

DIFFERENTIAL ECONOMIC PERFORMANCE  
IN DEVELOPING COUNTRIES

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DIFFERENTIAL ECONOMIC PERFORMANCE  
IN DEVELOPING COUNTRIES

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DIFFERENTIAL ECONOMIC PERFORMANCE  
IN DEVELOPING COUNTRIES

Charumporn Fon Vijakkhana

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THESIS ABSTRACT  
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This thesis examines the economic performance in developing countries. The 2003 data is collected from 74 developing countries. The level of economic performance is measured by GDP per capita. The independent variables that are used in this study are physical capital, human capital, percentage of service in GDP, political rights, inflation, foreign direct investment, and trade openness. FDI and education also used as interaction variable to investigate their effect on GDP per capita.

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## **CHAPTER I**

### **INTRODUCTION**

The Industrial Revolution brought many changes to the world. Prior to this period, the world's Gross Domestic Product (GDP) stayed relatively constant; there was not that much growth in GDP in any economy. With the burst of new technology, countries started to move from agrarian to manufacturing and began to experience growth in output. Originating in Britain and spreading throughout Europe and later to North America, this process of industrialization brought wealth and elevated people's standard of livings. Years passed, and wealth kept on growing. Today, growth is a very important indicator of the well-being of the economy. However, growth in output is uneven across countries. Although poor countries' GDP may increase, they are increasing at a slower rate. Many countries in South America, Africa, and Asia are low in GDP per capita. This thesis is the study of economic growth in such countries. There are total of six chapters in the thesis. The contents of each chapter are explained in the following paragraphs.

Chapter II presents background in economic growth. This chapter has three sections. The first section takes a look of GDP and GDP per capita of the world with

countries classified into high income, upper middle income, lower middle, and low income countries. The second section discusses current aspects of the problem of poverty in the world. The third section presents a brief summary of growth theory from the past to the present. The fourth section is a conclusion of the chapter.

Chapter III is a literature review. The chapter is divided into two sections. The first section reviews the literature of growth theory, which includes the Harrod-Domar, neoclassical, and endogenous growth theories. The second section reviews empirical studies of growth using cross-country data. These previous studies report the result on what factors affect growth. Robert J. Barro (1997) examines the relationship between political freedom and inflation and growth. Paul Segerstrom (1991) studies the link between technological innovation and imitation and their affect on growth in developing countries. The study by Borensztein, Gregorio, and Lee (1998) investigates the effect of foreign direct investment on the process of growth. Halit Yanikkaya (2003) examines the effect of the openness of a country on economic growth. Finally, this section presents the study by Mukesh Eswaran and Ashok Kotwal (2002) which looks into the role of service sector play in the process of agriculture sector and how the service sector affect economic growth.

Chapter IV is methodology. There are two sections in Chapter IV. The first chapter describes the conceptual model. This section also discusses the challenge faced in selecting independent variables, since there are many countries with different characteristics and many factors that contribute to growth. The first section concludes

with the conceptual model for this thesis. The second section defines and discusses each variable in detail and presents their descriptive statistics.

Chapter V presents the regression results. Chapter V is divided into four sections. The first section discusses the OLS assumptions and the consequences of violation of these assumptions. The second section reports the results of the Breush-Pagan test for heteroskedasticity. The third section discusses the misspecification problem and presents the results for the Ramsey's RESET test. The last section presents the regression results and the discussion of the interpretation of the results.

Chapter VI is a conclusion. The conclusion summarizes and comments on the results of this study. It also discusses ideas for further research.

## **CHAPTER II**

### **BACKGROUND**

This chapter addresses the definition and measurement of economic growth and the development process; it has four sections. The first section examines the composition of the world's GDP in the past and present. This section examines both GDP and GDP per capita of the world and countries which are classified into high income, upper middle income, lower middle income, and low income countries. The second section looks at the problem of poverty in the world. It defines what poverty is and presents a discussion of the current state of poverty in the world. The third section gives a brief overview of growth theory from the past to the present. This section also presents the challenges that are faced in cross-country studies of growth today. Finally, the last section presents a concluding remark.

#### **A. Overview of the World's Wealth**

Compared to fifty years ago, the world is producing and consuming more. Using 2000 as the base year, the world GDP was \$7,265,893,529,448 in 1960 and has grown to

\$37,866,383,439,225 in 2006. For the past fifty years, the world's output was on a steady rise. World production as a whole is growing, but the distribution of wealth is still far from even. For 2006, 78% of the world GDP goes to high income countries, 9% belongs to upper middle income, 9% goes to lower middle income, and only 3% are from low income countries (World Bank). This distribution has not changed much in the past fifty years. The high income countries produce the majority of world GDP. In 1960, the high income nations produce 84% of the world output, upper middle income countries produce 9%, middle income and lower income countries produce 4% and 2%, respectively. The largest gains are among the lower middle income countries, but that gain is only 5% (World Bank). The upper middle income nations' shares remain the same at 9%, and the lower income countries only gain one more percent of shared outputs. Table 1 below presents this information. Although the overall wealth of the world has increase, the distribution of wealth does not change much. The rich nations still get most of the wealth, and the income gap is still wide open.

Those statistics were based on total output; a more meaningful measure of economic well-being is GDP per capita. The share of GDP indicates that rich nations still enjoying more wealth, but overall GDP itself does not tell much about the welfare of people. An increase in overall GDP could mean that labor force has grown and thus the country produced more. GDP per capita needs to be examined to see if the average person actually enjoys more income, or whether instead the growth in GDP suggests that everybody still enjoys the same or smaller income, but there are just proportionately more

people. We observed that not only output is bigger, but GDP per capita also indicates people are getting more income. The world GDP per capita is \$2,405 in 1960 compared to \$5,810 in 2006. However, the distribution of the GDP per capita is very uneven. For 2006, the high income countries' GDP per capita is \$28,689. For developing countries, their GDP per capita are all under the world average. The GDP per capita for low income, low middle income, and upper lower income are \$509, \$1,565, and \$4,422 respectively (World Bank). The Table 2 below compares the GDP per capita in 1960 and 2006. In 2006, the world GDP per capita is closer to the developing countries than to the higher income countries. This indicates that the majority of people in the world are making relatively little money. In fact, about a third of the world population is still living in poverty. This topic is discussed in detail in the next section.

Table 1 – GDP distribution in 1960 and 2006

Countries	1960	2006
High Income	84%	78%
Upper Middle Income	9%	9%
Lower Middle Income	4%	9%
Low Income	2%	3%

Table 2 – GDP per capita in 1960 and 2006

Countries	1960	2006
High Income	\$8,790	\$28,689
Upper Middle Income	\$1,626	\$4,422
Lower Middle Income	\$262	\$1,565
Low Income	\$206	\$509
World	\$2,405	\$5,792

#### B. Poverty

From the previous section, both GDP and GDP per capita reveal that the distribution of wealth does not change much. Despite the increase in overall outputs and per capita output, there is still a large disparity in distribution of wealth among countries in the world. In 2006, the world average GDP per capita is \$5,810, while the high income countries' average GDP per capita is \$28,689. All countries except those in the "high income" group have GDP per capita figures that are below the world's average. These statistics indicate that the majority of people in the world are still living in poor conditions.

In fact, about a third of the world's population is living in moderate or extreme poverty. The World Bank defines extreme poverty as people that are living on less than \$1 a day and moderate poverty as people that are living less than \$2 a day. The following World Bank statistics were gathered by sampling 1.1 million people in over 100 countries (Ref). The surveys were conducted by government officials of the particular country. From these surveys, assessments can be made about the distribution of consumption in each country. From this distribution, the proportion of people who do not meet the level of poverty line is calculated. According to the World Bank's estimate, in 2001, 1.1 billion people have a consumption level less than \$1 a day, and 2.1 billion people live on less than \$2 a day. That is roughly a third the world population living in moderate poverty, and about one sixth of the world population live in extreme poverty.

According to the data from Human Development Report published by the United Nations, 85 countries have populations that are living under \$2 a day (Ref). The Table 3 below shows percentage of population of those countries that are living on less than \$2 a day. Table 3 shows that many countries in Africa and Asia have a majority of their population living in poverty. Nigeria has more than 90% of its population living in at least moderate poverty. Countries such as Zimbabwe, Zambia, Madagascar, Rwanda, Tanzania, and Niger have more than 80% living below poverty line. These countries are in Africa. However, in Asia, India and Bangladesh also have more than 80% of their population living on less than \$2 a day. Poverty is still everywhere in the world. In Eastern Europe, countries such as Slovakia, Latvia, Bulgaria, In South America, Mexico,

Argentina, Colombia, Panama, Peru, Guatemala, Venezuela, and El Salvador have their population living in poverty. In Asia, China has about 30%-40% living below \$2 a day. Many countries are still living in at least moderate poverty, and these countries are everywhere in the world.

