terms marked with asterisk (*).

◇ National Broadband Network (NBN)*1

A national network of communications infrastructure currently being built by NBN Co on behalf of the Federal Government of Australia. It's set to change the way Australians access the internet, with lightning-fast fibre-optic, fixed wireless and satellite technology being made available over the next 10 years.

◇ EC*2

E-commerce (electronic commerce) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet. These business transactions occur either business-to-business, business-to-consumer, consumer-to-consumer or consumer-to-business.

◇ Federal Communications Commission (FCC)*3

An independent agency of the United States government, created by Congressional statute (see 47 U.S.C. § 151 and 47 U.S.C. § 154) to regulate interstate communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia and U.S. territories. The FCC works towards six goals in the areas of broadband, competition, the spectrum, the

media, public safety and homeland security. The Commission is also in the process of modernizing itself.

◇ IPv4*4

This number is an exclusive number all information technology devices (printers, routers, modems, et al) use which identifies and allows them the ability to communicate with each other on a computer network. There is a standard of communication which is called an Internet Protocol standard (IP).

IP version 4 is currently used by most network devices. However, with more and more computers accessing the internet, IPv4 addresses are running out quickly. Just like in a city, addresses have to be created for new neighborhoods but, if your neighborhood gets too large, you will have to come up with an entire new pool of addresses. IPv4 is limited to 4,294,967,296 addresses.

◇ National Telecommunications and Information Administration (NTIA)*5

The Executive Branch agency that is principally responsible by law for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus largely on expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth.

◇ LTE*6

LTE, an abbreviation for Long-Term Evolution, commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed using a different radio interface together with core network improvements. The standard is developed by the 3GPP (3rd Generation Partnership Project) and is specified

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in its Release 8 document series, with minor enhancements described in Release 9.

Appendix D. Analysis Results

D.1. Developed Countries

Table9. Australia

Regression Statistics	
Multiple R	0.969407
R Square	0.939751
Adjusted R Square	0.73892
Standard Error	0.530201
Observations	14

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	13.15420428	1.31542	4.679326	0.1153552
Residual	3	0.843339641	0.281113		
Total	13	13.99754393			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	-176.61	93.36882247	-1.89153	0.154921	-473.751	120.5315	-721.969	368.7491
yit-1	0.613778	0.29660853	2.069321	0.130327	-0.330162	1.557719	-1.11869	2.346242
educ(Pre)	0.005023	0.036838128	0.136366	0.900169	-0.112212	0.122259	-0.21014	0.220192
educ(Prim)	1.863964	0.836635516	2.227929	0.112212	-0.798583	4.526512	-3.02275	6.750676
G	-1.84717	0.798802742	-2.31243	0.1038	-4.389322	0.694972	-6.51291	2.81856
FDI/GDP	0.114768	0.074655385	1.53731	0.221817	-0.122818	0.352355	-0.32129	0.550824
IU	-0.59385	0.165231577	-3.59408	0.036916	-1.119696	-0.06801	-1.55896	0.371248
MS	0.204584	0.108428689	1.886806	0.155645	-0.140485	0.549652	-0.42874	0.837906
HTE _x	0.853941	0.461415238	1.850699	0.161313	-0.614489	2.32237	-1.84114	3.549025
ICT _{Ex}	-1.11597	2.662467453	-0.41915	0.703311	-9.589128	7.357192	-16.6672	14.43526
ICT _{Im}	-0.00954	0.310514884	-0.03072	0.97742	-0.997737	0.978657	-1.82323	1.804149

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Table10. New Zealand

Regression Statistics								
Multiple R	0.934877							
R Square	0.873994							
Adjusted R Square	0.243966							
Standard Error	1.402294							
Observations	13							

