The Impact of Savings on Economic Growth in an Open Economy

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ABSTRACT

It is often argued that policies that support national savings are critical to economic growth of countries. It is believed that the level of savings in any country should be of major concern to stakeholders.

This study uses a Generalized Least Squares (GLS) panel regression technique to examine the impact of savings on economic growth. The study further examines the effect both openness and level of development have on the impact of savings on economic growth with the aid of interaction terms.

The study finds that savings have both direct and indirect impact on economic growth. The indirect effect occurs through the impact of investments in human and physical capital on economic growth. The study also finds that both higher capital mobility (financial openness) and higher levels of development lower the impact of national savings on economic growth.

Keywords: Economic growth, Savings, Open economy, Capital mobility, Development.

ÖZ

Genellikle milli tasarrufu artırmaya yönelik politikaların ekonomik büyüme için önemli olduğu savunulur. Ülkelerin tasarruf oranlarının ülkelerdeki ekonomik paydaşlar açısından önemli olduğuna inanılır. Bu çalışma, Generalized Least Squares (GLS) panel regresyon teknikleri kullanarak, tasarrufların ekonomik büyümeye olan etkisini incelemektedir. Çalışma ayrıca ticarete açıklık ve ekonomik kalkınmışlık düzeylerinin tasarrufların ekonomik büyümeye olan etkilerini değiştirip değiştirmediğine bakmaktadır. Sonuç olarak tasarrufların ekonomik büyümeye hem direkt hem de dolaylı olarak etki yaptığı saptanmıştır. Dolaylı etkiler fiziksel be beşeri sermayenin büyümeye etkisi üzerinden gerçekleşmektedir. Bir başka sonuç da, sermaye hareketliliği ve kalkınmışlık düzeylerinin tasarrufların büyümedeki etkisini azaltığı bulgusudur.

Anahtar Kelimeler: Ekonomik büyüme, Tasarruflar, Açık Ekonomi, Sermaye Hareketliliği, Kalkınma.

Dedicated to my entire family

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EU	European Union
FDI	Foreign Direct Investment
GCC	Cooperation Council for the Arab States of the Gulf
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product per Capita
GLS	Generalized Least Squares
GNP	Gross National Product
GNS	Gross National Savings
IMF	International Monetary Fund
M-R-W	Mankiw, Romer and Weil
NIPA	National Income and Product Accounts
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PPC	Production Possibility Curve
RRD	Researchers in research and development
TYDL	Toda and Yamamoto causality test
VECM	Vector Error Correction Model

Chapter 1

INTRODUCTION

1.1 Rationale of the Study

There are wide differences in saving rates across the world, for example as of 2012, Qatar saved as much as 62 percent of its GDP, Nigeria saved about 31 percent of its GDP while Montenegro managed to save only 1 percent of its GDP. These observed differences in saving rates across countries are due to numerous reasons. Examples of such reasons are income stream disparities, exposures to different types of shocks, demographics and country specific preferences. Similarly, there is a big diversity in terms of economic development and performance among the nations of the world. For example, in 2012, Qatar with a saving rate of 62% had a GDP per capita of $92,633 , Nigeria despite its relatively large saving rate of 31% had a GDP per capita of just $2,742 and Montenegro with just 1% saving rate had a GDP per capita of $6,517. Then the question is, 'should these differences in saving rates across countries be of major policy concern to governments?' In other words, are there major economic implications of these disparities in saving rates for economic performance of countries?

1.2 Statement of the Problem

Over the years, economic perception concerning the importance of savings of nations has varied.

The initial conventional perception has been that national savings always contributes to higher investment and consequently better economic performance (Ramsey, 1928; Harrod, 1936; Domar, 1946; Solow, 1956; Frankel, 1962; Cass, 1965). For example, a survey carried out by the World Bank (1993) to examine the role of savings in economic development revealed that nations with higher rates of savings tend to growth faster than those with lesser rates of savings. The World Bank consequently concluded that policies, which promote savings, are important for economic growth. Virtually all of these works are however based on closed economy models and they failed to acknowledge the possibility that the impact of national savings on growth can be reduced in cases of open economies with capital mobility. This is especially important since most world economies are now relatively open economies.

Another perception, based on the long run theories of growth says that although a country can grow faster through higher investments in both human and physical capital, an open economy country with access to international capital markets cannot however improve its economic performance through increased savings. It is believed that in such countries, the required investment can be financed through foreign inflow of funds, which can adequately serve as a substitute for national savings. See Aghion et al. (2009). National savings may thus be less relevant for economic performance. Instead, the ability to access foreign funds may be more important.