Table 4 further illustrates the fact that poverty is everywhere in the world; it groups the percentage of people that live on less than \$1 a day by regions. Table 4 reveals that Sub-Sahara Africa has 41.09% of the population living on less than \$1 a day. In South Asia, 31.11% of its population is living in extreme poverty. East Asia and Latin America have about 8% in extreme poverty. Middle East and North Africa have 1.47%. Finally, Europe and Central Asia have 0.95% living in extreme poverty. The Table 4 shows that poverty is still an important problem everywhere, and many people are still living with a consumption level less than \$1 a day.

But what does \$1 a day mean exactly? With \$1 or less a day, basic needs are not met. People that live in this condition do not have enough to eat, do not have proper shelter, and cannot afford proper health care. This means that people can die of illness that can be easily treated with proper medical care. When basic needs are not met, these people are set up for a continuation of the vicious cycle of poverty. They cannot afford proper education, so they do not have a chance to better their skills and attain better jobs. Poor health also hinders them from getting education or training they need. The opportunity to get out of this condition is slim to none. This creates a vicious cycle that people are stuck in for generations.

Table 3 – Countries with population living on less than \$2 a day

< 10%	10% - 20%	20% - 30%	30% - 40%	40% - 50%
Slovakia, Latvia, Ukraine, Chile, Uruguay, Bulgaria, Tunisia, Jordan, Iran, Lithuania, Malaysia, Costa Rica	Mexico, Russia, Romania, Morocco, Jamaica, Algeria, Kazakhstan, Dominican Republic, Argentina, Colombia, Panama, Turkey	Moldova, Brazil, Kyrgyzstan, Thailand, Georgia, Paraguay	Peru, Armenia, Guatemala, Azerbaijan, South Africa, China, Trinidad and Tobago	Venezuela, El Salvador, Ecuador, Sri Lanka, Bolivia, Tajikistan, Philippines, Egypt, Mongolia Yemen, Cote d'Ivoire

50% - 60%	60% - 70%	70% - 80%	80% - 90%	> 90%
Cameroon, Indonesia, Botswana, Namibia, Lesotho, Senegal, Kenya	Malawi, Mauritania, Nepal	Burkina Faso, Mali, Pakistan, Benin, Laos, Mozambique, Sierra Leone, Cambodia, Ethiopia Swaziland, Haiti, Ghana, Nicaragua	India, The Gambia, Zimbabwe, Bangladesh, Central Africa Republic, Madagascar, Niger, Zambia, Burundi, Rwanda, Tanzania	Nigeria

Table 4 – Percentage of population living on less than \$1 a day by region

Regions	2004
East Asia and Pacific	8.88%
Europe and Central Asia	0.95%
Latin America and the Caribbean	8.71%
Middle East and North Africa	1.47%
South Asia	31.11%
Sub-Saharan Africa	41.09%

Poverty is a very important problem in economic development. It's important for these countries to catch up with the develop nations in term of economic well-being. Economic growth is one of the goals that will help alleviate the problem of poverty. The question of what causes economic growth is quite relevant. The study of economic growth is important; finding the cause of growth could bring improvement to millions of people's lives.

### C. Growth Theory

Generally for there to be growth, an economy has to expand its production capacity. For the production capacity to increase there needs to be investment made into

physical capital. With investment in physical capital today, tomorrow's productive capacity is expanded, and therefore the whole economy will produce more output.

One well-known growth theory is the neoclassical model. In the neoclassical model, output is a function of capital and labor. Technology is given and assumed to be identically implemented everywhere. One of the well known facts that come out of the neoclassical model is that outputs will converge. This suggests that the poor countries will catch up with the rich nations in term of growth. A more complete discussion of the neoclassical growth model can be found in chapter III to follow.

The neoclassical growth model says that less developed nations will grow at a faster rate. Therefore, they will eventually catch up with the developed nations' output. As the data in the previous section shows, there is a huge disparity between developed and developing nations. The distributions of GDP today and fifty years ago are about the same. There is little sign of closing the gap. Many cross-country studies also have not been able to verify a convergence in rate of growth. With this flaw in the neoclassical theory, many economists look for a more relevant theory to model growth in cross-country samples.

The information from the Table 5 shows that the world GDP per capita grows by 141%. The lower middle income countries have almost a 500% increase in their GDP per capita. However, for the rest of the developing countries, their growth in output is less than that of the high income countries.

Table 5 – Growth in GDP per Capita from 1960 to 2006

Countries	GDP per capita Growth
High Income	226%
Upper Middle Income	172%
Lower Middle Income	497%
Low Income	147%
World	141%

These observations lead to endogenous growth theory. Now economists are studying growth in developing countries with assumption that technology is not the same in all countries and that many factors besides capital and labors affect growth in output. For one country to grow is a very complicate situation. The conditions will vary from one country to others. Each country has its own characteristics. The first and most important thing for growth is physical capital. A country needs an investment today in order to grow tomorrow. But there are also other factors that affect growth. A more complete discussion is provided in chapter III.

#### D. Conclusion

This chapter has shown that the overall GDP and GDP per capita are growing. However, the distribution of wealth does not change much in the past fifty years. In 2006, high income countries produce almost 80% of the output. Moreover, the upper middle income, lower middle income, and low income countries' GDP per capita is below the world average, which indicates that many people in the world are making little money. Further examination reveals that 2.1 billion people live in moderate or extreme poverty. Therefore, poverty is an important and relevant problem. Investigating the factors that affect economic growth is one part of solving this problem. To say that the study of the cause of growth in these developing countries is important is a dramatic understatement.

## **CHAPTER III**

### **LITERATURE REVIEW**

This chapter is divided into two parts. The first part reviews the literature of growth theory. This section discusses the economic growth theory from Harrod-Domar model, to neoclassical growth model, and to endogenous growth model. The second part of this chapter discusses the cross countries empirical studies of economic growth.

#### **A. Growth Theory**

The Great Depression brought about a change in the field of economics. The hands-off policy of the classical economists was no longer appropriate. Say's Law that supply creates its own demands had its limitations. This is where Evsey Domar (1947) and Ray Harrod (1948) pick up. They independently investigate the full employment conditions given that people hoard. Therefore, the main focus in this paper is investment's role. When people save, this saving turns into investment, and capital will then accumulate, thus the economy's productivity capacity increases. When capacity increases, Harrod and Domar argue three things can happen – the new capitals remain

unused, the new capital will substitute the old, or the new capital will substitute for labor and there will be unemployment. This suggests that the way to maintain full employment is to keep income growing. Domar is interested in finding the magnitude of investment that will keep economy at full employment. The condition for full employment is that the increase in income equals the increase in productive capacity.

Solow (1956) criticizes Domar-Harrod's assumption of fixed proportions in production. Solow argues that there is a possibility of substituting labor for capital in production. He developed what has become the heart of the neoclassical growth model. Output is a function of both capital and labor,  $Y=F(K,L)$ . Net investment is a rate of increase capital stock, which is equals to that part of income which is being saved. The model centers on the role of capital-to-labor ratio,  $r = K/L$ . Solow defined  $r^*$  as when the rate of change in the capital-to-labor ratio is equal to zero. When this happens, capital stock expands at the same rate as the labor force. Solow called this the warranted rate of growth. If  $r > r^*$ , then  $r$  will decrease and move toward  $r^*$ , which means capital will grow slower than labor. The opposite will happen if  $r < r^*$ , capital will grow faster than labor. This will happen until the economy is at  $r^*$ , which is the stable state. This result gives the balance growth path that an economy will follow. In terms of economic development, this implies that poor countries will catch up with the rich nations. This follows from the assumption diminishing marginal product of capital; poor countries have low ratio of capital-to-labor ratio, which means high marginal product of capital, and will grow faster

than rich countries with higher ratio of capital-to-labor. Thus, that there will be convergence in growth among countries in the world.

Many economists have since attempted to verify this convergence in cross-country data and found no support. Many criticize the neoclassical model for treating technology as exogenous. Then in 1980's many economists formulated new theory, which become known as the endogenous growth theory. Robert Lucas (1988) and Paul Romer (1986) suggest dropping the two central assumptions of neoclassical model that technological change is exogenous and that the same technology is available everywhere. Robert Barro and Xavier Sala i Martin(1992) suggest that the level of the technology can be different in different states or countries. They also suggest that there is diffusion of knowledge from high to low income regions. The flow of knowledge will make technology grow faster in the follower countries, since they do not have to develop this knowledge themselves. Technology diffusion will close up the technology gap. Many of these new theories and empirical works are known as the endogenous growth theory. The theory asserts that technology is not exogenous. Instead, it examines many varying factor that affect growth across countries.