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	27.278924	2.727892	1.387231	0.490032
Residual	2	3.93285934	1.96643		
Total	12	31.2117834			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	5.66778	143.02011	0.039629	0.971989	-609.6981	621.0336	-1413.78	1425.12
yit-1	-0.3398	1.40909249	-0.24115	0.831907	-6.402639	5.723032	-14.3248	13.64522
educ(Prim)	-0.20441	1.32276576	-0.15453	0.891375	-5.895812	5.486991	-13.3327	12.92383
educ(Sec)	0.092064	0.39380544	0.233781	0.836905	-1.602344	1.786472	-3.81639	4.000522
G	-1.58657	3.13021083	-0.50686	0.662612	-15.05478	11.88164	-32.6534	29.48028
FDI/GDP	1.19007	0.9443792	1.260161	0.334728	-2.873265	5.253406	-8.18275	10.56289
IU	-0.00333	0.48889155	-0.0068	0.99519	-2.106856	2.100205	-4.8555	4.848846
MS	-0.09864	0.25963975	-0.37993	0.74055	-1.215784	1.018495	-2.67553	2.478239
HTEx	1.158909	2.07504782	0.558497	0.632688	-7.769302	10.08712	-19.4356	21.75343
ICTEx	-8.82197	11.4910131	-0.76773	0.522903	-58.2638	40.61987	-122.868	105.2245
ICTIm	1.901769	3.64234644	0.522128	0.653651	-13.76998	17.57352	-34.2479	38.05149

Table11. Japan

Regression Statistics								
Multiple R	0.80562							
R Square	0.649024							
Adjusted R Square	-1.10586							
Standard Error	3.469616							
Observations	13							

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	44.5221021	4.45221	0.369839	0.8848396
Residual	2	24.0764674	12.03823		
Total	12	68.5985695			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	-540.155	900.090936	-0.60011	0.609371	-4412.934	3332.623	-9473.42	8393.106
yit-1	-0.83859	0.80582116	-1.04067	0.407312	-4.305762	2.628576	-8.83624	7.159056
educ(Pre)	-5.01017	3.86649693	-1.29579	0.324437	-21.64637	11.62602	-43.3845	33.3642
educ(Prim)	7.966353	8.10529648	0.982858	0.429305	-26.90792	42.84063	-72.4774	88.41015
G	64.03532	65.4339311	0.978626	0.430965	-217.5042	345.5748	-585.386	713.4568
FDI/GDP	24.08421	27.5928619	0.872842	0.474787	-94.63829	142.8067	-249.771	297.939
IU	0.802356	0.83725847	0.958314	0.439032	-2.800076	4.404789	-7.5073	9.112015
MS	0.518437	0.81894351	0.633056	0.591429	-3.005192	4.042067	-7.60945	8.646323
HTEx	7.914993	9.40440379	0.841626	0.488591	-32.54889	48.37888	-85.4222	101.2522
ICTEx	-0.86129	3.13705747	-0.27455	0.80942	-14.35896	12.63638	-31.9961	30.27351
ICTIm	-6.9891	6.93786803	-1.00738	0.419818	-36.84034	22.86214	-75.8464	61.86815

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Table12. United States

Regression Statistics	
Multiple R	0.987975
R Square	0.976094
Adjusted R Square	0.896407
Standard Error	0.556222
Observations	14

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	37.896605	3.789661	12.24908	0.0314879
Residual	3	0.92814958	0.309383		
Total	13	38.8247546			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	33.47756	49.2776111	0.679366	0.545627	-123.34579	190.3009	-254.348	321.3036
yit-1	-0.26897	0.14926152	-1.80199	0.169343	-0.743984	0.20605	-1.14079	0.602856
educ(Pre)	0.1589	0.07865213	2.020284	0.136619	-0.0914066	0.409206	-0.3005	0.6183
educ(Prim)	-0.75488	0.38654669	-1.95287	0.145864	-1.9850399	0.475288	-3.01266	1.502908
G	6.722856	13.2592409	0.507032	0.647053	-35.473966	48.91968	-70.7232	84.16888
FDI/GDP	0.82798	0.7167629	1.155166	0.331678	-1.4530796	3.109039	-3.35857	5.014527
IU	0.149446	0.08024771	1.862315	0.159463	-0.1059376	0.404831	-0.31927	0.618166
MS	0.148435	0.06611767	2.245011	0.110447	-0.061981	0.358851	-0.23775	0.534622
HTE _x	-0.34069	0.35781751	-0.95214	0.411267	-1.4794291	0.798041	-2.43067	1.749286
ICTE _x	2.654229	0.92960708	2.855216	0.064831	-0.304196	5.612653	-2.77552	8.083979
ICTIm	-1.52133	0.76970698	-1.9765	0.142542	-3.9708767	0.928226	-6.01711	2.974463

Table13. Canada

Regression Statistics	
Multiple R	0.974261
R Square	0.949185
Adjusted R Square	0.69511
Standard Error	1.011074
Observations	13

