

A Test for Beta Convergence

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ABSTRACT

The research is based on examining of beta convergence among the countries around the world. The method of estimation adopted in this framework is a cross-sectional analysis of regression, employing data from 46 selected countries for the period of 1980 to 2014. The sources of the data set involve in the research is the World Bank Development database.

The outcome of the regression provides a strong evidence of a negative relationship between growth and the initial per capita GDP of a country. This basically means that a country which tends to have a lower level of initial per person income is further away from its steady state, thus it grows faster compared to a country with a higher initial income per person who is closer to its steady state grows slower. Based on the regression it is also clear that investment is a strong key in the process of growth. The higher the investment level, the higher the chances of growth occurrence. The model shows a long run relationship between the dependent and the independent variables which provide room for the poorer countries to grow faster and catch up with the wealthy countries at the steady state despite their diversities.

Keywords: beta convergence, countries cross-sectional, development, growth. Investment, income per person, poor, wealthy

ÖZ

Bu araştırma, dünyadaki birçok ülke verisi kullanarak, beta yakınsamasını ölçmektedir. Tam olarak 16 ülkeden 1980 ile 2014 yılları için veriler kullanılmış ve bu veriler Dünya Bankası, Kalkınma veritabanından elde edilmiştir.

Regresyon sonuçları ekonomik büyüme ile başlangıç kişi başı GSYİH arasında negatif bir ilişki olduğunu doğrulamaktadır. Dolayısıyla başlangıç kişi başı GSYİH düzeyi düşük olan ülkeler 1980-2014 yılları arasında hızlı büyümüş, gelir düzeyi daha düşük olan ülkeler ise aynı zaman sürecinde daha yavaş büyümüştür.

Regresyon sonuçları aynı zamanda özel sektör yatırımlarının ekonomik büyümeye olan etkisini de göstermiştir. Gelir düzeyi düşük ülkeler daha çok yatırım yapmakta, bu da ekonomik büyümeyi hızlandırmaktadır. Sonuç olarak regresyon sonuçları teorik beklentileri doğrular niteliktedir ve gelir düzeyi düşük ülkelerin gelişmiş ülkeleri, gelir düzeyi bakımından yakalayacağını göstermektedir.

Anahtar Kelimeler: beta yakınsama, kesit ülkeler, gelişme, büyüme. Yatırım kişi, yoksul başına gelir, zengin

To My Family

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In the name of Allah, most Beneficent, most Merciful. I glorify the Almighty Allah (S.W.T) and seek for his everlasting blessings and salutation of peace for our Noble Prophet Mohammed (S.A.W) and his companions and those who follow him. Amen.

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LIST OF ABBREVIATIONS

ASEAN	ASEAN Free Trade
EU	European Union
FTA	Free Trade Area
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per Capita
GMM	Generalized Method of Moments
IMF	International Monetary fund
NAFTA	North America Free Trade Agreement
OIC	Organization of Islamic Cooperation
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PWT	Penn World Tables
TFP	Total Factor Productivity
VIF	Variance Inflation Factor

Chapter 1

INTRODUCTION

1.1 Background of the Research

The basic concept of convergence within the theory of economic growth is based on the prediction that countries that tend to have a low level of per capita income at initial, grow faster in the long run in order to catch up with the wealthy countries. That is to say in the long run, at the steady state both the poor and the wealthy countries have the same level of income per capita. Some explanations for this may be that the poorer economy adopts the production pattern and methods of the wealthy economies as well as its own qualities that may expose them to faster growth compared to the wealthy economies. This means that the level of the returns to the capital and technological process is higher in the poorer economies, while in the wealthy economies it's lower leading to slower growth.

The issue of convergence is important in the sense that we have a very diverse group of countries; richer, low income and the poorer countries, so really we have this question that will it ever come a time that the poorer countries will achieve similar living standard as does developed countries?

Convergence has been defined differently in a different context by scholars. More specifically the growth literature focus on two types of convergence: sigma (α) convergence and beta (β) convergence. The sigma (α)-convergence which is said to

be a decrease in the income level differences around different countries, while the beta (β)-convergence which is the basis of this research, is when the poorer countries grow faster than the richer countries. Looking at worldwide experiences, in the recent past, may indicate some support for beta (β)-convergence. While rich countries of Europe and Japan produce very low growth rates, East Asian tigers such as high-income countries, Singapore, Taiwan, Korea as well as some East European countries such as Poland have been growing much faster. These countries are recently regarded as developed countries by the IMF (Wikipedia the free encyclopedia).

Quite often, several economic growth based literature explain vital issues concerning whether over time countries with differences become similar. Analysis based on whether countries converged or not has been conducted by employing cross section method by several empirical researchers.

Convergence among different countries is seen as an inclination that income level per person (productivity) will equate in the long run which would exist only if the poorer economies grow faster in the transition period. Basically, there are two major competitive theories of growth. First, which was established by Solow in (1956), it's known as the neoclassical theory of economic growth (convergence optimism). The theory concludes that the income level between economies converged over time. Based on their argument, as a result, decrease in reward to reproducible of capital, the marginal productivity of capital in a poorer economy with low ratio level of capital-labor is high, thus possessing the same investment level and savings level, the poorer grow faster than the wealthy economy.

Moreover, free trade and mobility of factors of production play an essential role in fostering convergence through factors-prices equalization. In this theory exogenous supply of given input determines growth; although technology is exogenous and input possess decreasing return to scale. If an economy is exposed to same technology it leads to convergence eventually. Based on the prediction of the model, initial income per person has an inverse relation with the income per capita growth of the economy. And in steady state, the growth rate of income per capita is identical for all countries. While in the short run on the path to steady state an adjustment process occur as poorer countries grow faster than the wealthy countries because their marginal productivity of capital which is as a result of the low capital-labor ratio.

While the new economics on growth ‘endogenous growth theory’ (convergence pessimism) developed by Romer in 1986, which lay that continues rise in inequality in income level among countries as a result of investment in innovation, human capital and knowledge enhances economic growth.

This theory challenged the decreasing reward for technology and capital, predicted by the neoclassical theory. Romer (1986) and Lucas (1988) lay that external factors like human capital formation and R&D expenditure are the key forces of convergence. The endogenous factors that foster the process of growth eliminate the decreasing return to capital and technology process.

Economies with high technology and qualified human capital as a result of higher educational level grow at a highly fast rate. Empirically, the inclusion of technology and human capital into beta (β)-convergence equation of the neo-classical model

would lead to the improvement of the parameter to a higher significant level and foster increase in convergence speed (β coefficient) Barro(1991).

Conversely, Convergence theory also faced several critics by some scholars. Reinhard (1976) and Glynn (2011) said that policy of the government being an endogenous factor has more effect on the growth of the economy in relation to the exogenous factors. Sokoloff (1994) debated that factor abundance in an economy determines the development of that economy.

1.2 Statement of the Problem

After a deep study of the neo-classical theory of economic growth, convergence to be precise would come up with several questions like do poorer countries grow at a faster rate in transition to catch up the wealthy ones in the steady state? How do countries converge? Do wealthy countries with surplus capital experience diminishing return to capital and does this really reflect in making them grow slowly? Why do countries tend to grow differently? Does modern world converge? Although Solow (1956) and other economists view economic growth as an influence of exogenous factors. The endogenous growth theory was established in the 1980s, Romer (1980) and Lucas (1988) viewed economic growth differently, they said growth is influenced by technological process and savings rate; therefore they adapted microeconomics tools to develop their macroeconomic model

One of the basic fundamental issues in the world is economic growth. The most population of the world is faced with a different set of challenges which varies from poverty, lack of basic necessity and absence of better quality life. Basically, the

clarifications to such issues are factual economic policies and growth theories analysis.

1.3 Objective of the Research

As days pass by, economist have made strong efforts in determining better policies that would relate in determining convergence through economic growth theories like the conditional convergence which says that convergence is conditioned on certain aspect, that is if there are the same technology, similar depreciation rate, similar population growth rate etc. therefore conditional convergence put responsibility on government, and also put responsibility on international institution to achieve that condition so that the poorer countries do get a chance to catch with the richer ones

Absolute convergence, on the other hand, says that the countries will converge to the same income level per person regardless of anything else and therefore it de-emphasize any policy or corporation or coordination simply because it says, no matter what, the countries will converge in the long run.