## B. Empirical Studies

With the advance of endogenous growth theory, many economists found new ways to model growth using cross-country data. With the new assumptions that technology is not exogenous and not the same for every country, many new variables must now be included into the model. The question here is what variables to include.

For this paper, determining what variables to include is aided by the results of previous studies. Thus, a few important prior studies were used as a guide in determining what variables to be used in the model to be analyzed here.

Robert Barro (1991) examines many factors that affect economic growth. The study includes 98 countries from 1960-1985. In this paper, he found that GDP per capita is positively related to human capital. Barro uses school enrollment for primary and secondary as a proxy for human capitals. He suggested that countries with higher human capital have higher growth and lower fertility. The explanation is that with higher human capital, the cost of parents' time increases. Therefore, the cost of raising children increases. This increasing cost leads to lower fertility. Barro also found that growth is inversely related to the share of government consumption in GDP. However, growth is insignificantly related to the share of public investment. Finally, growth is inversely related to a proxy for market distortion.

Barro (1997) also examined the relationship between democracy and economic growth. The study uses panel data of 114 countries from 1960-1990. In this study, Barro refers to many earlier works that economic freedom undoubtedly affects economic growth. Barro talks about how there are many studies that link economic freedoms – free markets, small government, and property rights – to economic growth. There is a positive correlation between the two. However, political freedom's effect on economic growth is unclear. Some studies argue that economic and political freedom is “mutually reinforcing.” From his study, Barro makes two points. First, there is positive correlation

between democracy and prosperity. The second point is that when political freedoms are low, democracy has a positive effect on growth; however, when political freedoms are high, democracy depresses growth. The interpretation of this is that in the situation such as the dictatorship, an increase in political rights tends to increase growth and investment. But in a place that already have political rights; further increase in political rights will impair growth because the dominant effect comes from the concern with income redistribution.

Barro (1997) also examines the relationship between growth and inflation. Barro found that inflation has a negative effect on growth. However, Barro concludes that the relationship between low inflation and growth is significant. Therefore, the negative effect of inflation on growth comes from the high inflation cases. He finds that the effect of inflation on growth is very small. However, in the long run, Barro argues that this adverse effect that inflation has on growth amounts to a large slowing of growth. Therefore, inflation is important factor that affect economic growth.

With the endogenous growth theory, now the belief is that different technology is available to different countries. Therefore, there are many studies that include variables proxying technology in the model. Many studies have looked into this topic. Paul Segerstrom (1991) investigates the effect of technology through research and development sector in the economy. Segerstrom develops a dynamic general equilibrium model that includes the process of innovation and imitation. He models the economy

where some firms create new products and some firm imitate this new technology.

Innovation subsidies are shown to promote economic growth.

Some examples of technology diffusion are the import of high-technology products, adoption of foreign technology, and foreign direct investment by multinational corporations. Borensztein, Gregorio, and Lee (1998) examine the effect of foreign direct investment on economic growth. Through this transfer of technology, developing countries can benefit from the technology of the developed nations. Their study includes 69 developing countries over 20 years. They found that FDI has a greater effect on growth than domestic investment. But FDI also acts in concert with human capital. Secondary school attainment is the measure they use for human capital. They interacted foreign direct investment with human capital and found that foreign direct investments' effect on growth depends on the level of human capital. They also found that foreign direct investment has an indirect effect on domestic investment.

Halit Yanikkaya (2003) studied 100 developed and developing countries from 1970-1997. His particular interest was in the effect that the "openness" of an economy has on growth. The openness measures he considered can be divided into two main categories – trade intensity and trade barrier. Yanikkaya used different variables to measure trade intensity. He used trade openness, which is the ratio of import plus export to GDP. He also used import penetration ratio, which is a ratio of imports to consumption, and export shares in GDP, which is the percentage of exports in GDP. He found that when using trade intensity as openness measures, openness has a positive

effect on growth. The other group of openness measurement is trade restriction. For measures of trade restriction, Yanikkaya used total import duties, export duties, and tax on international trade. However, when using trade barriers as an openness measure, the higher the barrier the higher the growth.

Mukesh Eswaran and Ashok Kotwal (2002) attempt to answer the question of whether high agricultural productivity help or hurt the industrialization process. To do so, Eswaran and Kotwal build on the work of Matsuyama (1992). To sum up Matsuyama's work, in a closed economy high agriculture output aids industrialization. However, in an open economy, if a country's comparative advantage lies in agriculture, then to industrialize there needs to be protection of its infant manufacturing sector. Eswaran and Kotwal took that notion further by investigating what role the service sector plays in industrialization. They included the non-traded service sectors such as construction, transportation, and insurance. They argued that the expansion of the service sector will lower the cost of the service input in the industrial sector, and the service sector can expand by either through higher agricultural productions and the exporting of these products or by other exogenous factors. Therefore, Agricultural productivity growth therefore can lead to industrialization.

### C. Conclusion

This chapter has presented the growth theory from Harrod-Domar model, to neoclassical model, and to endogenous growth model. Many past empirical studies are also presented in this chapter. From these past literatures, we found that many factors

affect economic growth. These factors are such as human capital, political freedom, inflation, foreign direct investment, and openness of trade.

## **CHAPTER IV**

### **METHODOLOGY**

Chapter 3 has three sections. The first section discusses the challenge facing the study of growth in cross-country studies and presents the conceptual model. The second section discusses at length the reason why each variable is included in the model and reports the basic descriptive statistics of each variable.

#### **A. Conceptual Model**

Economic growth refers to an increase of output over time. Economic development, however, is much more than that. Economic development focuses not only on an increase in output, but also on an equal income distribution and an improvement in living conditions. In the previous section, the literature review focuses on the study of economic growth. This thesis investigates the level of economic development in developing countries. However, it should be noted here that economic growth and economic development are used interchangeably throughout the study. The reason for this is that the level of development is a part of economic growth process. Therefore,

economic growth and economic development are used synonymously.

The data used for this paper is cross-sectional data. Cross-sectional data has advantage over time series and panel data. Since this thesis focuses on economic performance in cross-countries, time series data is not appropriate. Panel data also presents some problem. Since this study investigates the level of development over time across countries, using panel data faces with many missing data. Therefore, the cross-sectional is used for this study.

Economic growth is measured by the output of an economy measured per consuming unit. Therefore, GDP per capita is used as the dependent variable. Deciding on dependent variable is very straight forward nearly all studies of economic development use GDP per capita. The challenge for a cross countries study is deciding what independent variables to include, since many factors can affect economic growth.

When studying growth in one economy, the task of finding what cause an increase in GDP is challenging enough. The theory is that output is a function of capital and labor, given that technology is exogenous. However, when investigating what causes growth across countries, the difficulty increases. Each country has its own level of technology. Many empirical studies cannot verify the theory that a poor country will grow at a faster rate and catch up with rich nations as is predicted by the neoclassical theory. This is the main controversy of concerning neoclassical growth model. Among other things, this leads us to discard the assumption of technology is exogenous.

In addition to different levels of technology, each country also has its own unique characteristics in term of its location, natural resources, culture and traditions, history, etc. The choice for independent variables seems to be endless. First of all, these countries have different geographic area and natural resources. Some countries have easy access to water and some do not. Some are located where it is strategically advantageous to trade with other nations. These countries also have different natural resources endowment. They also vary in labor force size and its skill level. The skill level of the labor force is very important. An economy's ability to grow depends on use these resources to the optimal extent, so better skills mean more productive uses of resources and higher growth. Therefore, an economy's capacity to grow depends on both physical capital and human capital.

In addition, these countries are made up of different traditions, cultures, and religions. In other words, these countries have different value systems. These values can influence the way they trade and conduct other policies. Moreover, some countries have been colonized, and they have thus been influence by the Western values.

Therefore, for this study, past model specifications are used as guideline in determining independent variables. From these studies, independent variables that are usually included in this kind of model can be grouped as physical capital, human capital, and other policy and control variables. Therefore, capital and education are included in this model. Other independent variables, discussed in chapter III, that are included in the model are inflation, political rights, foreign direct investment, and trade openness. The

justification of including all these independent variables can be found in the next section.