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	38.19043448	3.819043	3.735843	0.2295326
Residual	2	2.04454153	1.022271		
Total	12	40.23497601			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	88.8814	97.29142019	0.913558	0.457386	-329.7298	507.4926	-876.721	1054.483
yit-1	-0.30756	0.333013002	-0.92358	0.453206	-1.740404	1.125275	-3.61267	2.997537
educ(Pre)	-3.39158	2.859189579	-1.1862	0.35736	-15.69368	8.910522	-31.7686	24.98543
educ(Prim)	0.99265	1.657657098	0.598827	0.610081	-6.139673	8.124973	-15.4593	17.44464
G	-9.19522	4.505389369	-2.04094	0.178045	-28.58035	10.18991	-53.9105	35.52006
FDI/GDP	0.304676	0.279919186	1.088442	0.390083	-0.899719	1.509071	-2.47348	3.08283
IU	0.504223	1.053369324	0.478676	0.679392	-4.02806	5.036505	-9.9503	10.95875
MS	0.440992	0.257749703	1.71093	0.229223	-0.668016	1.549999	-2.11713	2.999117
HTE _x	-1.02718	0.605156879	-1.69738	0.231718	-3.630964	1.576596	-7.03327	4.978903
ICTE _x	2.651727	4.444018484	0.596696	0.611258	-16.46934	21.77279	-41.4545	46.75791
ICTIm	-0.16637	2.989928151	-0.05564	0.960686	-13.03099	12.69826	-29.8409	29.5082

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D.2. Developing Countries

Table14. Chile

Regression Statistics	
Multiple R	0.93709
R Square	0.878138
Adjusted R Square	0.471929
Standard Error	1.358926
Observations	14

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	39.9213899	3.992139	2.161792	0.2853505
Residual	3	5.54004238	1.846681		
Total	13	45.4614323			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	112.3679	148.801102	0.755155	0.505033	-361.1837	585.9194	-756.766	981.5016
yit-1	0.130417	0.25621332	0.509019	0.645815	-0.684968	0.945803	-1.3661	1.626936
educ(Pre)	0.263544	0.24986636	1.054739	0.368981	-0.531642	1.05873	-1.1959	1.722991
educ(Prim)	-0.76919	0.55733552	-1.38012	0.261413	-2.542882	1.004498	-4.02454	2.486154
G	-53.1238	120.728443	-0.44003	0.68969	-437.3356	331.088	-758.288	652.0401
FDI/GDP	1.184155	0.56585391	2.092687	0.12745	-0.616645	2.984955	-2.12095	4.489256
IU	-0.23241	0.18381899	-1.26432	0.295415	-0.8174	0.352589	-1.30608	0.841265
MS	-0.11984	0.2145428	-0.55858	0.615428	-0.802611	0.562931	-1.37296	1.133285
HTEx	2.601413	1.360241	1.912465	0.151758	-1.727481	6.930307	-5.34363	10.54646
ICTEx	-2.59484	7.11060993	-0.36493	0.739376	-25.22398	20.03429	-44.1273	38.93758
ICTIm	0.493081	1.11113918	0.443762	0.68727	-3.043059	4.029222	-5.99698	6.983145

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Table15. Malaysia

Regression Statistics								
Multiple R	0.996431							
R Square	0.992874							
Adjusted R Square	0.957246							
Standard Error	0.552276							
Observations	13							

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	84.99793633	8.499794	27.86741	0.0351244
Residual	2	0.610016821	0.305008		
Total	12	85.60795315			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	-82.05	21.05202998	-3.89748	0.05997	-172.6295	8.529622	-290.988	126.8881
yit-1	-0.45346	0.098001831	-4.6271	0.04367	-0.875132	-0.0318	-1.42612	0.519188
educ(Pre)	0.110838	0.197070731	0.562425	0.630457	-0.737089	0.958764	-1.84506	2.066734
educ(Sec)	0.267091	0.210647222	1.267952	0.332444	-0.639251	1.173432	-1.82355	2.357731
G	20.41618	6.729474609	3.033845	0.093636	-8.538411	49.37077	-46.3728	87.20516
FDI/GDP	1.130283	0.152342921	7.419333	0.017686	0.4748041	1.785761	-0.3817	2.642262
IU	-0.01055	0.123561194	-0.08538	0.939737	-0.54219	0.521091	-1.23688	1.215776
MS	0.033772	0.084476717	0.399781	0.727972	-0.329702	0.397246	-0.80465	0.87219
HTEx	0.728972	0.347856652	2.09561	0.171092	-0.767735	2.225678	-2.72345	4.181394
ICTEx	-0.80888	0.217838006	-3.7132	0.065484	-1.746158	0.128404	-2.97089	1.353131
ICTIm	0.361843	0.186486076	1.940321	0.191873	-0.440542	1.164228	-1.489	2.212688