Club convergence says even if we have some convergence, still no matter what we cannot get the poorer countries to the same level with the richer countries, because the richer countries converge to a point themselves, while the poorer countries converge to a lower point which is lower than that of the richer countries, but they converge between themselves. This is as a result of the fact that for economic growth policies to be achieved successfully a clear study and understanding of the theory of convergence are necessary, being it an economy which government relaxes their restrictions on trade or in a highly restricted economy.

The basic interest of this research is the beta (β) convergence, by exploiting the growth determinants and analyzing the theory of convergence in order to test for beta (β) convergence. That is to test if really countries especially the poor countries converged at time passes. In accordance with other empirical studies, this framework uses theories of convergence and growth hypothesis in detecting the possibilities of convergence. That is to test if the wealthy and the poor economies meet at the steady state base on the circumstances that the poor economies grow faster based on their initial level of income per person. Another area is to study the existence of convergence among the countries around the world

1.4 Structure

This framework is categorized into eight different chapters which are briefly discussed below:-

Chapter one is the introductory part of the research, which present the stated problems, objectives and the structure of the study.

The second chapter represents and explains different convergence theories and models, types of convergence and illustration of graphs

Chapter three, present the reviews of the previous relevant empirical researches which are related to the topic in question.

The fourth chapter deals with the empirical specification. It provides a detail discretion on the independent variables sign and it also presents the model (regression equation)

The fifth Chapter deals with data. It provides a detailed list of selected countries used in the sample and discusses how the variables are calculated and their sources.

Chapter six contains the description of the used estimation technique.

The seventh chapter explains test and result from the regression, in which their outcome leads to the results of the estimations.

Finally the last chapter, chapter eight gives a summary of the whole framework.

Chapter 2

CONVERGENCE THEORY AND MODELS

2.1 Convergence Theory

The issue of convergence is important in the sense that we have a very diverse group of countries; richer, low income and the poorer countries, so really we have this question that will it ever come a time that the poorer countries will achieve similar living standard as does developed countries?

Based on the notion of factors of production, the main theories of growth are the neoclassical growth theory introduced by Solow in (1956) and the new economics on growth 'endogenous growth theory' by Romer in (1986). The neoclassical theory holds that convergence exists among countries as a result of physical capital accumulation, the theory is known as optimism convergence. While the endogenous theory of growth also called pessimism convergence is based on accumulation of technology, is a continuous improvement in technology, which in return makes the economy grows continuously.

Convergence is the tendency of faster growth rate in the economy of poorer countries compared to the wealthy economies. Countries that are developing possess qualities of faster growth rate in relation to countries that are developed; one of the reasons might be as a result of decreasing in return to capital. That is the developed countries has more capital compare to the developing countries, therefore when the rich

economies accumulate a little bit more capital the marginal return is small, but for the developing countries which doesn't have so much capital, any addition of capital gives a lot of increase in productivity (larger marginal productivity return).

More so the developing countries tend to adopt technologies, the method of production etc. of the rich economies. Convergence has two meanings in the process of economic growth: the beta (β) convergence happens when developing countries experience faster growth more than the wealthy countries, while the sigma (α) convergence occurs when the distribution of income level across the country reduces.

Principally the dissertation on convergence would be better when the basic theories are being looked at in details. Basically, there are three types of beta (β) convergence; the absolute convergence, conditional convergence, and the club convergence, although there is no detailed explanation of the club convergence by the neoclassical growth model.

2.1.1 Absolute Convergence

The concept Absolute convergence holds that irrespective of anything, initial capital stock or growth characteristics, poorer countries grow faster and eventually they catch up with the rich countries at the steady state. That is to say, all countries will converge to the same GDP per capita in the long run irrespective of their initial starting point. It is predicted by absolute convergence that the entire countries converge to the same GDP per capita, the same level of per worker income and same steady state. More so economic growth of the poorer countries tends to move in a speedy state in order to catch up the wealthy countries provided they are given enough time.

Absolute convergence states that regardless of anything, we may have same saving we may not, same technology or not, we may have same depreciation rate or not, same population rate or not, regardless of anything there will be convergence. And because there is not conditioning parameter, it is automatic to say that the poorer countries will always grow faster, this is as a result of a decline in growth experience by the richer economies because they are closer to their steady state. The poorer economies most catch up with the richer economies. The higher growth rate will be achieved with a lower initial GDP per capita. This has an effect because poverty vanishes by itself and it hasn't given any detail description of the reasons some countries for many decades had a zero level growth.

2.1.2 Conditional Convergence

Conditional convergence is a more clear prediction which is in line with Solow model. It says that convergence is conditioned on certain aspect that is if there are the same technology, similar depreciation rate, similar population growth rate etc. therefore conditional convergence put responsibility on government, and also put responsibility on international institution to achieve that condition so that the poorer countries do get a chance to catch with the richer ones.

It stresses that weaker economy grows in a faster manner and it will eventually catch up with the rich economy, as long as both weak and the rich economies share the same characteristics (A, s, n, δ). It then means that it is very likely for the poorer countries to converge with the wealthy ones if the fundamental parameters are same. In other words, country tend to grow quicker when it is further away from its steady state, however, every country possess its own steady state value per capita GDP, contingent on level of savings, growth rate of the population, depreciation, investment, and technology, therefore there are no reasons for per capital income

across the countries equalizing in the long run, it is clear that each country moves towards its own separate steady state.

Conditional convergence holds that essential parameters of a country characterize the convergence of the country's per worker income in the long run. As stated by Sorensen et al. (2005) every country's per worker income would eventually converge to their own particular growth path in the long run, which rely essentially on the growth parameters of the country's economy (A, s, n, δ). The diagram below provides a clear explanation on conditional convergence.

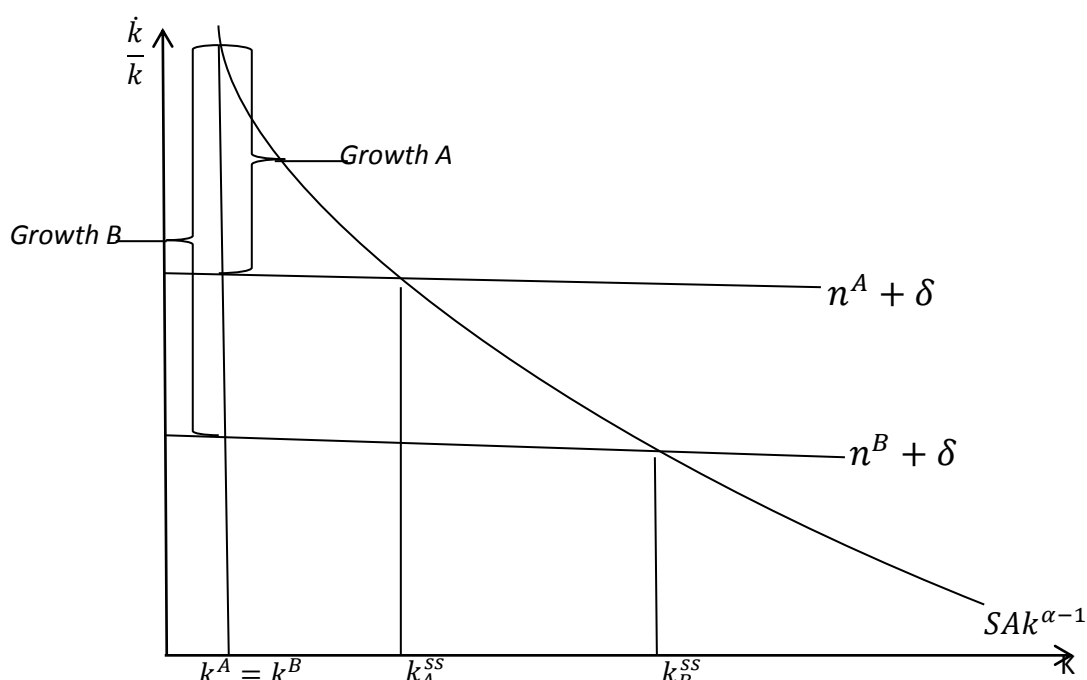


Figure 2.1. Graphical illustration of conditional convergence

Where

n = population growth rate

δ = depreciation rate

s = savings

A = technology

k = capita per person (worker or capital)

k_{ss} = capita per person in Steady state

From the above-illustrated diagram, it is clear that both countries started from the same income per worker at k_A and k_B , their respective steady state are k_{SSA} and k_{SSB} , while *growth A* and *growth of B* represent their growth rate respectively. Country A and B are equally rich countries because their initial income per capita is the same $k_A = k_B$, country A has a higher population growth rate at $(n_A + \delta)$ which means the income per work is closer to the steady state, leading to slow growth. Country B grows faster despite the fact that it is not a poor country, but because its income per capita is further away from the country's steady state that makes it to grow faster compare to country A. even if countries are equally rich they don't necessarily grow at the same speed rate, because country A is closer to its steady state base on the population and depreciation rate and country B is further away from its steady state, country B has a long distance to go, therefore it must go faster.