The conceptual model is

$$\text{GDP per capita} = \beta_0 + \beta_1 \text{ capital} + \beta_2 \text{ education} + \beta_3 \text{ service} + \beta_4 \text{ political rights} + \beta_5 \text{ inflation} + \beta_6 \text{ FDI} + \beta_7 \text{ openness} + \varepsilon$$

## B. Data

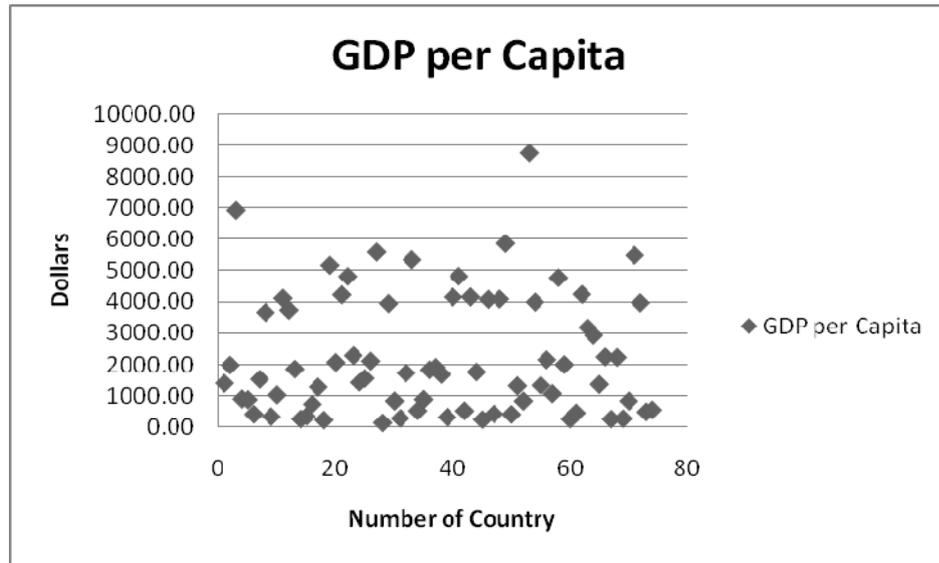
The data in this paper is from the World Bank's World Development Indicator (WDI) database. The year is 2003. The World Bank classifies countries into high income, upper middle income, lower middle income, and low income countries. There are a total of 209 World Bank member countries. The World Bank uses Gross National Income (GNI) as a measure in classifying countries. The high income countries are defined as those countries with GNI per capita of \$11,116 or more. There are 60 high income countries. This paper deals with the developing nations, which are classified as upper middle income, lower middle income, and lower income countries. The upper middle income countries are those that have GNI per capita in the range of \$3,596 - \$11,115. The lower middle income countries are in the range of \$906 - \$3,595. The low income countries have a GNI per capita of \$905 or less. There are 53 low income countries, 55 lower middle income countries, and 41 upper middle income countries. There are some missing data, so after deleting countries with missing data there are 74 observations in the sample employed.

Table 6 – Country Classification

Lower Income	< \$905
Lower Middle Income	\$906-\$3,595
Upper Middle Income	\$3,596-\$11,115
High Income	> \$11, 116

1. GDP per capita.

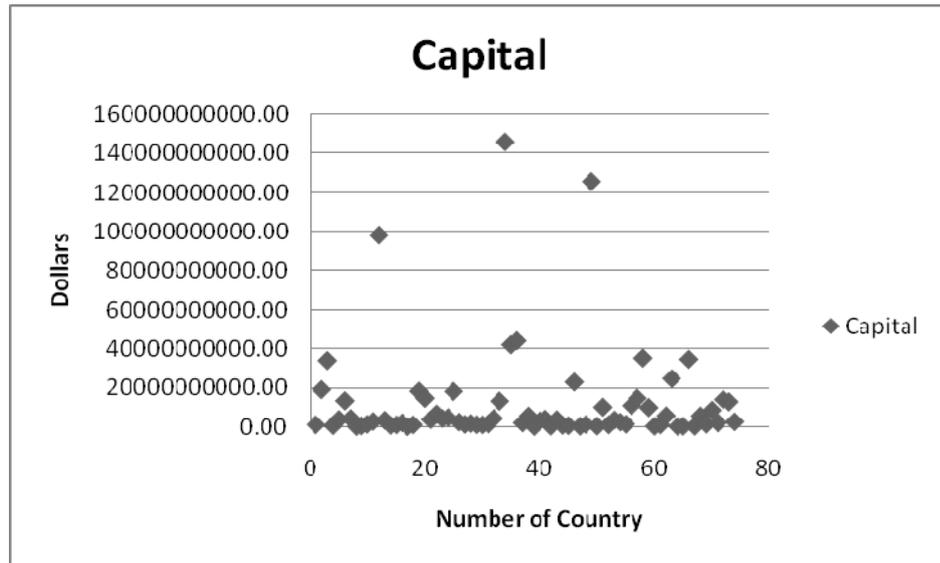
GDP per capita is included as the dependent variable. There are 74 developing countries in the sample. The average GDP per capita from the sample is \$2233.56. This average falls in the range of the lower middle income countries according to the World Bank's classification. The maximum for GDP per capita is \$8769.26. That country is Oman. The least GDP per capita is Ethiopia with \$121.19. The scatter plot below shows the distribution of the data. There are a large number of countries that GDP per capita is below \$1,000. The majority of countries in this sample are in the range of lower middle income countries which is \$906-\$3,595. The standard deviation for this sample is \$1926.63.



**Figure 1 -GDP per capita**

## 2. Capital

Capital plays a vital role in the process of growth. For a country to grow in the future, saving needs to turn into investment for the future. For physical capital, this paper uses gross fixed capital. Past literature has used many variables to measure physical capitals. One study used the number of telephone lines as a proxy. For this paper, fixed capital is used. The maximum is \$146,106,122,240.00, and the minimum is \$109,850,952.00. The average is \$12,058,250,494.92, the median is \$3,249,333,248.00, and the standard deviation is\$ 25,515,467,699.57. From the scatter plot, the majority of countries have their capital below \$20,000,000,000. Capital is expected to positively affect GDP per capita; the more capital, the higher economic growth.



**Figure 2 - Capital**

### 3. Education

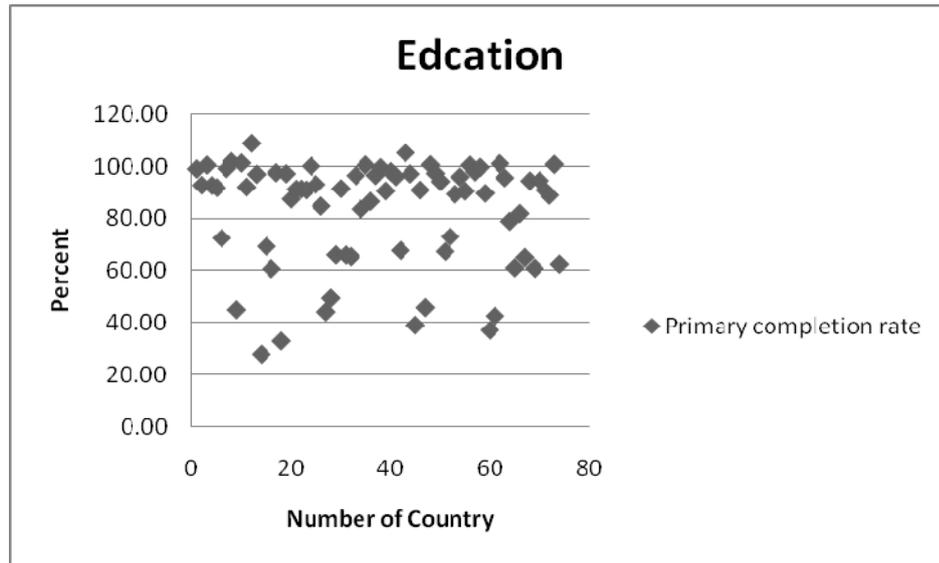
Physical capital is not the only essential element for growth. There will be no use for physical capital if there is no one there to use it. Therefore, human capital is also a very important factor in the process of economic growth. Higher education means higher skill level. Education brings specialization. This means that the labor force will be more productive.

Human capital is included here because many empirical researchers attest that human capital plays a vital role in growth. There are many empirical studies that look into the effect of human capital on growth. For example, human capital will contribute to the research sector. The higher human capital, the better the research sector will be. Thus, this will lead to faster technological progress, and ultimately to growth. Higher

human capital will lead to a quicker absorption of new ideas from outside the country. Thus, countries with higher human capital will grow faster. Romer (1990) and Nelson and Phelps (1966) Therefore, human capital will expected to be positively related to GDP per capita. The variable used to measure human capital in this study is the rate of primary school completion.

There are many variables that can be used as proxy for education. Some proxies that are used for education are teacher-to-student ratio, spending on education, literacy rate. For this thesis, the primary completion rate is included as a proxy for education. This study use developing countries; thus, the primary education is sufficient. Primary completion rate is defined as the total number of students minus the number of repeaters in that grade divided by the total number of children of official graduation age.

In this sample, the maximum is Brazil with the completion rate of 108.8%, and the minimum is Burkina Faso with the rate of 28.17%. The average is 83.15, and the standard deviation is 20.05.