Table16. Mexico

Regression Statistics								
Multiple R	0.911123							
R Square	0.830145							
Adjusted R Square	-0.01913							
Standard Error	2.760394							
Observations	13							

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	74.48158749	7.448159	0.977477	0.605751
Residual	2	15.2395524	7.619776		
Total	12	89.72113988			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	143.457	296.1224678	0.484452	0.675928	-1130.655	1417.569	-2795.51	3082.426
yit-1	-0.7918	0.492087662	-1.60905	0.248881	-2.909077	1.325487	-5.67569	4.092098
educ(Pre)	-0.5055	0.900624515	-0.56128	0.631106	-4.380578	3.369571	-9.44406	8.433054
educ(Prim)	-1.29734	2.635633025	-0.49223	0.671283	-12.63755	10.04288	-27.4556	24.86091
G	65.81753	45.70553889	1.440034	0.286526	-130.8375	262.4726	-387.803	519.4378
FDI/GDP	-0.34978	1.541089529	-0.22697	0.841536	-6.980554	6.280992	-15.6449	14.94529
IU	-0.69814	0.930488626	-0.75029	0.531336	-4.701708	3.305431	-9.93309	8.536815
MS	0.537207	0.527678302	1.018058	0.415762	-1.733209	2.807624	-4.69992	5.774332
HTEx	0.571484	2.089395865	0.273516	0.810113	-8.418461	9.561429	-20.1654	21.30841
ICTEx	-4.36066	2.26838229	-1.92237	0.194491	-14.12072	5.399399	-26.874	18.15268
ICTIm	0.860182	1.430742925	0.601213	0.608764	-5.295808	7.016172	-13.3397	15.06008

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Table17. Peru

Regression Statistics	
Multiple R	0.981404
R Square	0.963154
Adjusted R Square	0.840335
Standard Error	1.078195
Observations	14

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	91.1640738	9.116407	7.842045	0.058395
Residual	3	3.487511631	1.162504		
Total	13	94.65158543			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	-245.157	74.37374348	-3.29629	0.045861	-481.8477	-8.46681	-679.568	189.253
yit-1	-0.71995	0.27762954	-2.5932	0.080849	-1.603491	0.163591	-2.34156	0.901659
educ(Pre)	-1.42986	0.285351404	-5.01086	0.015301	-2.337972	-0.52174	-3.09657	0.236855
educ(Prim)	2.29241	0.556919633	4.116231	0.025979	0.520043	4.064777	-0.96051	5.545327
G	21.45417	8.285341411	2.589412	0.081115	-4.913489	47.82182	-26.9398	69.84809
FDI/GDP	-0.92698	0.748470877	-1.23849	0.303609	-3.308945	1.454991	-5.29873	3.444774
IU	2.884955	0.580532861	4.969495	0.015653	1.03744	4.73247	-0.50588	6.275795
MS	0.022422	0.09606903	0.233395	0.830474	-0.283313	0.328157	-0.53871	0.583552
HTEx	-1.74347	0.830653802	-2.09892	0.126696	-4.386985	0.900038	-6.59525	3.1083
ICTEx	26.87642	9.043343533	2.971957	0.058976	-1.903531	55.65638	-25.9449	79.69777
ICTIm	0.910951	1.382495174	0.658918	0.557008	-3.488765	5.310668	-7.16408	8.98598

Table18. Singapore

Regression Statistics	
Multiple R	0.882133
R Square	0.778158
Adjusted R Square	0.423211
Standard Error	3.642198
Observations	14