In conditional convergence it is clear that if countries possess same fundamental economic parameters those countries will converge to the same level of income per worker, for that to occur those countries will grow at the same speed, on the other hand, if those countries possess dissimilarities in their characteristics any tin can happen, the poorer or the wealthy country can grow faster, with this one can conclusively say country whose income per capital tend to be distant away for its steady state grows faster, while the one whom steady state is closer grows slower.

Now let's provide a figure in order to explain the concept of conditional convergence in a case where both countries possess the same characteristics.

The diagram below gives the percentage growth in capita per person; it provides a dynamic in percentage change in capital per person.

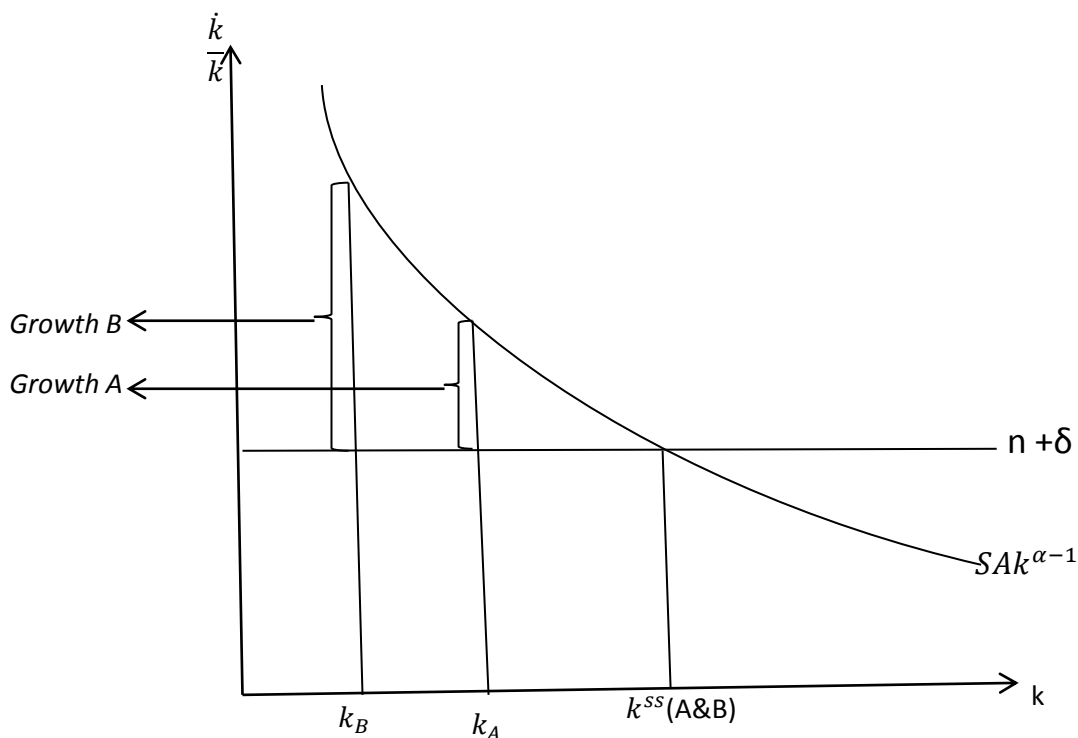


Figure 2.2. Graphical illustration of conditional convergence

Where

n = population growth rate

δ = depreciation rate

s = savings

A = technology

k = capita per person (worker or capital)

k^{SS} = capita per person in Steady state

A and B = represent rich and poor countries. From the above diagram, it is clear that the wealthy and the poor country share the same steady state at k^{SS}_A and k^{SS}_B , their initial income per capita are k_B and k_A for the poor and the rich country respectively.

It is quite obvious that richer country which has more k_A because it's closer to the steady grows slowly and the growth rate is at point *growth A*, while the poorer country which its starting point is at k_B which looks to be further away from its steady state grow faster and the growth rate is at point *growth B*.

2.1.3 Club Convergence

Club convergence holds that convergence occurs among some category of countries base on critical initial income per person, the countries which have higher income than the critical initial income per person will converge to a high-income level while the countries with initial income per person lower than the critical point will also converge, but the converging point will not be the same. In order words the rich countries will converge to a high-income point while the lower income countries will converge to a lower income point, therefore there will be two convergences. The position of the country in terms of the initial level of out, geographical and proximity between neighboring it's very vital in possessing a club membership. Club convergence has not been detailed explained by the neoclassical model of growth.

2.2 The Solow-Swan Growth Model

It's a long run growth model which is formed based on the neoclassical economic model. It focuses on technological progress (labor, capital formation and increase in productivity) in defining the scope of economic growth in the long run. The model was established in 1956 by Robert Solow and Trevor Swan. They expose the model to microeconomics with the use of Cobb-Douglas aggregate production function. This part provides the properties that make up the theory of growth. As discussed in 2.1 optimism convergence is a neoclassical model of growth formed by Solow and Swan, the model states that technology process as an exogenous factor defines

growth rate in the long run. The model is an aggregate function of production with capital and labor as the basic variables.

$$Y_t = AK^\alpha L^{1-\alpha} \quad (1)$$

$$\frac{dk}{dt} = \dot{k}_t = sy - (n + \delta)k_t \quad (2)$$

Where

n = population growth rate

δ = depreciation rate

s = savings

y = income per capita

k = capital per person (worker or capital)

\dot{k} = change in k over time

From the above functions, Y represent the output, K capital, and L labor. The model predicts that factor inputs possess constant return to scale and a diminishing marginal return to input. The production function is increasing, concave and homogeneous of degree one. The function of production above was further expanded; exogenous factor (technological process) was taken into consideration by the neoclassical model of growth which is called labor augmenting technological process. The adjusted function is as follows:

$$Y_t = K_t^\alpha (A_t L_t)^{1-\alpha} \quad (3)$$

$$\dot{k}_t = sy - (n+g+\delta)k_t \quad (4)$$

Where

n = population growth rate

δ = depreciation rate

s = savings

y = income per capita

k = capital per person (worker or capital)

\dot{k} = change in k over time

g = % change in efficiency

The figure below shows the equilibrium in adjusted neoclassical model of growth with technology progress

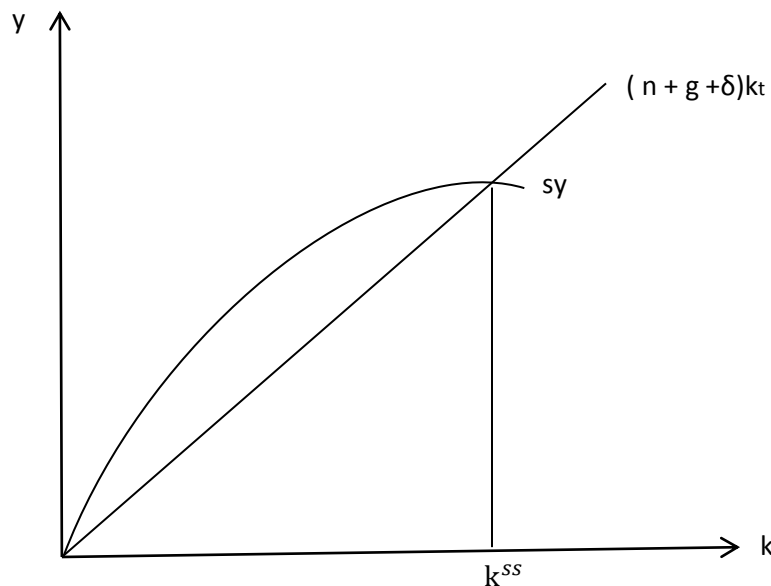


Figure 2.3. Neoclassical model of growth with the exogenous factor.

2.3 Convergence in Solow and Swam Model

This model is extracted from Solow's model, the neoclassical model of growth with the exogenous technological process. It incorporates Cobb-Douglas function of production, which is illustrated in equation below:

$$Y = AK^\alpha L^{1-\alpha}$$

While the steady state K/L is

$$k^{SS} = [sA/(n + \delta)]^{1/1-\alpha} \quad (5)$$

The above model shows that changes in labor force growth (population) rate and changes in technology are the only factors which can lead to growth rate differences, although there are other factors suggested by growth literature other than the two listed above, the neoclassical model can be subjected to adjustment for proper fit to the experiment.