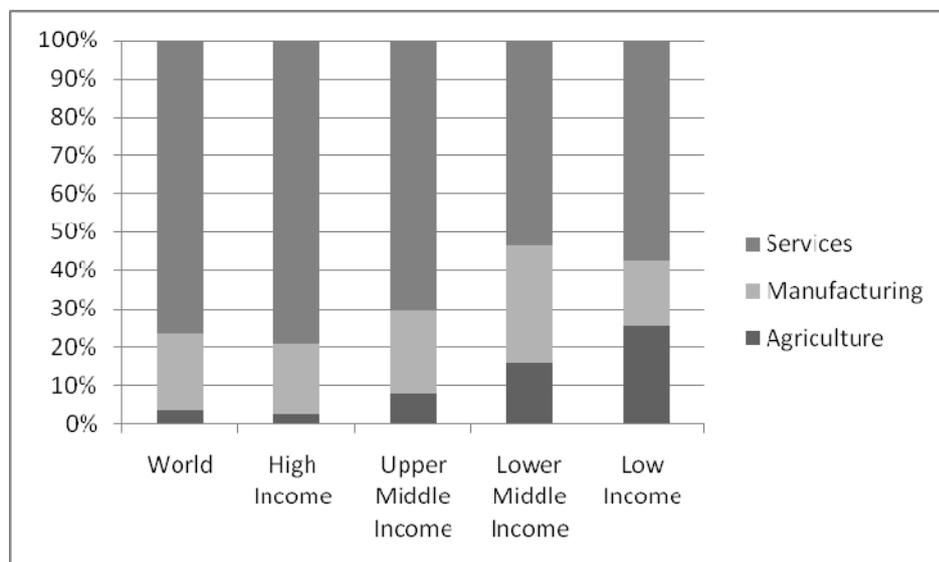
**Figure 3 - Education**

#### 4. Service

GDP is generally taken as originating in of the three sector – agriculture, manufacture, and service. There is a theory that an economy will go through structural changes. It will moves from agriculture to manufacturing, and finally to service. The size of the service sector can be used to measure the maturity of the economy.

The world GDP is made up of 3% from agriculture products, 18% from manufacturing goods, and 69% from services. However, the high income countries' GDP's comprised of 72% service, 17% manufacture, and 2% agriculture. For low income countries, 50% of GDP made up of service, 15% is from manufacturing sector, and 22% is from the agriculture sector. For lower middle income countries, 45% is from

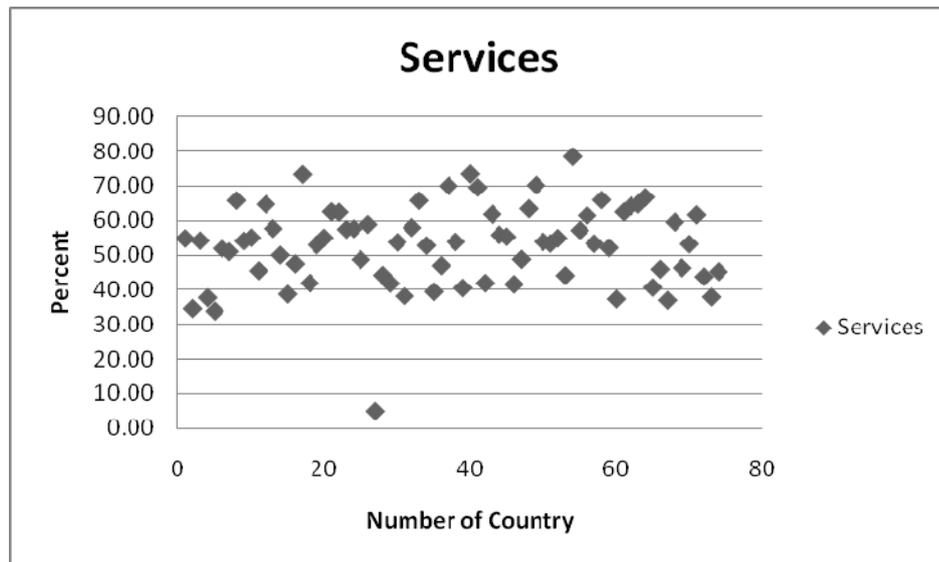
service sector, 26% is from manufacturing, and 13% is from agriculture. For upper middle income, 62% is from service, 19% is from manufacture, and 7% is from agriculture. The Figure shows the composition according to the classification of high income, upper middle income, lower middle income, and low income countries. This data shows that agriculture is the smallest component of GDP in the high income countries. But it is interesting to note that, the lower middle income countries' GDP is made up of more manufacturing goods than the upper middle income countries'.



**Figure 4 - GDP Structure**

The size of the service sector is measured by service as percentage of GDP. This variable proxies the maturity of the economy. The assumption here is that an economy goes through stages of change. An economy starts off as a agrarian society, then an economy will progress to manufacturing. And finally, the economy will enter the service sector. Thus, service output as a percentage of GDP is also included. The mean is 52.82. The

median is 53.87. The standard deviation is 11.809. Equatorial Guinea has the minimum percentage of service in GDP at 5.12, while Panama has the maximum percentage of GDP at 78.53%.



**Figure 5 -Service**

## 5. Political Rights

The level of freedom in a country and the level of government corruption have an impact on growth. A political rights variable is included in the model to account for these effects. The explanation of what political rights encompass is given in the following paragraphs. The political rights variable that is included in this study is ordinal data, which has a questionable role in regression analysis. The details of how this index is derived are in the following paragraphs.

Political rights data was obtained from Freedom House. Countries are rated on the scale of 1-7 with 1 being the most free. The political rights ratings are based on questions in three categories – electoral process, pluralism and participation, and functioning of government. The survey has 10 questions. Three questions are for electoral process, four questions are for pluralism, and three questions are for functioning of government. The electoral questions are as follows: is the head of the government elected through free and fair election, are the representative elected through free and fair election, and are the electoral laws fair? Political pluralism, which measures the degree in which the political power does not reside only with a few groups, and participation ask questions such as do people have the rights to organize political parties and is the system open to the rise and fall of these competing parties? Is there significant opposition votes to increase support and gain power through elections? Are people's political choices free from military, foreign powers, or any other power groups? Do ethnic, cultural, religious, or minority groups have full political rights and electoral opportunities? The third group of questions deals with the functioning of government: Do the elected governments determine the policies of government? Do government free from corruption? Is the government accountable to the electorate between elections, and does it operate with openness and transparency? The score range from 0-4 in for these questions. Then they add up and convert to a 1-7 scale.

The rating of 1 means election is fair, those elected rule, and the opposition play an important role and has actual power. The rating of 2 means political rights is less free.

There is corruption, discrimination against minority, and military or foreign power may have influence on the country's politics. The ratings of 3, 4, and 5 have the same conditions as rating 2. In addition, these countries have other factors such as civil war, heavy military involvement in politics, unfair election, and one-party dominance. Countries whose rating is 6 are ruled by military juntas, one-party dictatorships, religious hierarchies, or autocrats. A rating of 7 means political rights are absent or nonexistent.

Table 7 –Political Rights Rating

Total Score	PR Rating
36-40	1
30-35	2
24-29	3
18-23	4
12-17	5
6-11	6
0-5	7

The mode of the sample is 6, and the average is 3.5. Countries such as Belize, Bulgaria, Chile, Hungary, and South Africa have the best political rights rating of 1. Three

countries from the sample have the political rights rating of 7; these countries are Equatorial Guinea, Swaziland, and Vietnam.