ANOVA					
	df	SS	MM	F	Significance F
Regression	8	232.659509	29.08244	2.192319	0.2013589
Residual	5	66.32801913	13.2656		
Total	13	298.9875281			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	-161.577	78.76407581	-2.05141	0.095472	-364.0467	40.89234	-479.165	156.0109
yit-1	0.184543	0.28444118	0.64879	0.54509	-0.546637	0.915722	-0.96236	1.33145
G	-0.6006	0.809305196	-0.74212	0.491382	-2.680988	1.479783	-3.86384	2.662632
FDI/GDP	0.067419	0.234289283	0.287758	0.785078	-0.534841	0.669678	-0.87727	1.012106
IU	-0.67014	0.488639495	-1.37144	0.228583	-1.926228	0.585948	-2.6404	1.300124
MS	1.085454	0.495728755	2.189613	0.080136	-0.188857	2.359765	-0.9134	3.084303
HTEx	-1.79903	1.210606715	-1.48605	0.197407	-4.910991	1.312936	-6.68037	3.082312
ICTEx	1.304813	1.995549752	0.653861	0.542075	-3.824911	6.434536	-6.74153	9.351154
ICTIm	3.838821	2.040226493	1.881566	0.118638	-1.405748	9.08339	-4.38766	12.06531

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Table19. Vietnam

Regression Statistics								
Multiple R	0.973034							
R Square	0.946796							
Adjusted R Square	0.76945							
Standard Error	0.34783							
Observations	14							

ANOVA					
	df	SS	MM	F	Significance F
Regression	10	6.459051672	0.645905	5.338679	0.09738
Residual	3	0.362957833	0.120986		
Total	13	6.822009505			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	42.63558	26.45574306	1.611581	0.205443	-41.55841	126.8296	-111.89	197.1612
yit-1	-0.44882	0.212837459	-2.10874	0.125517	-1.126163	0.228524	-1.69198	0.794345
educ(Pre)	-0.02009	0.191206041	-0.10507	0.922952	-0.628593	0.588413	-1.13691	1.096727
educ(Prim)	-0.4559	0.213372171	-2.13666	0.122238	-1.13495	0.223141	-1.70219	0.790383
G	10.42103	4.775713162	2.182089	0.117119	-4.777418	25.61948	-17.4735	38.31554
FDI/GDP	0.035246	0.114071028	0.308982	0.77755	-0.327779	0.398271	-0.63103	0.701524
IU	0.195709	0.264464541	0.74002	0.512939	-0.645935	1.037353	-1.349	1.740422
MS	-0.00256	0.022285161	-0.11507	0.915663	-0.073486	0.068357	-0.13273	0.127601
HTEx	0.234131	0.139156586	1.682499	0.191062	-0.208727	0.676989	-0.57867	1.046932
ICTEx	-0.01218	0.212964082	-0.05719	0.95799	-0.689926	0.665567	-1.25608	1.231724
ICTIm	-0.63012	0.223212525	-2.82295	0.066576	-1.34048	0.080244	-1.93388	0.673646

D.3. Pooled

Table20. Pooled Data (Dummy Variable Included)

Regression Statistics								
Multiple R	0.5859895							
R Square	0.3433837							
Adjusted R Square	0.301472							
Standard Error	2.2999938							
Observations	151							

ANOVA					
	df	SS	MM	F	Significance F
Regression	9	390.0680549	43.34089	8.19303	9.722E-10
Residual	141	745.885969	5.289971		
Total	150	1135.954024			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	3.1029196	0.892954733	3.47489	0.000679	1.3376093	4.86823	0.771283	5.434556
G	-1.436412	0.337750797	-4.25288	3.82E-05	-2.104123	-0.7687	-2.31833	-0.5545
FDI/GDP	0.2608346	0.057835063	4.509973	1.35E-05	0.1464986	0.375171	0.109819	0.41185
IU	-0.075832	0.032645958	-2.32286	0.021617	-0.140371	-0.01129	-0.16108	0.009411
MS	-0.00526	0.011704399	-0.44942	0.653819	-0.028399	0.017879	-0.03582	0.025302
HTEx	0.1834716	0.070793378	2.591649	0.010557	0.0435179	0.323425	-0.00138	0.368324
ICTEx	-0.299494	0.087311401	-3.43018	0.000791	-0.472102	-0.12688	-0.52748	-0.07151
ICTIm	0.1829818	0.090255309	2.02738	0.044508	0.0045532	0.36141	-0.05269	0.418652
Tech(Time)	0.1981511	0.121192262	1.635014	0.104277	-0.041438	0.43774	-0.1183	0.514602
Dummy	-0.108494	1.283535318	-0.08453	0.932757	-2.645956	2.428967	-3.45999	3.243005

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Table21. Pooled Data (Dummy Variable Excluded)

Regression Statistics	
Multiple R	0.5859611
R Square	0.3433504
Adjusted R Square	0.306356
Standard Error	2.291939
Observations	151