With the clear understanding of convergence and growth, the factors that influence the economies steady state level include the rate of depreciation, share of capital, discount rate, population growth etc.

Chapter 3

LITERATURE REVIEW

3.1 Introduction

This thesis attempts to provide evidence of convergence. In other words, it attempts to show how countries converge. Convergence is a theory in which the income per capital of poor economies grows at a high-speed compared to the wealthy economies. Eventually, based on income per capita every economy converged in the long run, although countries that are developing possess the potential of faster growth compare to the developed countries. Convergence in economic growth is defined in two forms, first the sigma (σ)-convergence seeing as a decrease in the distribution of income level around the economy. Secondly, the beta (β)-convergence it's when the growth of developing economies move faster than the wealthy or developed economies. The issue of convergence is important in the sense that we have a very diverse group of countries; richer, low income and the poorer countries, so really we have this question that will it ever come a time that the poorer countries will achieve similar living standard as does developed countries? To this end, we provide a literature review in this chapter.

Quah (1995) in studying convergence, he used the empirical and theoretical model in his paper. With this, traditional analysis difficulties have being overwhelmed. First of all, he states that the uninspiring statistical unvarying leads to the findings convergence, although he said it's not likely, but it kind of possible. Secondly, he put

up some instance which contends that the findings of the convergence might be deceptive. Quah issued a theoretical model. The model states income distribution all over the economies and variety of endogenous convergence clubs become the contrasting situation. The abundant economies get richer, the less abundant economies gets poorer, while the middle-class economies disappear. He indicates such kind of divergence is controlled by some grounds on 2 percent convergence which was accommodated previously as a conventional perception.

Rappaport (2000) measured the speed at which income per capital of a country move towards its steady state proportional to the steady state distance based on his assumption its constant. On the contrary, convergence speed reduces as the income moves towards its steady states based on the capital accumulation model of the neoclassical. As the speed of convergence increases, it questioned coefficient variables of regressions in cross-sectional growth, although it eliminated initial income out of cross-sectional regressions, but exogenous coefficients variables are left to be interpreted as the measure of changes in the correlation.

Zhou and Biswas (2002) try to examine those countries who are open, gain more growth rates compared to less open countries ,and if poorer countries grow quicker than the wealthy once with a similar level of openness. The purpose of their study is to examine the role played by trade in the course of convergence. Convergence of prices of factor across associates' countries is as a result of discharging factors and goods internationally. Moreover, trade between countries is the crucial means by which technology and idea circulate among the countries.in some research, it was stated that countries tend to converge in income per capita if they extremely trade with each other. In this study, they employed data from Penn World of 1950-1992 in

order to examine the effect of trade on convergence. Growth rate (average) of real per capita GDP was regressed on the initial stage of log real per capital GDP. If negatively related it means the poorer country grows faster. This method is called beta convergence. They assessed linear and nonlinear least square method and their finding prove that developed countries tend to converge and trades helps a lot in the success of the process.

O'Neill and Van Kerm (2004) evolve a model that combined an old measure of beta (β)-convergence and sigma (σ)-convergence in examining income dynamic in the cross country. For this to exist they studied the close relation linking income convergence study and examining the tax system progressivity. Their study offers sigma (σ) -convergence as a mixture of leapfrogging and beta (β)-convergence between countries. They used data of 1960 to 2000 to express their model.

Sohn and Lee (2005) examined if being a member of free trade area (FTA) has an effect on the level of income in the economy of the members to converge or otherwise, using data extracted from Penn World Tables (PWT version 6). Despite the fact that a lot of research assumed some tendency of the member of FTA to converge to some extent, although no evidence was provided. Their aim was to apply an accelerating convergence concept instead of beta (β)-convergence in order to quantify the effect of FATs on convergence. The economic growth model of the neoclassical was drawn-out to contain the change steady state of an open economy form. They adopt the method of Generalized method of moments (GMM) system to a changing panel, which consists of the top FTAs like; North American free trade agreement (NAFTA), ASEAN free trade area (AFTA), European Union, and

Mercosur. In the virtue of implementing an FTA booming membership, they found strongly significant evidence that FTAs has an effect on income convergence.

Paas and Schlitte (2007) handled the growing EU inequalities in regional GDP per capita and the convergence procedure. They used a cross section data of 861 regions which were collected in 1995 and 2003 for their analysis. They applied a method known as Thiel's index of disparity to prove the evolution within the country and between country's inequalities. More so they ran an analysis of beta (β)-convergence. Their outcome proves that regions which consist of the poor who are mostly located at European boundary grow quicker compare to the richer counterparts who are located at the center of Euro, and national factors geared convergence procedures. Furthermore, the inequalities increased between the new member countries. They found that the importance of spillovers growth loses across the national border.

Ramos el. Al (2009) examined the strong effect of human capital in terms of levels of educational background, on convergence and productivity regionally. They adopted panel data econometric techniques in capturing the possible existence of the geographical indirect effect of human capital. The theoretical study of 50 Spanish provinces that adopted an annual panel GDP data of capital stock employment productivity and physical capital from the period of 1980 to2008. The study proved the positive effect of physical (human) capital on convergence and productivity regionally, although there was not any proof of the geographical indirect effect of human capital. They found that growth and productivity has a positive correlation with human capital, so also secondary and tertiary studies are positively significant on productivity, but they discover that the primary studies have no effect on convergence and productivity

Bajona and Kehoe (2010) present a result from a model in which income level convergence around closed countries is as a result of factors productivity formation within the poorer countries, exposing these countries to trade could lay off convergence or even lead to divergence. They prove these using Heckscher Ohlin's model-two goods, two factors trade model of Heckscher-Ohlin and two sector model of growth, with consumers who lived boundlessly where lending and borrowing globally is forbidding. They came up with two outcomes: firstly countries with capital per person in abundant and vary only in their initial blessings might diverge or converge in the level of income, in the long run, depending on traded goods elasticity of substitution. The values of the parameter that entail convergence in a closed economy could lead to divergence and otherwise. Secondly, equalization of factor price in a particular period doesn't describe future period equalization of factor price.

Duasa (2010) selected 10 organizations of Islamic cooperation (OIC) countries in other to examine if divergence and convergence exist among them. He makes use of nonlinear and linear stationary experiments on variance in income between the selected countries and US. The research found Benin, Burkina Faso, and Bangladesh are the only countries possess with income equality, and the other countries possess income inequality. Those countries that are classified at the top base on technology, economic growth, and globalization possess income inequality, while those classed at the bottom in terms of economic growth, technology and globalization tend to experience income convergence. His finding shows a support on laid approach and the endogenous theory of growth which anticipated that globalization exposes countries to income inequality other than income equality.

Li and Zhou (2011) examined how per capita real GDP converge absolutely and conditional amongst 164 economies in the world within 1970-2006 sample periods. The justification of the use of semi parametric and nonparametric models was driven by data specification experiments model. It shows that in the poor or developed economy, control variables has a significant effect. A conditional convergence reflects on all the economies, while absolute reflect on only low-level development economies.

Dhondge and Miao (2013) tested income inequality convergence across countries, although the neoclassical Model involves the whole distribution, not just the main level of income. They captured huge data on Gini indices of 25years. Inequality convergences in developing and developed countries were examined individually, with panel and cross-section data. Using efficient OLS and Generalized method of moments (GMM) estimators they estimated a changing panel model for a limited sample. They found that income inequality converged in 1980 and 2005 across countries. The Gini indices convergence is faster compare to conventional income per capital convergence. Convergence tends to be slow in the developing countries, while the developed countries converged faster.

Dobrinsky and Havlik (2014) made a study on the velocity and form on how the economy of central and eastern new EU member's states converges. They provided evidence of convergence and growth In Europe and also adapt the aimed convergence growth literature. Their study used average annual real GDP growth rate of 1995-2012 in percentage, they applied approaches like; multivariate econometric analysis, random variables growth regression, they ran a series of growth regression and testing models on convergence in order to unveil the form and

velocity of convergence. Their purpose was to view several phases in the processes of convergence by applying optional approaches thereby compiling them in other to the sought similarities and dissimilarities characteristics. The econometric appraisal and theoretical provided in the study emphasized on the considerable on certain occasion it raises , growth heterogeneity, stating mostly within EU economic convergence is not even. They found that complete real convergence continued on average among the NMS and other EU countries with no disruption.