## 6. Inflation

Inflation is also included. How does inflation related to growth? Inflation should be negatively related to growth. If there is inflation, households and businesses are expected to be worse off. Inflation affects consumers' and producers' behavior in the economy. Moreover, when there is an expectation of inflation, people expect the economy to slow down. They will adjust their behavior, which in turn might actually slow down the economy. Past literature has found that low inflation has no significant effect on growth, only high inflation does. However, it is important to include this Chad,

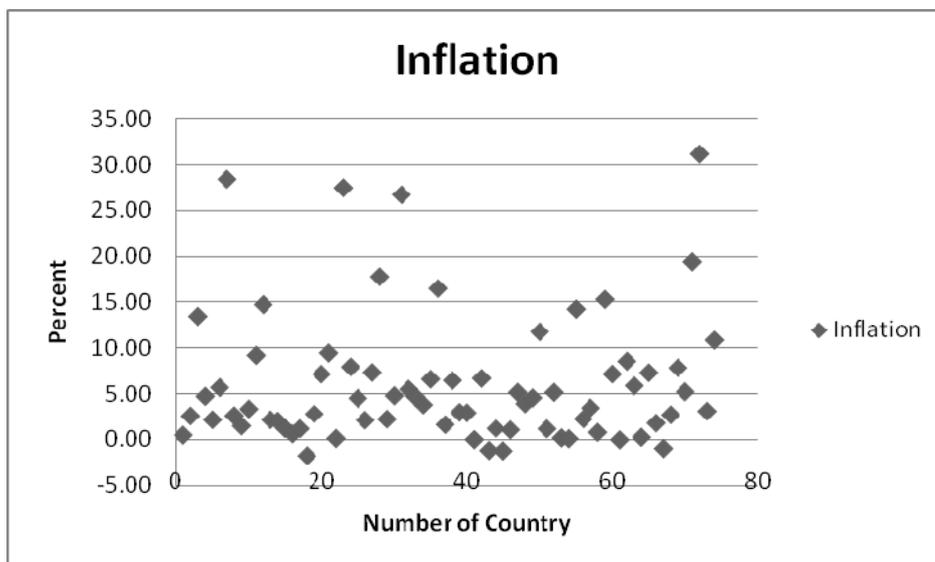
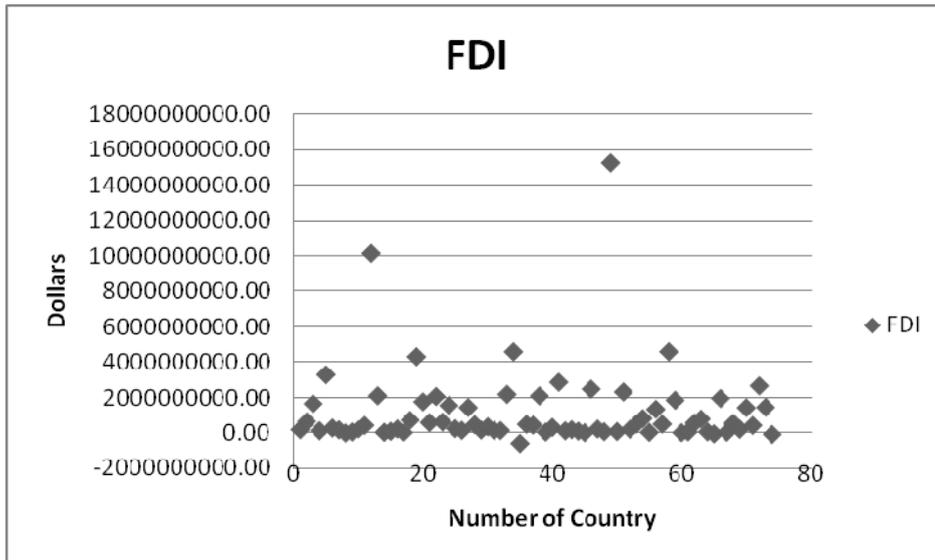


Figure 6 –Inflation

variable, since countries are affected by high inflation. The mean in the sample is 6.16. The maximum inflation is 31.11, which occurred in Venezuela. There is a deflation in which is -1.75. The median is 4.21. The standard deviation is 7.089.

## 7. Foreign Direct Investment

With the endogenous growth theory, technology is not longer treated as the same in every country. Each country has its own different level of technology. Technology is developed within a country through research and development. But for many developing countries, one of the easier ways to have new technology is through the adoption of new technology from the developed nations. This can happen through many channels. A country can adopt new technology from developed country or import the technology. One of the ways is through foreign direct investment. From past literature, foreign direct investment has a direct effect on growth. Therefore, this variable is also included in this study. The maximum is \$15,256,200,000.00, and the minimum is -\$596,923,827.79. Mexico is the country with the most foreign direct investment, while Indonesia is the least. The mean is \$1,177,258,072.32, and the standard deviation is \$2,277,003,579.29.

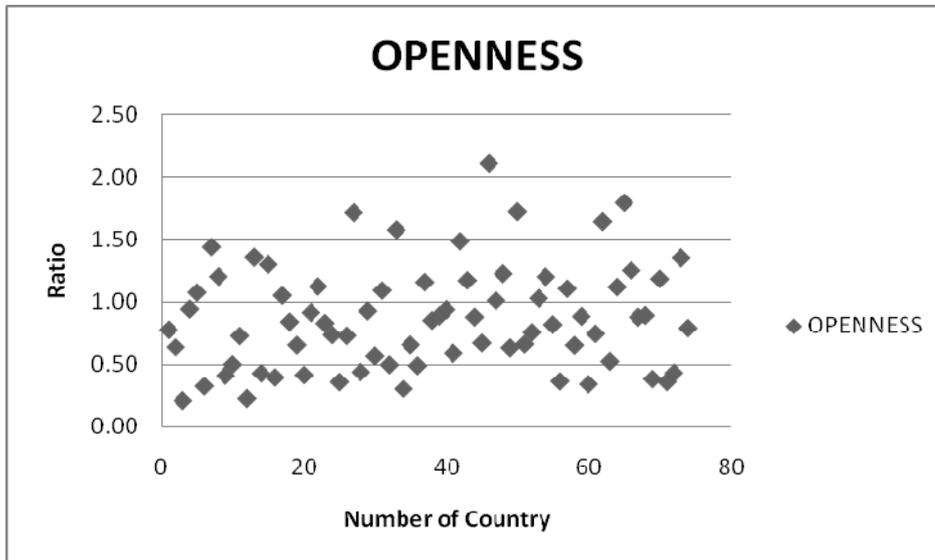


**Figure 7 – FDI**

## 8. Openness

Trade is also essential to the process of growth. A country should focus on producing goods that it has lower opportunity cost and trade for other goods. The measure of trade openness is also included. There is a consensus among economists that trade liberalization is supposed to aid the process of economic growth. The study done by Yanikkaya (2003) yields ambiguous results. When using variables that measure trade intensity, Yanikkaya found that openness is directly related to growth. However, when he used variables that measure trade barrier such as tariff, he found that the higher the barrier, the higher the output growth. For this paper, openness measure is the sum of export and import divided by total GDP. This is one of the measures that Yanikkaya used for trade intensity. In the sample of 74 countries, the maximum is Malaysia with an

openness ratio of 2.109, while the minimum is Argentina with a ratio of 0.205. The mean is 0.867, and the standard deviation is 0.416.



**Figure 8 – Openness**

### C. Conclusion

Chapter IV has presented the conceptual model and data. The first section gives the conceptual model and discusses the challenge in cross-country data. The the second section of this chapter gives the descriptive statistics of the data and the justification of including each variable. This chapter has laid the groundwork for the next chapter where the regression results are presented.

## CHAPTER V

### RESULTS

This chapter is divided into five parts. The conceptual model in the previous chapter will be estimated by using ordinary least square (OLS). Thus, the first section presents OLS assumptions and consequences of violation of these assumptions. The second section discusses the Breush-Pagan test for heteroskedasticity. The third section discusses the Ramsey's RESET test of misspecification. The fourth section reports the regression results and discusses the interpretation. Finally, the last section is a concluding remark.

#### A. OLS assumptions

In classical least square regression analysis, the following assumptions are essential to the model. The regression model is linear in parameters,  $y_i = \beta_1 + \beta_2 X_i + \varepsilon_i$ . The expected value of the random disturbance given the value of X is zero,  $E(\varepsilon_i | X) = 0$ . This assumption implies that there is no specification error. In other words, there is no factor in the residual that correlated with the explanatory variables. Another assumption states that the conditional variance of the residual given the value X is constant for or all observations,  $\text{var}(\varepsilon_i | X) = \sigma^2$ . This is a homoskedasticity assumption. If it is violated,

then there is heteroskedasticity. Next, there is no autocorrelation. There is no multicollinearity, which is an exact linear relationship among some or all explanatory variables in the model. Finally, the last assumption is normality.

If these assumptions hold, the OLS estimates will be BLUE – best linear unbiased estimator. A violation of OLS assumption can result in an estimator that is not BLUE. An estimator is unbiased when the expected value of the estimator is equal to the true parameter,  $E(b_j) = \beta_j$ . The *best* estimator is the one with the smallest variance. According to the Gauss Markov theorem, OLS estimators are “best” at least among all other estimators that are also linear and unbiased if the above assumptions are met. Moreover, the estimates need to be unbiased, consistent, and efficient. An estimate is a consistent estimator of a true parameter,  $\beta$ , if it approaches the true value of  $\beta$  as the sample size gets larger without bound. In other words, if  $\text{plim } b = \beta$ , i.e. attain its Rao-Cramer lower bound. An estimator is efficient if has the smallest variance. These conditions are important. It can be shown that the OLS estimator meets these conditions if the assumptions held.