ANOVA					
	df	SS	MM	F	Significance F
Regression	8	390.0302583	48.75378	9.281159	3.05E-10
Residual	142	745.9237655	5.252984		
Total	150	1135.954024			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	3.0613129	0.742429399	4.123372	6.32E-05	1.59367	4.528956	1.122907	4.999718
G	-1.431948	0.332428085	-4.30754	3.06E-05	-2.089096	-0.7748	-2.29988	-0.56401
FDI/GDP	0.2633841	0.049174733	5.356086	3.35E-07	0.166175	0.360593	0.134994	0.391774
IU	-0.078192	0.016867119	-4.63574	7.98E-06	-0.111535	-0.04485	-0.12223	-0.03415
MS	-0.005129	0.011560502	-0.44367	0.657956	-0.027982	0.017724	-0.03531	0.025054
HTE _x	0.1841013	0.070153805	2.624252	0.009634	0.04542	0.322782	0.000937	0.367265
ICT _{Ex}	-0.300669	0.085894571	-3.50045	0.000621	-0.470467	-0.13087	-0.52493	-0.07641
ICT _{Im}	0.1854719	0.085013602	2.181673	0.030779	0.017416	0.353528	-0.03649	0.407433
Tech(Time)	0.2046618	0.093239444	2.195013	0.029787	0.020345	0.388979	-0.03878	0.4481

Table22. Group of Developed Countries

Regression Statistics	
Multiple R	0.376721
R Square	0.141919
Adjusted R	0.025569
Standard Er	1.699947
Observator	68

ANOVA					
	df	SS	MM	F	Significance F
Regression	8	28.19905	3.524881	1.219758	0.303629
Residual	59	170.499334	2.889819		
Total	67	198.698384			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	1.787687	4.19351949	0.426298	0.671442	-6.603526	10.1789	-9.37445	12.94982
G	-0.18633	0.64772109	-0.28767	0.774609	-1.482416	1.109758	-1.91041	1.537748
FDI/GDP	0.092882	0.11879514	0.78187	0.437418	-0.144826	0.330591	-0.22332	0.409086
IU	-0.01077	0.05792435	-0.18591	0.853153	-0.126675	0.105138	-0.16495	0.143412
MS	-0.00867	0.01992469	-0.43531	0.664923	-0.048543	0.031196	-0.06171	0.044361
HTE _x	-0.04059	0.10615298	-0.38233	0.703594	-0.252997	0.171827	-0.32314	0.241969
ICT _{Ex}	-0.0543	0.12615597	-0.4304	0.668472	-0.306735	0.19814	-0.39009	0.281499
ICT _{Im}	0.189398	0.19995587	0.947199	0.347401	-0.210713	0.589509	-0.34284	0.721632
Tech(Time)	-0.03435	0.18857498	-0.18215	0.85609	-0.411686	0.342989	-0.53629	0.467592

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Table23. Group of Developing/Emerging Countries

Regression Statistics								
Multiple R	0.571486							
R Square	0.326597							
Adjusted R Square	0.253796							
Standard Error	2.638453							
Observations	83							

ANOVA					
	df	SS	MM	F	Significance F
Regression	8	249.842772	31.23035	4.486194	0.00018
Residual	74	515.1461338	6.961434		
Total	82	764.9889059			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 99%	Upper 99%
Intercept	1.965423	1.590536879	1.235698	0.220479	-1.20379	5.134637	-2.239817	6.170664
G	-1.753959	0.461447261	-3.801	0.000294	-2.673413	-0.83451	-2.973986	-0.53393
FDI/GDP	0.332333	0.078524318	4.232227	6.56E-05	0.1758696	0.488796	0.124721	0.539944
IU	-0.139778	0.065185949	-2.14429	0.035294	-0.269663	-0.00989	-0.312124	0.032568
MS	-0.01876	0.022267236	-0.84248	0.402231	-0.063128	0.025609	-0.077632	0.040113
HTE _x	0.353896	0.11614492	3.047022	0.003203	0.1224723	0.58532	0.046819	0.660973
ICT _{Ex}	-0.483864	0.166459434	-2.9068	0.004815	-0.815542	-0.15219	-0.923969	-0.04376
ICT _{Im}	0.246038	0.175048311	1.405544	0.164044	-0.102753	0.594829	-0.216774	0.708851
Tech(Time)	0.537201	0.202762481	2.649411	0.009853	0.1331881	0.941214	0.001115	1.073288