Barrientos et. Al (2015). used data on 13081 families, which were questioned twice in a different trend in 1993 to 1994 surveys called Indian human development profile to examined the frequent changes in the income of households in rural Indian from 1994-2005, at the period when India were facing a loose reforms, which there were unequal income measurement convergence and poverty outflows. The known scheme clearly communicates concerning possible quantification of error income and that of poverty and initial income. Even though the natural data provide evidence of income and poverty increasing over time, they found that facts which state poverty and income convergence that the weak households are meeting up with the richer once, so also they found that occupation, education are factors of accretion of income, therefore, poverty will be minimal.

Ganong and Shoag (2015) states income per persons all over US states were converging significantly and the poorly populated area moves to the wealthy areas. They claimed that the poor and the rich areas are highly related. When there is abundant labor in an area, wages will pull down by migration and it enhances convergence in the level of human capital. The states experience a falling income convergence for the past 30years. This issue co-occurred with wealthy areas housing

prices raises, changes in the skill earning of the region, and unskilled migrating out of the wealthy region. They established a model that indicate income convergence and also discourage migration of the unskilled even with the increasing housing prices in the rich region. Adopted a new quantifying panel of regulations on the supply of housing, they indicate the essentiality link in the data. They found that places with fewer regulations experience income convergence continuity, while places with high regulations don't.

Chapter 4

EMPIRICAL SPECIFICATION

4.1 The Model

The basic purpose of this study is to analyze empirically the beta (β)-convergence. The idea is to examine if the poorer countries catch up with the wealthy countries at the steady state based on the speed rate of growth possess by the poorer because of the low level of their income per person. Divergence being opposite of convergence is one of the major concerns of the world economies.

The analysis of beta (β) convergence will be conducted using growth and initial level of income per person. In addition here are some other explanatory variables involved: government, trade openness, inflation, and investment. The model or formula is represented bellow:-

$$Growth = \beta_0 - \beta_1 GDP_{PC1980} + \beta_2 OPENESS_{2014} + \beta_3 GOVT_{2014} + \beta_4 INVEST_{2014} + u$$

.....(7)

Where

Growth = represent the growth per capita GDP of 1980 to 2014 as the dependent variable. $(GDP_{2014} - GDP_{1980} / GDP_{1980})$

GDP_{PC1980} = represent initial per capita GDP of 1980 which is the main explanatory variable

$GOVT_{2014}$ = represent government final spending of 2014 as a control variable

(Gov't spendin₂₀₁₄/GDP₂₀₁₄)

$OPENESS_{2014}$ = represent openness to trade is a control variable

(Exports₂₀₁₄+Import₂₀₁₄/GDP₂₀₁₄)

$INVEST_{2014}$ =represent investment as a proxy of GFCF in %GDP of 2014

u =the error term

β = is the intercept

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4,$ = are the coefficient of the parameters to be estimated in the model

The model above equation or model is formed based on other researches I studied which are made on economic growth. The error term (u) captures information which is not captured by the parameters in the model.

4.2 Sign Expected of the Variable

The table below represents the sign expected of each variable in the model.

Table 4.2. Contains specification and signs of the variables

INDEPENDENT VARIABLES	EXPECTED SIGN
Initial per capita GDP	- (negative)
EXPLANATORY	EXPECTED SIGN
Government	+ (Positive)

Trade openness	+ (positive)
Investment	+ (positive)

Initial per capita GDP

The initial GDP per person has a negative effect on the rate of growth as expected. This shows that lower initial income level per person foster the country's growth to catch up the developed countries at the steady state.

Government final expenditure

Government spending should have a positive impact on growth if the government spends more on investment goods, although it could possess a negative effect when there are higher taxes which affects the productivity of the private sector and also when the government spends more on consumption goods this will affect growth negatively.

Trade openness

Openness to trade means the rate at which an economy allow or create room for foreign trade, which goes a long way in fostering faster growth and catch up at steady state happens. It is predicted that trade has an effect, which tends to be a

positive effect on economy growth. The more trade flows among countries the higher their chances of faster economic growth.

Investment level

The investment level possesses a positive relationship with the rate of growth. This indicates that level of investment leads to faster growth of every economy. This research employs gross fixed capital formation (GFCF) in % of GDP (percentage of GDP) as a substitute for investment. It is clear that gross fixed capital formation in percentage GDP can serve as investment, for the this analysis sake, adopting GFCF in % GDP in place of investment provides vital effect to the country's beta (β)-convergence. Thus aids the foreign trade to be segregated, which made it a clear and good means of acquiring investment level in a country.

Chapter 5

DATA

The inspiration for this study is as a result of the nature of variation in the economic development among the countries around the world (divergence), in spite of the theory of convergence (beta convergence) which notion is that the poorer countries develop quickly in order to meet up with the wealthy countries.

This study intends to examine as well as evaluate empirically the occurrence of beta (β) convergence, it will investigate if poorer countries converge or develop to meet up the developed or wealthy countries. This chapter issued a detailed data and the discretion of the variables used in the course of this study.

In this research forty-six countries which have complete required data for the studies are selected (refer to table 5.1). Among the forty-six listed countries, twenty-four are developed countries some of which, for example, Cyprus, Hong Kong, South Korea, and Singapore, are newly listed as advanced or developed countries by the IMF, while the other twenty-two are developing countries. The whole concept of this collection is to enable us to analyze the fluctuation on initial gross domestic product per capita (GDPPC) and the basis of growth.

The study looks at total growth rate for over 34 years from 1980 to 2014, but the initial income per person variable, needed to capture the impact of convergence is the year 1980. As stated initially, the research would capture forty-six countries. The

main reason for the limited number of countries is that some countries data of some years are not available to support this research, so such countries are not included to avoid some difficulties in this analysis.

Table 5.1. Represent the list of countries involved in the econometrics analysis

Developed countries	Developing countries
1. Australia	1. Benin
2. Austria	2. Brazil
3. Belgium	3. Burkina Faso
4. Canada	4. Cameroon
5. Cyprus	5. Chile
6. Denmark	6. China
7. France	7. Egypt
8. Germany	8. India
9. Greece	9. Indonesia
10. Hong Kong	10. Kenya
11. Iceland	11. Malaysia
12. Ireland	12. Mexico
13. Italy	13. Morocco
14. Japan	14. Nigeria
15. South Korea	15. Paraguay
16. Netherland	16. Philippine
17. Norway	17. Senegal
18. Portugal	18. Thailand
19. Singapore	19. Togo

20. Spain	20. Turkey
21. Sweden	21. United Arab Emirate
22. Switzerland	22. Uruguay
23. United Kingdom	
24. United States	

5.1 Description of the Variables

The data use in the analysis accommodates information which captured 46 countries, these data are collected in 1980 and 2014. The countries selected are based on the data availability.

5.1.1 The Principal Variables

Growth

Gross domestic product (GDP) is one of the key determinants' used in accessing economic enactment of a country. That is, it weighs the performance of a country's economy. In this research statistics I employed Gross domestic product (GDP) at constant 2005 US dollars (\$) instead of that of adjusted for purchasing power parity (PPP), this is basically because of unavailability of data for some countries on purchasing power parity (PPP) basis.

I computed growth rate by subtracting GDP2014 from GDP1980 , divided it by GDP1980 and multiply by 100 using GDP at constants 2005 US dollar (\$). The outcome of the computation is presented as the growth rate of each country. Thus each country listed in this research has its own growth, which is percentage change in GDP (% Δ GDP) calculated based on the period of time captured in the research

(1980 and 2014). The data used by the study is collected from the World Bank Development Indicators database.

Computation method adopted:

$$GROWTH = \frac{GDP_{2014} - GDP_{1980}}{GDP_{1980}} * 100$$

Initial level of GDP per capita or person

For the sake of this analysis, the initial point and condition of the countries is substituted with GDP per capita at initial. This is as a result of the limitation of data based on GDP per Person adjusted for purchasing power parity (PPP) in some countries. The research used GDP per person at constant 2005 United States dollar (\$). Basically, GDP per capita is said to partake a key position in outlining the process of growth in a country's economy, so this study involved GDP per capita in order to amend for the initial position of these countries economy.

The countries involved in this research possess data required for the analysis (1980 and 2014), all the sampled countries have a starting GDP level per person. For the analysis to be balanced and to eliminate any form of biases, the study uses starting GDP level per person of 1980. The logic behind starting with the initial GDP per capita of 1980 is that if any other is chosen within the selected sample in the data, it might not provide a valid outcome that would have allowed us to analyze beta (β) convergence. The GDP per person at constant 2005 US dollar (\$) data was acquired from World Bank Development Indicators data bank.