The violation of  $E(\varepsilon_i | X) = 0$  implies that there is specification error. One type of specification error is omitting a relevant variable from the model. The consequence of omitting a variable is a biased, inconsistent, and inefficient estimate. A violation of homoskedasticity results in a variance that is not the smallest and, unless correctly estimated, also inconsistent. The consequence of this is, at the minimum, inflated t or F statistics. A violation of no multicollinearity results in inflated variance and a greater

probability of making type I error, which is failing to reject the null hypothesis when it is false. Violation of an assumption can have a serious consequence. Therefore, the following sections report some tests to ensure that there is no violation of the assumptions.

### B. Testing for Heteroskedasticity

As mentioned earlier, homoskedasticity is one of the assumptions of OLS. With heteroskedasticity, the estimates are no longer BLUE. The estimates are still linear, unbiased, and consistent. However, they are not the best estimates; they do not have the minimum variance. As a result, the t and F statistics are no longer reliable.

To make sure that this assumption is not violated, the Breush-Pagan test is used to test for heteroskedasticity. To do so, first regress the model by OLS and save the residuals and square,  $e_i^2$ . Next, create  $g_i = e_i^2 / \sum (e_i^2 / n)$ . Regress  $g_i$  on the independent variables of the model (i.e.  $g_i = \alpha_1 + \alpha_2 Z_{2i} + \dots + \alpha_m Z_{mi} + v_i$ ) and save the explained sum of square or SSR. Next construct the LM statistics,  $LM = \frac{1}{2}(SSR) \sim \chi^2_{m-1}$ . The null hypothesis is that there is homoskedasticity, in other words,  $H_0 = \alpha_2 = \alpha_3 = \dots = \alpha_m = 0$ . If the null hypothesis is rejected, that means there is heteroskedasticity. If there is heteroskedasticity in the sample, the OLS variance estimates can be easily corrected by reporting the White's heteroskedasticity consistent standard error in the final model.

### C. Testing for Specification Errors

Specification errors happen in the case of omitted variables, irrelevant variables, incorrect functional form, or errors in measurement. Omitted variable is the case of leaving out the variables that belong in the model. The consequence of omitting a variable is a biased, inconsistent, and inefficient estimate. Irrelevant variable is the case of including too many variables that do not belong in the model. In this case, the estimates are all still unbiased and consistent; however, they are not efficient.

To make sure that there is no specification error, the Ramsey's RESET can be used to test for misspecification. As mentioned in the previous chapter, many variables can be included as the independent variables. Past literature is used as a guideline in terms of what variables to include in the model to be estimated. Therefore, the Ramsey's RESET is necessary to test for any omitted or irrelevant variables and incorrect functional form. The functional form to be used to estimate the conceptual model of chapter IV is log-log.

The steps for the RESET test are following. First, regress the model and obtain the estimated  $\hat{Y}_i$ . Next regress the model with additional  $\hat{Y}_i^2$ ,  $\hat{Y}_i^3$ , and  $\hat{Y}_i^4$  as independent variables. Construct the F-statistics as follows:  $F = [(R^2_{\text{new}} - R^2_{\text{old}})/3]/[(1 - R^2_{\text{new}})/(n-k-3)] \sim F(3, n-k-3)$ . The null hypothesis is that there is no misspecification. That's it,  $H_0: \hat{Y}_i^2 = \hat{Y}_i^3 = \hat{Y}_i^4 = 0$ . If the computed F statistics is greater than the critical value, then the hypothesis is rejected and there is specification error (Gujarati 2003).

#### D. Regression Results

$$\ln \text{ GDP per capita} = \beta_0 + \beta_1 \ln \text{ capital} + \beta_2 \ln \text{ education} + \beta_3 \ln \text{ service} + \beta_4 \ln \text{ political rights} + \beta_5 \ln \text{ inflation} + \beta_6 \ln \text{ FDI} + \beta_7 \ln \text{ openness} + \varepsilon$$

Table 8 – Regression Results

Variable	Coefficient	Standard Error	t-statistics
Intercept	0.2507	2.3888	0.105
ln Capital**	0.1446	0.0707	2.045
ln Education*	1.6944	0.2956	5.732
ln Service***	-0.7361	0.5199	-1.416
ln Political Rights*	-0.5513	0.1649	-3.342
ln Inflation**	-0.1647	0.7540	-2.184
ln FDI	0.0053	0.2402	0.222
ln Openness	0.7294	0.1968	0.371
R <sup>2</sup> = 0.5336	N=74		

\*significant at the 1% level

\*\*significant at the 5% level

\*\*\*significant at the 10% level

The results shown in Table 8 are reported in White's Standard Error, since the data shows heteroskedasticity. With heteroskedasticity, the variance is not the minimum

variance. Thus, the t-statistics are no longer reliable. The White's Standard Error corrects this problem. The computed F statistics for the RESET test is 0.4419. Therefore, we fail to reject the hypothesis of no misspecification. Thus, there are no omitted and irrelevant variables in the model. There are 74 observations in this sample. The regression results report  $R^2$  of 0.5336. This means that the independent variables explain 53.36% of the dependent variables.

The capital coefficient is 0.1446. This means that with a 1 percent increase in capital, the GDP per capita will increase by 0.1446. Its t-statistics is 2.045. Therefore, Capital is statistically significant at the 5% level and is positively related to GDP per capita. The relationship between capital and GDP per capita is what anticipated by theory – more capital means more growth in output. However, the magnitude of the coefficient is quite small. Once again, it is shown that physical capital is essential to growth. Therefore, an economy needs to invest and accumulate physical capital in order to expand their production capability and enable the economy to produce more outputs.

Human capital also plays an important part in economic growth. The variable Education is positively related to GDP per capita. Its coefficient is 1.6944, which means a 1 percent increase in education leads to a by 1.6944 percent increase in GDP per capita. It is statistically significant at a 1% level with a t-statistics of 5.732. This means that the null hypothesis that the coefficient is equal to zero is rejected with 99% confidence. This result is expected. Education should affect output positively. The higher the training of the labor force, the more productive they are. Thus, the more output an economy can

produce. This result once again confirms how important education is the process of growth. Developing countries need to invest in education of their labor force for economic growth in the future.

The service variable coefficient is -0.7361. It is negatively related to GDP per capita. This means that a 1 percent increase service sector as the percentage of GDP will cause GDP per capita to decrease by 0.736 percent. Service is statistically significant at 10% level with a t-statistics of -1.416. Service sector is used as the measure of maturity of the economy. Measuring output in the service sector presents some challenges because the outputs are intangible. The negative relationship could also means that the economy is not using its resources efficiently. This is a signal that these resources might be better used somewhere else.

Political rights are inversely related to economic growth. Its coefficient is -0.5513. This means a 1 percent increase in political rights, GDP per capita decrease by 0.5513 percent. This makes sense because the index of 1 means the most free. Therefore, the less free the country, the lower its growth. The variable's t-statistics is -3.342. It is statistically significant at a 1% level. Therefore, the result suggests that the freer the government, the higher the growth. However, it is important to note that political rights are ordinal data. The countries are ranked. A country with 1 is more free the one with 2 political index; however, how much freer is unknown. This kind of data is hard to quantify. A change in one unit could mean many things. It's hard to pinpoint exactly what the results imply. Moreover, the political rights variable measure three

main areas – electoral process, pluralism and participation, and functioning of government. Thus, an improvement in any of these areas means an increase in output. One of the ways to improve the regress is to include political rights as a dummy variable.

Inflation is inversely related to economic growth. The t-statistics is -2.184. Therefore, the hypothesis that the coefficient is different from zero is rejected at the 95% confidence level. The coefficient is -0.1647. That means a one percent increase in inflation causes economic growth to decrease by 0.1647 percent. This result is what was expected.

FDI is positively related to GDP per capita. Its coefficient is 0.0053. This means a 1 percent increase in FDI, GDP per capita will increase by 0.0053. However, FDI is not statistically significant. Its t-statistics is 0.222. This is too small thus we cannot reject the null hypothesis of zero. This is consistent with the past finding. In the study by Borensztein, Gregorio, and Lee (1998), foreign direct investment is found to be statistically insignificant in the model. However, when Borensztein, Gregorio, and Lee interact FDI with education, the new variable is statistically significant and is positively related to output. This result leads to the conclusion that the effect of foreign direct investment has on growth depends on the level of education in the country. This result only confirms further the importance of human capita in the process of economic growth.

Openness is also positively related to growth. The coefficient is 0.7294. This means that a 1 percent increase in openness, the GDP per capita will increase by 0.7294 percent. However, openness is not statistically significant. Its t-statistics is 0.371.

As mentioned earlier, political rights are ordinal data. We attempt to improve the model by including political rights as dummy variable. Countries with political rights index of 6 or 7 are assigned 1, whereas countries with political right index of 1, 2, 3, 4, or 5 are assigned the value of 0. In other words, the value of 1 means a country is not free; while the value of 0 means that a country is relatively free.