It has also been suggested that access to foreign funds in an open economy nation provides not only an alternative source of funds but also an added advantage of providing funds to domestic firms at a cheaper rate since firms can obtain funds from wherever the lowest interest rates are charged. See McKinnon (1973) and Shaw (1973).

It therefore seems that there is no consensus on the relevance or otherwise of domestic savings to economic performance of countries.

1.3 Aim of the Study

Due to the conflict of opinion on the importance of national savings to economic growth, and especially because most of the existing growth models such as the Harrod-Domar, Solow and Romer models focus mainly on closed economies, this study aims to examine the impact of national savings on economic growth in an open economy. This will be done using a panel data of random sampled 20 countries between the years 1998 and 2012. Moreover, the study aims to ascertain if the level of economic development and the degree of capital mobility (financial openness) of nations in any way affect the impact that national savings have on economic growth.

1.4 The Structure of the Study

The structure of the study is as follows: The first chapter presents, the rationale of the study, problem statement, aim of the study and the structure of the study. The second chapter covers the review of theoretical literature relevant to the study. The third chapter covers the empirical literature review for the study. The fourth chapter describes the econometric specification for the study. The fifth chapter presents the data. The sixth chapter describes the methodology used. The seventh chapter presents

and discusses the estimated results. The eighth and last chapter covers the conclusions and recommendations based on the study.

Chapter 2

THEORETICAL LITERATURE REVIEW

This study attempts to investigate the impact of saving rates on economic growth rates by using a panel data of 20 countries, some of which can be characterized as open economies with relatively high levels of capital mobility and some with less so. Thus, this chapter presents some insight into the related concepts and models.

2.1 Open Economy with Capital Mobility

Open economy implies that the country interacts freely and thus trades heavily with the rest of the world. This may also include international capital flows among the countries. In an open economy with capital mobility, there are no restrictions to economic activities between a particular domestic country and other foreign countries. This is unlike a closed economy in which no economic activity is conducted with other countries.

There are a few characteristics particular to open economies, which differentiate them from autarkic economies. These characteristics include the following:

2.1.1 International Flow of Goods and Services

For a closed economy, all the output produced is traded within the domestic economy; no portion of it is traded abroad. Expenditure in such an economy is limited to only three components: domestic consumption, domestic investment in goods and services and government spending on domestic goods and services. However, in an open economy, some portion of domestic output is traded

internationally and this result in a fourth component called net exports. This relationship is shown with the following equation.

$$Y = C + I + G + (X - M) \quad (2.1)$$

Where Y = GDP, C = consumption, I = Investment, G = Government spending, X = Exports, M = imports, X-M = NX = Net exports.

Or

$$Y = C + I + G + NX \quad (2.2)$$

Alternatively,

$$NX = Y - (C + I + G) \quad (2.3)$$

The implication of the above equation is that domestic expenditure need not necessarily be equal to domestic output. In a case where domestic expenditure exceed domestic output, the difference must have been imported and if it is the other way round, then the difference must have been exported.

2.1.2 International Flow of Capital

This refers to the flow of capital from one nation to another nation. The concept of international capital flow is different from that of international flow of goods and services (international trade) because it is not related to the movement of goods and services between countries or to payment for exports and imports between countries.

International capital flows occur majorly in two ways:

i. **Direct Capital Movement**

   This is more commonly referred to as Foreign Direct Investment (FDI). FDI is a cross-border investment by either a resident or an entity in one country in another country, with the sole purpose of obtaining a lasting investment in an enterprise resident in the other country (OECD, 2014). There are numerous

benefits associated with FDI such as, creation of long lasting relationships between economies, transfer of technology, access to foreign markets, means of additional source of funding etc.

ii. Indirect Capital Movement

This is known as portfolio investments. It is a form of investment in mainly securities for the purpose of financial gain without necessarily resulting in a long lasting interest in the enterprise or in ownership of the enterprise.

2.2 Savings

According to Abel and Bernanke (2001), saving of an economic unit is defined as that unit's income in the current period less its spending on current needs. Savings simply refers to the process of setting aside some portion of current income for future use.

2.2.1 National Savings

Gross national saving is obtained by subtracting final consumption expenditure from Gross national disposable income (C.I.A., 2014). According to the National Income and Product Accounts (NIPA) of the American Bureau of Economic Analysis, Gross national savings is made up of the addition of three basic components, personal saving by households, business saving , and government saving. It however excludes foreign saving. Gross national saving figures are normally reported as percentages of GDP. When a negative Gross national saving result is obtained, it is an indication that the economy is spends more than it produces, such an economy is therefore drawing down national wealth or dissaving. A positive figure on the other hand is an indication that the economy is spending less than it produces. It is worthy of note that in national income accounting in a closed economy, national savings always equals investment whereas in an open economy national savings plus borrowing from

abroad equals investment. We can thus infer that because of the relationship between savings and investment, savings must be vital to economic performance of any country. Savings provide opportunities for capital accumulation, which in turn leads to further productivity and consequently more consumption in the future.