5.1.2 Secondary Variables

Openness to trade

Trade openness is the degree of freedom in which an economy allows trade to flow in the economy. Despite there are several ways in computing trade openness, this study use sum of total inflow and outflow of goods and services (import and export) which are said to be preferred and standardized method of weighing trade. For the sake of this research, I adopt trade as % GDP (percentage GDP) in weighing the effect of unforeseen convergence. The sum of imports and exports shows the collective inflow and outflow of trade of a country, which can be employed as a vital means to weigh trade openness. It then means that the more a country is exposed to trade the more open the economy will be, vice versa.

Although, there might be shortcomings in employing trade as a means to determine openness to trade. For example, the summation of imports and export might not segregate the contribution of exports and impact in trade at all time. In a case where a country concentrates more on imports and no or a little export, then the outcome of the computation, in this case, would be so much on import based. Thus the outcome might not be reliable information to portion the influence expected from the trade components. That is to say, the vitality of the variable is very minimal in realizing the objective of this analysis.

To compute trade openness for the countries individually, I extracted imports, exports, and GDP of 2014 from the World Bank Databank. The calculation was made by adding exports₂₀₁₄ to imports 2014, divided by GDP₂₀₁₄ multiply by a 100.

$$TRADE\ OPENNESS = \frac{EXPORTS_{2014} + IMPORTS_{2014}}{GDP_{2014}} * 100$$

Government final consumption / expenditure

Government final expenditure is employed by this research as an important variable for testing for beta (β)-convergence. The framework computed government expenditure as $[(\text{Government spending}_{2014} / \text{GDP}_{2014}) * 100]$ It's the expenses the government incurs for the production of traded and non-traded goods and services. Public spending on certain non-productive sector may hinder economic growth. Moreover, private sector contributes highly in the growth of the country when taxes are high it really affects the productivity of private sector leading to falling economic growth. That is to say, higher taxes discourage the full participation of the private sector, and the private sector tends to contribute higher percentage in the growth level of an economy. On the other hand, when government invest more on investment goods and reduces spending on consumption goods this would faster growth significantly. The source of this data is the World Bank development database. Nevertheless, overall government spending (as a proxy for the size of government) is assumed to have a positive impact on growth.

Investment

Investment is employed by this analysis as a vital variable indicator of beta (β)-convergence. There are various ways of acquiring the level of a country's investment. This research employs gross fixed capital formation (GFCF) in percentage of GDP (% of GDP) as a substitute for investment. It is clear that gross fixed capital formation in percentage GDP can serve as investment, for this analysis sake, adopting GFCF in % GDP in place of investment provides vital effect to the country's beta (β)-convergence. Thus aids the foreign trade to be segregated, which made it a clear and good means of acquiring investment level in a country.

The data gross fixed capital formation in percentage GDP which is adopted as a proxy for investment in this analysis is extracted from the World Bank Development Databank

Table 5.2. Display variables and their sources

Dependent Variable	Reports and Data source
Growth	<p>The performance of any economy activities is weighed by the GDP development (growth). The study employed GDP growth in constant 2005 united states dollar (\$) as the dependent variable. GDP growth data was acquired from World Bank Database.</p>
Explanatory Variables	Breakdown and Data source
Initial GDP per person	<p>This is computed by dividing GDP of the year in question by the county's general population. It is the product value in total produced per individual. The starting point of the country was captured usin1980 GDP per person. This to capture the initial position of the country's economy, which influences vitally the process of growth in the economy. The data GDP income per capita (GDPPC) is captured in the World Bank Database</p>

<p>Explanatory variables (control variable)</p>	<p>Analysis and data source</p>
<p>Trade openness</p>	<p>This is the degree at which a country allows inflow and outflow of goods and services within the economy. The higher the rate at which the economy is open, the more it chances of flow of foreign trade. Vice versa. This is obtained by adding exports to imports, divided by GDP and multiplied by 100. World Bank Development Databank is the source of the data of trade openness.</p>
<p>Government final expenditure</p>	<p>It's the expenses the government incurs by producing of traded and non-traded goods and services. It is obvious that when the government spent more on a sector that is nonproductive consumption like fire, justice, politics, defense etc. reduces growth. The private sector contributes highly to the growth of the country when taxes are high it really affects the productivity of private sector leading to falling economic growth. That is to say, higher taxes discourage the full participation of the private sector which tends to contribute higher percentage in the growth level of an economy. On the other hand, when government invest more on investment goods and reduces spending on consumption goods would faster growth significantly. The</p>

	source of data is the world bank development database
Investment	Investment is employed as a substitute of gross fixed capital formation (GFCF) in % of GDP (percentage of GDP).it is clear that gross fixed capital formation in percentage GDP can serve as investment, for the sake of this analysis, adopting GFCF in % GDP in place of investment provides vital effect to the country's beta (β)-convergence. Thus aids the foreign trade to be segregated, which made it a clear and good means of acquiring investment level in a country. Data of GFCF was extracted from the World Bank Development Data Bank.

All variables are logged, because the data involve are quite large which might lead to non-normality in empirical distribution, by applying log the variables distribution will behave better. Moreover, based on other research work, this framework logged its variables in order to bust the significance of it variables.

The extremity in the data is also reduced, and outlier effects are also clipped. A Large number of the coefficients are nicely interpreted when they are logged. This is basically because of the nature of the numbers involved.

Chapter 6

ESTIMATION TECHNIQUES

The estimation technique adopted in this analysis framework is a cross-sectional analysis regression to weigh beta (β) convergence, employing data collected for 1980 and 2014. The World Bank Development Database is the source where the data employed in this research work is extracted. For this model to achieve reliable scientific evidence, a simple OLS estimation was adopted.

An equation on cross-sectional model is created for the betterment of the study, which growth as the dependent variable is placed as the determinant of the performance of the country's economy, the key independent variable gross domestic product per capita (GDPPC) 1980 employed to weight beta (β) convergence, thus the other variables (control variables) includes openness to trade, government final expenditure and investment level. Growth for the purpose of this framework is computed by deducting GDP2014 from GDP1980, divide by GDP1980 and multiply by a 100. This provides us with $\% \Delta$ in GDP between 1980 and 2014.

Initial GDP per person of 1980 is adopted as the key independent variable to determine the beta (β) convergence, which is in line with preceding theory of convergence studies. The whole concept is in line with the Solow model theory which stresses that the smaller the initial income GDP per person, the faster the growth of the economy. It then means that the initial income level per person of a

country determines the speed rate of its growth. For the purpose of this analysis which intends to test for beta (β) convergence, it adopts growth as a dependent variable, while GDPPC as the key explanatory variable which economically there is an existence of an inverse relationship between these variables, and thus create room for analysis for beta (β) convergence.

The literature also uses some other control/independent variables such as total factor productivity (TFP) etc. but because of limitation of time and data availability, I choose not to include them in the model, and also their absence in the model will produce a lower R^2 , the less the variable the lower the explanation of the change, although this would not invalidate a test for beta convergence which is the purpose of the research.

6.1 Multicollinearity Test

It's a situation in a model with multiple regressions where two or more estimators are highly related or correlated. The way of detecting the existence of multicollinearity in any model is by variance inflation factor (VIF) or detecting the model tolerance. The formulas are stated below: - this is an issue mostly found in the analysis of cross-sectional regression. As advocated by some scholars

$$\text{Tolerance} = (1 - R^2)$$

VIF measures the rate at which the variance of the independent variable is inflated. The lower the VIF the better, when VIF is high it means there is multicollinearity and this could lead to a larger standard error even if the specifications are correct.

$$\text{VIF} = \frac{1}{\text{Tolerance}} = \frac{1}{(1-R^2)}$$

If tolerance level is < 0.10 or 0.20 and VIF value > 5 or 10 depending on the size of the samples, this indicates multicollinearity in the model. (See Basic Econometrics by Damodar N. Gujarati, Econometrics-part 3 Thomas Andren and Wooldridge, 2009)

6.2 Heteroscedasticity Test

Heteroscedasticity is non-existence of Homoscedasticity. It means variance or error are not constants. The existence of heteroskedasticity is detected by the use of Cook-Weisberg or the Breusch Pagan test of heteroskedasticity as stated in Basic Econometrics by Damodar N. Gujarati. It tests the hypothesis in the form below:-

H₀: residual is homoscedasticity

H₁: residual is heteroscedasticity

Comparison of probability value and chi-square value will be taken after running the Breusch Pagan or the Cook- Weisberg test, and if the probability value is smaller in relation to chi-square, it then means the model is free from heteroscedasticity and vice versa. Also, if the chi-square value is greater than 5% that means we should accept the null hypothesis. Heteroscedascity rebust is use to correct for heteroscedasticity found in regression analysis.