Table 9 – Regression Results with Political Rights as a dummy variable

Variable	Coefficient	Standard Error	t-statistics
Intercept	-2.5154	2.6437	-0.9510
ln Capital **	0.1456	0.0746	1.952
ln Education*	1.8718	0.3177	5.891
ln Service	-0.3798	0.6575	-0.578
ln Political Rights	-0.2884	0.2412	-1.196
ln Inflation**	-0.1501	0.0759	-2.014
ln FDI	0.0094	0.2501	0.373
ln Openness	0.1738	0.2115	0.822
R <sup>2</sup> = 0.4614	N=74		

\*significant at the 1% level

\*\*significant at the 5% level

\*\*\*significant at the 10% level

The results are reported in Table 9. The results here are reported with White's Standard Error. The  $R^2$  is 0.4614. The Ramsey's RESET was not conducted for this model because the previous model is considered to be the best model. Therefore, the test for misspecification is not necessary here. Capital is positively related to economic and statistically significant at the 5% level. Education is also positively related to growth; it is statistically significant at the 1% level with a t-statistics of 5.891. Service is negatively related to output; however, in this model, service is not statistically significant. Political right also has a negative relationship with growth. Inflation is inversely related to growth, and it is statistically significant at the 5% level. FDI and openness are positively related to economic growth. Like the previous model, FDI and openness are not statistically significant.

From both models, FDI is found to be statistically insignificant. This is the same result that Borensztein, Gregorio, and Lee found in their study. To improve the model, Borensztein, Gregorio, and Lee interact FDI with education. We follow their lead by interacting FDI with education. The results are found in Table 10.

The results here are reported with White's Standard Error. The  $R^2$  is 0.5336. The results here show that education is not significant. Capital is still statistically significant and directly related to economic growth. The service variable is negatively related to growth, and it is statistically significant at the 1% level. Political rights and inflation are

also negatively related to growth, and they both are statistically significant at the 1%

Table 10 – Regression Results with interacting FDI and Education (I)

Variable	Coefficient	Standard Error	t-statistics
Intercept	8.2209	6.4171	1.281
ln Capital **	0.1356	0.0678	2.001
ln Education	0.0344	1.3347	0.026
ln Service***	-0.8539	0.5228	-1.633
ln Political Rights*	-0.5875	0.1637	-3.589
ln Inflation*	-0.1767	0.0743	-2.831
ln FDI***	-0.4129	0.3161	-1.306
ln Openness	0.0469	0.1869	0.251
ln FDI*ED***	0.0953	0.0731	1.303
R <sup>2</sup> = 0.5336	N=74		

\*significant at the 1% level

\*\*significant at the 5% level

\*\*\*significant at the 10% level

level. Unlike the previous two models, FDI is statistically significant at the 10% level. The FDI's coefficient is negative. However, FDI is not negatively related to GDP per capita. FDI is interacted with education. Separating the effect of FDI has on GDP per capita by taking the partial derivative shows that FDI's coefficient is 0.00839. Thus, FDI is positively related to economic growth. The openness variable is once again found to be statistically insignificant, and it is positively related to growth. Finally, the new interaction term between FDI and education is positive, and it is significant at the 10% level. The previous study by Borensztein, Gregorio, and Lee has found that the coefficient of the interaction term is positive, which is the same result that is found here. They suggested that the effectiveness of the foreign direct investment on growth depends on the level of education.

However, in this model the education variable is found to be insignificant. Since education is found to be insignificant when including the interaction variable, the next model drops the education and FDI variable and includes the interaction term. Therefore the model becomes:

$$\ln \text{GDP per capita} = \beta_0 + \beta_1 \ln \text{capital} + \beta_2 \ln \text{service} + \beta_3 \ln \text{political rights} + \beta_4 \ln \text{inflation} + \beta_5 \ln \text{openness} + \beta_6 \ln \text{FDI} * \text{education} + \varepsilon$$

Table 11 – Regression Results with interaction FDI and Education (II)

Variable	Coefficient	Standard Error	t-statistics
Intercept	2.9919	2.5143	1.190
ln Capital*	0.2559	0.0615	4.158
ln Service	-0.2392	0.5247	-0.456
ln Political Rights*	-0.6288	0.1831	-3.435
ln Inflation	-0.1096	0.8676	-1.264
ln Openness**	0.4207	0.2132	1.937
ln FDI*ED	0.0061	0.0051	1.199
R <sup>2</sup> = 0.4112	N=74		

\*significant at the 1% level

\*\*significant at the 5% level

\*\*\*significant at the 10% level

The results of the regression are presented in Table 11. The estimates are reported with White's Standard Error. The R<sup>2</sup> is 0.4112. When dropping both education and FDI, the interaction term between FDI and education turns out to be statistically insignificant. Capital is statistically significant at the 1% level. Its coefficient is 0.2559 Political rights are statistically significant at the 1% level, and it is negatively related to growth with a coefficient of -0.6288. The service variable is insignificant. Inflation is

also statistically insignificant in this model. However, the openness variable for the first time is found to be statistically significant at the 5% level, and it is directly related to GDP per capita with a coefficient of 0.4207.

#### E. Conclusion

In this chapter, the first section has discussed the assumptions of OLS and the consequence of any violations. The next two sections present the of assumptions violations. The second section talks about the Breusch-Pagan test of heteroskedasticity, while the third section discusses the Ramsey's RESET test of misspecification. Finally, the fourth section presents the regression results. Four models were estimated including the original model, the model with political rights as a dummy variable, model with interaction term of FDI and education, and the model with the interaction term excluding the education and FDI variables. These four models give the same results with a few exceptions. Capital and education are found to be positively related to economic growth. Service, political rights, and inflation are found to be negatively related to growth. FDI and openness are found to be directly related to economic growth. However, in many models they are found to be statistically insignificant. The interaction term of FDI and education is also found to be positively related to economic growth.

## **CHAPTER VI**

### **CONCLUSION**

From the results in Chapter V, the following can be concluded. Physical and human capitals positively affect economic growth. More physical capitals mean larger production capacity. Similarly, more human capitals mean better trained labor, which also leads to growth. In reality, the situation is more complicated. We know that more physical and human capital will mean more growth. However, the challenge here is how can a country gain more physical capital or human capital? For physical capital to accumulate, first there needs to be saving. But how can a country save if the majority of its population do not have their basic needs met. There will be nothing left to save. The similar situation happens with human capital. There are many people that cannot afford education. Their health prevents them from pursuing education or training to attain better skills. These are the real challenges that are facing in economic development.

The percentage of service output and GDP per capita is negatively related. The bigger the service sector actually slows growth. This could be a result of inefficiency. Therefore, the resources that are used in the sector are not being utilized to their optimal use. This inefficiency could point to the need for better training for labor force.

The political rights variable also shows that the freer the country, the higher the growth. However, problems such as corruption are not easy to correct. The data show that a free nation is good for growth. The practical question then is: how can a country get achieve this goal? A country needs a fair election with transparency. Every citizen, despite of their ethnic or religious background, can freely exercise the right and participate in the political process. There needs to be an effective opposition to those in power to keep the system in check. Voters also need to be educated in order to make a better decision and stay clear of political propaganda. These are some of the issues face by developing countries.

The result that inflation is negatively related to growth as expected. Foreign direct investment and openness are not significant in the original model. However, when interacting FDI with education, the new interaction term is found to be positive and statistically significant. Past literatures have found these variables to be related to economic growth. In the case of FDI, it was found that the level of education affect the efficiency of foreign direct investment in a country.

Again and again, many of these problems can be traced back to the lack of proper training or education. Education is the root of many things. Better training makes people more productive. Therefore, the resources at their disposal become better utilized. The same can be said about foreign direct investment. In short, highly skilled labors use resources to their optimal use. Education is also important in the political process. Although some corruption is unpreventable, educated voters alleviate the problem to a

degree. Therefore, these developing countries should focus on better training and education for their population.

Will developing countries ever catch up in term of GDP and share the world's wealth, which is enjoyed by developed nations? If they will, how will that happen? To catch up in terms of their GDP share, these developing countries have to grow at a faster rate. How will that happen? Much more research can be done in this area. The world today is different from two hundred years ago when the Western nations first took off in growth during the Industrial Revolution. Developing countries are growing in different environments. Different factors contribute to economic growth. It is an interesting topic. The tasks of this study were to find out what can allow these nations to catch up with developed nations. Economic development is more than just the sum of total outputs. Economic development means a more equal distribution of income and an improvement in living conditions for everybody. Above all, when basic needs are met, people can lead a more fulfilling life.

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