- **A SIMPLE MODEL OF NATIONAL SAVINGS FOR A CLOSED ECONOMY**

$$Y = C + I + G \tag{2.4}$$

Where: Y = National Income = GDP, C = consumption, I = Investment, G = Government expenditure.

The equation above simply means that National Income or GDP is used mainly for three things, consumption, Investment and government expenditure.

$$NS = Y - C - G = I \tag{2.5}$$

Where NS = National Savings

Based on equation (2.5), National Savings can be simply viewed as the part of National Income that remains after consumption and government expenditure has taken place. We can therefore assume that National Savings is also equal to investment.

$$(Y - T - C) + (T - G) = I \tag{2.6}$$

Where: T = Taxes paid by consumers to government = government revenue through taxation.

(Y – T) = Disposable Income

(Y – T – C) = Private Savings

(T – G) = Government Savings = Budget Surplus.

In equation (2.6), the National savings have been disaggregated into the private and government savings components.

2.2.2 Foreign Savings

Net Foreign Savings is explained as the current account balance under the balance of payments, with reversed signs. For example, a current account deficit is a reflection of the level of foreign savings inflow into a country (a current account deficit of 3% indicates foreign savings net inflow of 3%).

- **A SIMPLE ECONOMIC MODEL OF NATIONAL SAVINGS FOR AN OPEN ECONOMY**

$$Y = C + I + G + NX \tag{2.7}$$

Where NX = net exports = Exports – Imports.

$$Y - C - G = I + NX \tag{2.8}$$

Where: Y – C – G = National Savings.

Therefore,

$$NS = I + NX \tag{2.9}$$

Or,

$$NS - I = NX \tag{2.10}$$

Where: NS – I = net capital outflow or net foreign investment. It is the proportion of national savings not used to finance domestic investment and thus serves as foreign savings to another country.

From equation (2.10), we can establish that net capital outflow also equals net exports in each country.

2.3 Economic Growth

Economic growth is the increase in the national output in real terms, caused by either improvements in quality of resources (both human and physical) e.g. through improved technology, or increases in quantity of resources. Similarly, economic growth rate of a country refers to the rate, at which its Gross National Product (GNP) is increasing, (Begg et al. (2008). Conventionally, economic growth is measured as percentage change in GDP or as the percentage change of the ratio of GDP to population, known as GDP per capita.

2.3.1 Basic Determinants of Economic Growth

i. Physical Capital Accumulation

The rate at which physical capital is accumulated in an economy is a key determinant of economic growth. According to Todaro & Smith (2011), when some parts of current income is saved and then invested (e.g. in new machines and equipment) as a means to achieve increment in future output and income, the nation's stock of physical capital increases. Consequently, this results in increased output. Todaro & Smith (2011) also further point out the importance of investments in socio-economic infrastructure such as roads, water, power etc. and their role in the facilitation and integration of economic activities.

ii. Human Capital Accumulation

Just like in the case of physical capital, the rate of human capital accumulation also plays a vital role in economic growth in any country. Investments in human resources through formal education, vocational education, training programs etc. lead to increases in quantity (e.g. through increased enrolments) and quality (e.g. through improvements in abilities of

employees) of human resources. This consequently also results in increased output.