Chapter 7

RESULTS AND DISCUSSION

7.1 Result

The model undergoes multicollinearity and Heteroscedasticity test, which is presented below.

Testing for multicollinearity

From the below regression in Table 7.1 column, 4 Tolerance and Variance inflation factor (VIF) was used to test for multicollinearity and it was discovered the model doesn't have multicollinearity problem. The value of tolerance was computed as $(1 - R^2)$, which outcome is $(1 - 0.62) = 0.38$. thus the outcome is obviously greater than 0.1 or 0.2. Conclusively we can interpret that the model is free from multicollinearity.

Table 7.1. Multicollinearity test
Variance Inflation Factors
Sample: 1 46
Included observations: 46

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2.323775	379.0743	NA
LOGGDPPC	0.002974	36.99012	1.359289
LOGOPEN	0.021836	71.33051	1.132974
LOGGOVT	0.077228	94.66389	1.327255
LOGINVEST	0.101644	156.7599	1.147749

From the table above, the outcome of the variance inflation factor centered are less than 5, which according to Wooldridge (2009) is the standard way of measuring

multicollinearity. Thus the variables involve in the regression are not correlated in any way

Testing for Heteroscedasticity

Breusch-Pagan test for heteroscedasticity was conducted. The outcome of the Breusch-Pagan test proves that the model possesses constant variances. That is it has a homoscedasticity (a constant variance).

H₀: residual is homoscedasticity

H₁: residual is heteroscedasticity

Table 7.2. Heteroscedasticity test
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.974015	Prob. F(4,41)	0.1165
Obs*R-squared	7.428386	Prob. Chi-Square(4)	0.1149
Scaled explained SS	6.192205	Prob. Chi-Square(4)	0.1852

From the above table, it is clear that the chi-square has a greater value (11.65) which is greater than 5. Thus we fail to reject the null that residual are not heteroscedasticity, that is residual are homoscedasticity. The regression doesn't suffer from heteroscedasticity. Now let's look at the regression results

Regression Results

Table 7.3 Column (1) provides the relationship that exists between growth and initial per capita GDP. From the analysis, we provide a clear evidence of convergence, which is basically in line with several literatures.

The initial income per capita GDP possesses a negative sign which means growth and the initial per capita GDP are inversely related as the analysis basically expected.

The negative coefficient implies that the higher the value of the coefficient parameter the lower the growth, while smaller value of coefficient parameter indicates faster growth, this indicates that the poorer countries grow faster. Therefore, it implies that the poorer countries will catch up the rich ones, which in turn implies that the income gap between rich countries and poorer countries will be reduced and disappear in time.

A 1% increase in GDPPC, causes 0.304% decrease in growth rate of GDP and the R^2 fund is 0.39 which mean the initial capital GDP could explain 39% variation in the growth. It then means that there is a higher possibility that the poorer countries will grow at a speedy rate in order to meet up with the wealthy countries at the steady state.

Table 7.3. Provides evidence of convergence between growth and initial per income GDP, Openness to trade, Government final Spending, and level of investment.

	(1)	(2)	(3)	(4)
INDEPENDENT VARIABLES				
GDPPC	-0.304***	-0.32***	-0.26***	-0.21***
	(0.06)	(0.05)	(0.06)	(0.05)
	[-5.3]	[-5.8]	[-4.5]	[-3.85]
OPENNESS		0.39**	0.27*	0.23
		(0.16)	(0.16)	(0.15)
		[2.4]	[1.65]	[1.5]
GOVERNMENT			-0.68**	-0.6**
			(0.31)	(0.28)
			[-2.2]	[-2.2]
INVESTMENT				1.1***
				(0.32)
				[3.4]
CONSTANT	7.85***	6.3***	8.13***	4.35***
	(0.50)	(0.83)	(1.17)	(1.5)
	[15.7]	[7.6]	[6.97]	[2.9]

OBSERVATIONS	46	46	46	46
F-STATISTIC	28.2	18.4	14.9	16.9
PROP(F-STATISTIC)	0.00	0.00	0.00	0.00
R-SQURE	0.39	0.46	0.52	0.62

Ols is employed to estimate the equation in order to test for convergence using 46 countries sampled in the analysis. The standard error is in parenthesis and the t-values are in square brackets, while the absolute value of t-statistic are * denotes level of significance at 10%, ** denotes level of significance at 5% and *** indicates level of significance at 1% respectively

Column 1 represents a regression of growth and initial GDPPC, Column 2 represent estimation including openness to trade; Column 3 includes government final expenditure while Column 4 is the unrestricted equation involving the level of investment.

Model number one; - $\ln\text{GROWTH} = 7.857 - 0.304 \ln\text{GDPPC}_{1980}$

s.e (0.5) (0.057)

$R^2 = 0.39$

The control variables will be added individual in each column in other to have a very clear glance of their individual effect on growth.

From the series of outcomes displayed in the table 7.3 column 2 provides evidence of convergence with the involvement of openness to trade, the initial income per capita GDP possess a negative sign which means growth and the initial per capita GDP are inversely related and openness to trade is positive, which means it has positive effect on growth. A 1% increase in GDPPC, causes 0.32% decrease in growth rate of GDP, while a one% increase in openness to trade will cause GDP growth rate to increase by 0.39% and the R^2 fund is 0.46 which mean the initial capital GDP and openness to trade could explain 46% variation in the growth. This shows a higher possibility that

the poorer countries will grow faster to catch up with the wealthy countries at the steady state.

Colum 3 provides evidence of convergence with the inclusion of government final spending. From the equation it is clear that a one% increase in GDPPC leads to decrease in GDP growth by 0.26% which indicates convergence, a one% increase in openness to trade causes GDP growth to increase by 0.27% which is as expected and one% increase in government spending causes growth to decline by 0.66%. The nature of the government go a long way in determining the impact of government on growth, there is this argument that the bigger the government, the more distortion in the private sectors of the economy, and therefore bigger government with higher taxes, with higher borrowing, causes a distortion in private sector which lower economic growth. Collectively the independent variables explained the variation in GDP growth by 0.52%

Colum 4 represents the evidence of convergence with investment as the fourth explanatory variable. If GDPPC increase by one% growth decline by 0.21%, a one% increase in openness leads to an increase in growth by 0.23%, one% increase in government spending decreases growth by 0.6% , while a one present increase in investment will lead to 1.1% increase in GDP growth and the R^2 fund is 0.62.

It is quite obvious that there is an inverse relation between the growth and initial income per capita GDP. Moreover, two of the control variables remain as predicted by the research. Openness to trade and the level of investment which were expected to have a positive effect on growth. The outcome clearly shows an evidence of convergence between countries with low initial income per capita GDP and the

wealthy economies, although the other control variable which is the government final spending or expenditure possess a negative effect on growth which basically because of the following reasons.

Firstly if the government expenditure is in the production of final goods and services that are not marketable and also if goods and services provided by the government are social transfer in kind. Increase in government spending in nonproductive sectors especially in the following sectors defense, police, justice military and fire payroll, welfare and health limits growth which is in accordance to some researches using cross-section by Kormendi and Meguire (1985), Grier and Tullock (1987) and Borro (1991).

Secondly, there is this argument that the bigger the government the more distortion in the private sectors of the economy and therefore bigger government with higher taxes, with higher borrowing cause a distortion in the private sector. The private sector is the major source of economic growth; therefore with these distortions by the government, it will limit their involvement in the economic activities which on the order hand lower economic growth.

In the table 7.3 Column 2, it is clear that openness to trade is in line with the research expectation. It is found to be statistically significant at 5% and 10% respectively in Colum 2, while in Colum 4 it tends to be statistically not significant even at 1% 5% and 10%. Basically one of the reasons might be the effect of openness to trade is not fully affected in the poorer economy growth, because they are still further away from their steady state and probably because most countries involve in the sample are developed countries.

The equation in table 7.3 Column 4 present model below:-

$$\ln\text{GROWTH}=4.35-0.21\ln\text{GDPPC}_{1980}+0.23\ln\text{OPEN}_{2014}$$

$$\text{S.E} \quad (1.5) \quad (0.05) \quad (0.15)$$

$$-0.6\ln\text{GOVT}_{2014}+1.1\ln\text{INVEST}_{2014}$$

$$(0.28) \quad (0.32)$$

$$R^2 = 0.62$$

To test the model overall significance, the restricted and unrestricted equations F-statistics outcome should be related with their p- values, Wooldridge (2009). From table 7.3 column 1 and 7.3 column 4 above the F-statistic are (28.19 16.87) and the F-statistic if greater than the P-value (0.000003 0.00000) in restricted and unrestricted equation. Therefore we fail to reject the H0: or the hypothesis, there is a high possibility of convergence.

7.2 Economic Implication of the Outcome

The obtained outcome from the regression is basically similar to most empirical frameworks on convergence theory occurrence. The β_1 coefficient is the estimator of initial GDP per capital parameter in the regression model, was gotten as -0.21, which proved convergence between poorer and reach economies. If the wealthy economy income per capital GDP rises by one percent, the growth rate of the country falls by 0.21 percent. It then means that the poorer country catches up the richer countries at the steady state based on their faster nature of growth due to the lower initial level of GDP per capita.

Openness to trade it's when a country allows trade to flow in the country. That it is, the country engages in trade with the rest of the world which will foster economy

growth. In this model β_2 (0.23) is the coefficient estimator of openness to trade parameter. This clearly indicates that a one percent increase in trade level leads to 0.23 percent effect on growth. Although openness to trade is not statistically significant which means it plays no role in convergence process, this is because of the following reasons. First, most of the sample involve in these research are developed countries, meaning openness to trade has less significant in defining growth, because mostly developed countries trade more with the developing countries compare to developed to developed. Secondly, the developing countries are at the moment distant away from the steady state and they are yet to be influenced by the benefits of trade openness.

The government final expenditure is another variable which could trigger growth positively or even negatively based on where the wealth is being spent. When the government spends more on investment good there will be a positive impact while spending on consumption goods reduces growth. In this model β_3 , the estimator parameter of government final spending is -0.599. This shows that a one percent increase in government spend will lead to 0.599 percent decrease in growth. It is clear that the government concentrate in spending on consumption goods which lead to a negative growth effect.

Investment is one of the fundamental agents that influence economic growth; therefore it is a valuable determinant of convergence. The coefficient parameter of investment β_4 (1.1) has a positive effect in the model. This means that a one percent increase or change in investment level will lead to 1.1 percent effect on growth level.

Finally, the chi-square obtain from the heteroscedasticity test is greater than 5, which means that the model has a homoscedasticity (Constance variance), so also the variables involved in the model are not correlated base on the multicollinearity test conducted using tolerance and VIF.

Chapter 8

CONCLUSION

8.1 Conclusion

In this framework, I employed several explanatory variables with initial GDP per person as the primary explanatory variable in testing for beta (β)-convergence phenomena. The varying economic growth among countries around the world geared the conduction of this study. The research upholds to the theory of convergence which stress countries with a lower level of initial income per capital grow faster in order to meet up with the developed ones. The validity of the poorer countries converging noted in the theory is the main focus of this study. The research employs a cross section data analysis in the test of beta (β)-convergence using 46 selected sample countries in 1980 and 2014.

The outcome of the regression proves that growth and the initial GDP per person possess a negative relationship, which is in line with the expectations of the study. That is, an increase in initial GDP per capita will tremendously lead to a decrease in growth rate. The other control variables also possess the expected sign except for the government final expenditure which has a negative impact on growth which is basically as a result of the direction in which the government spent it resources.

Government expenditure is the expenses the government incurs in production of traded and non-traded goods and services. It is obvious that when the government

spent more on a sector that is nonproductive consumption like fire, justice, politics, defense etc. reduces growth. The private sector contributes highly to the growth of the country when taxes are high it really affects the productivity of private sector leading to falling economic growth. That is to say, higher taxes discourage the full participation of the private sector which tends to contribute higher percentage in the growth level of an economy. On the other hand, when government invest more in investment goods and reduces spending on consumption goods would enhance growth significantly.

Openness to trade and level investment has a positive effect on growth; although openness to trade is not statistically significant which means it plays no role in convergence process, this is because of the following reasons. First, most of the sample involve in these research are developed countries, meaning openness to trade has less significant in defining growth, because mostly developed countries trade more with the developing countries compare to developed to developed. Secondly, the developing countries are at the moment distant away from the steady state and they are yet to be influenced by the benefits of trade openness. But its involvement in the regression is very vital to the model and the research entirely.

Empirical evidence show that negative change in initial GDP per person leads to growth declining. Perhaps this denotes that countries who are distanced away from it steady state and possess a low initial income GDP per capita will grow tremendously faster compare to the countries who are closer to their steady state and possess higher initial GDP income per person.

Moreover, investment level is revealed by the analysis to be a vital parameter in promoting growth. Therefore improving physical and human investment by the poorer countries will go a long way in hindering growth. When a country is stocked with human capital, physical capital etc. that country is expected to grow fast. The higher the investment level, the higher the probability chances of growth.

Generally, the variables involve in the regression analysis possess a natural relationship in the long run. This shows that despite diversities and inequalities among countries; the poorer countries grow tremendously faster at a speedy rate in order to meet with the wealthy economies at the steady state in the long run.

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APPENDIX

Appendix A: Regression Result

Table 10.1. Provides evidence of convergence between growth and initial per income GDP.

Dependent Variable: LOGGROWTH

Method: Least Squares

Sample: 1 46

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.856902	0.500651	15.69337	0.0000
LOGGDPPC	-0.304407	0.057335	-5.309239	0.0000
R-squared	0.390481	Mean dependent var		5.248121
Adjusted R-squared	0.376628	S.D. dependent var		0.824429
S.E. of regression	0.650919	Akaike info criterion		2.021643
Sum squared resid	18.64262	Schwarz criterion		2.101149
Log likelihood	-44.49778	Hannan-Quinn criter.		2.051426
F-statistic	28.18802	Durbin-Watson stat		1.963509
Prob(F-statistic)	0.000003			

Table 10.2. Illustration of convergence evidence with openness to trade

Method: Least Squares

Sample: 1 46

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.262524	0.825180	7.589283	0.0000
LOGGDPPC	-0.317921	0.054853	-5.795869	0.0000
LOGOPEN	0.385246	0.162806	2.366287	0.0225
R-squared	0.460706	Mean dependent var		5.248121
Adjusted R-squared	0.435622	S.D. dependent var		0.824429
S.E. of regression	0.619353	Akaike info criterion		1.942712
Sum squared resid	16.49473	Schwarz criterion		2.061971
Log likelihood	-41.68237	Hannan-Quinn criter.		1.987387
F-statistic	18.36691	Durbin-Watson stat		1.853499
Prob(F-statistic)	0.000002			

Table 10.3. It illustrate the evidence of convergence with government final spending

Dependent Variable: LOGGROWTH

Date: 05/15/16 Time: 23:47

Sample: 1 46

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.127634	1.165909	6.971071	0.0000
LOGGDPPC	-0.262123	0.058513	-4.479745	0.0001
LOGOPEN	0.271289	0.164676	1.647413	0.1069
LOGGOVT	-0.675049	0.309869	-2.178496	0.0350
R-squared	0.515457	Mean dependent var		5.248121
Adjusted R-squared	0.480847	S.D. dependent var		0.824429
S.E. of regression	0.594020	Akaike info criterion		1.879134
Sum squared resid	14.82012	Schwarz criterion		2.038146
Log likelihood	-39.22008	Hannan-Quinn criter.		1.938701
F-statistic	14.89322	Durbin-Watson stat		2.023011
Prob(F-statistic)	0.000001			

Table 10.4. It illustrate the evidence of convergence with investment

Dependent Variable: LOGGROWTH

Method: Least Squares

Sample: 1 46

Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.346052	1.524393	2.851004	0.0068
LOGGDPPC	-0.209697	0.054534	-3.845266	0.0004
LOGOPEN	0.227629	0.147771	1.540418	0.1311
LOGGOVT	-0.599402	0.277900	-2.156902	0.0369
LOGINVEST	1.083796	0.318816	3.399440	0.0015
R-squared	0.622000	Mean dependent var		5.248121
Adjusted R-squared	0.585122	S.D. dependent var		0.824429
S.E. of regression	0.531024	Akaike info criterion		1.674302
Sum squared resid	11.56143	Schwarz criterion		1.873067
Log likelihood	-33.50893	Hannan-Quinn criter.		1.748760
F-statistic	16.86638	Durbin-Watson stat		2.069936
Prob(F-statistic)	0.000000			