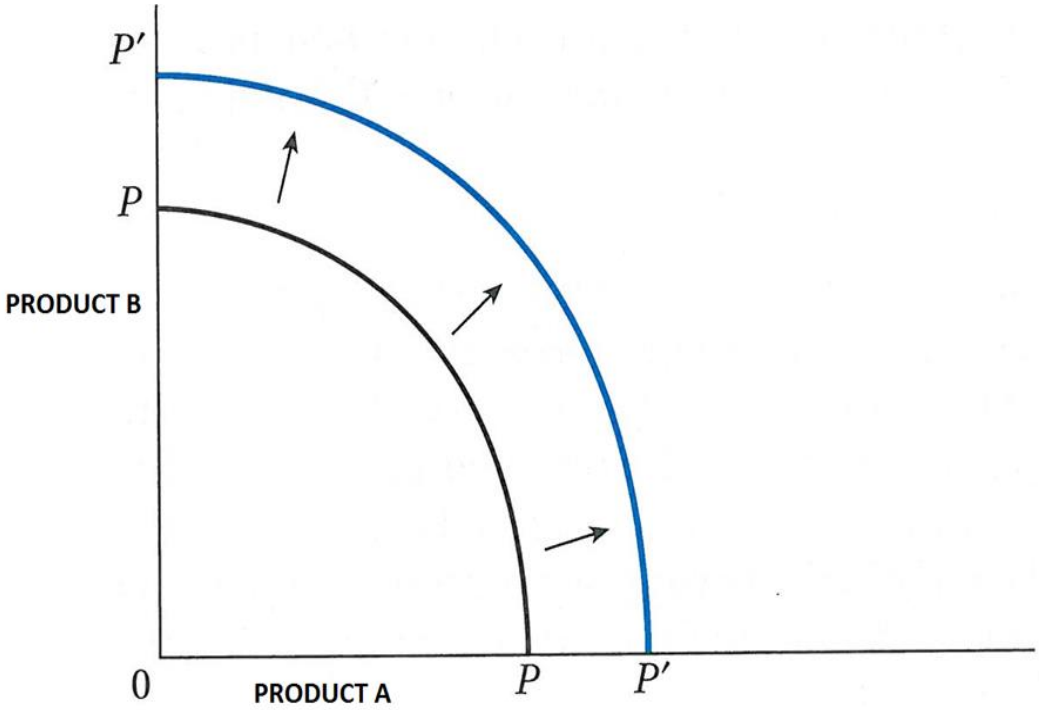


Figure 2.1: Effect of Physical and Human Capital Accumulation on Production Possibility Curve

Physical and human capital accumulation shift the production possibility (PPC) curve outwards from pp to p'p'.

iii. Research And Technology

This is perhaps the most important determinant of economic growth, especially because it leads to permanently higher growth rates. According to Bassanini & Scarpetta (2001), spending on research and development is a form of investment in knowledge which results in technological progress either in the form of discovery of new technologies or in the form of achievement of better ways of utilizing existing resources (human and physical).

2.4 Savings Led Theories of Growth

There are several theories of growth, which emphasize the role of savings in the growth process, those theories are discussed in details below.

2.4.1 Rostow's Linear Stages of Growth Theory

This model developed by Rostow in 1960 is one of the growth models that have established the crucial role of savings and investment in the achievement of sustainable long run economic growth. The theory claims that growth and development occur through series of stages and that all countries must pass through these stages before development is attained. The stages are traditional society, preconditions for take-off into self-sustaining growth, take-off, drive to maturity and age of mass consumption. According to this model, one of the principal requirements for take-off into self-sustaining growth is the availability of savings. However, the model has several times been challenged as a theory because it was arrived at merely through historical observations rather than through an inductive process.

2.4.2 Harrod-Domar Model

Roy Harrod (1939) and Evsey Domar (1946) independently developed this growth model. The model was originally designed for business cycle analysis but was eventually adapted into an economic growth theory. The Harrod-Domar model is associated with a production function in which output or growth is a function of capital, represented mathematically as:

$$Y = \alpha K \tag{2.11}$$

In the Harrod- Domar model, the relationship between economic growth and savings is established through the equation:

$$g = s/v \tag{2.12}$$

Where: g = growth rate of GDP, s = saving rate, v = capital-output ratio.

The economic logic of this equation is that GDP growth rate must equal the ratio of saving rate (which is equal to share of investment in output) to the capital-output ratio for any economy. In addition, given that the capital-output ratio is fixed, then the GDP growth rate must equal saving rate (which is equal to growth rate of capital). Therefore, higher savings results in higher growth. However, a major criticism of this model, amongst others, is its assumption of the availability of human capital based complementary factors such as skilled labour, managerial skills, administrative abilities etc.

2.4.3 Solow Model

The Solow growth model is another model that has been able to establish the link between growth, investment and saving. The model improved on the Harrod-Domar model by introducing labour and technology into the growth equation in addition to capital. It describes the impact of factors such as population growth, savings and technology on economic performance. According to the model, accumulation of capital results in higher output and eventually faster growth, and that capital accumulation depend on saving rate in the economy. see Claus et al. (2001). It however ignores the effect of capital mobility in the form of international borrowing in an economy. The Solow model production function shows that economic growth depends on capital, labour and technology. It is given mathematically as:

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha} \tag{2.13}$$

Where: Y = GDP, K = capital stock, L = labour, A = labour productivity and α = income share of capital ($0<\alpha<1$)

The Solow-Swan model also established an equation for capital accumulation, given as:

$$\Delta K_t = sY_t - \delta K_{t-1} \tag{2.14}$$

Where: sY_t = proportion of income saved, δ = depreciation rate, K = stock of capital.

The relationship between savings, capital and growth can be clearly illustrated with the aid of the Solow diagram below.

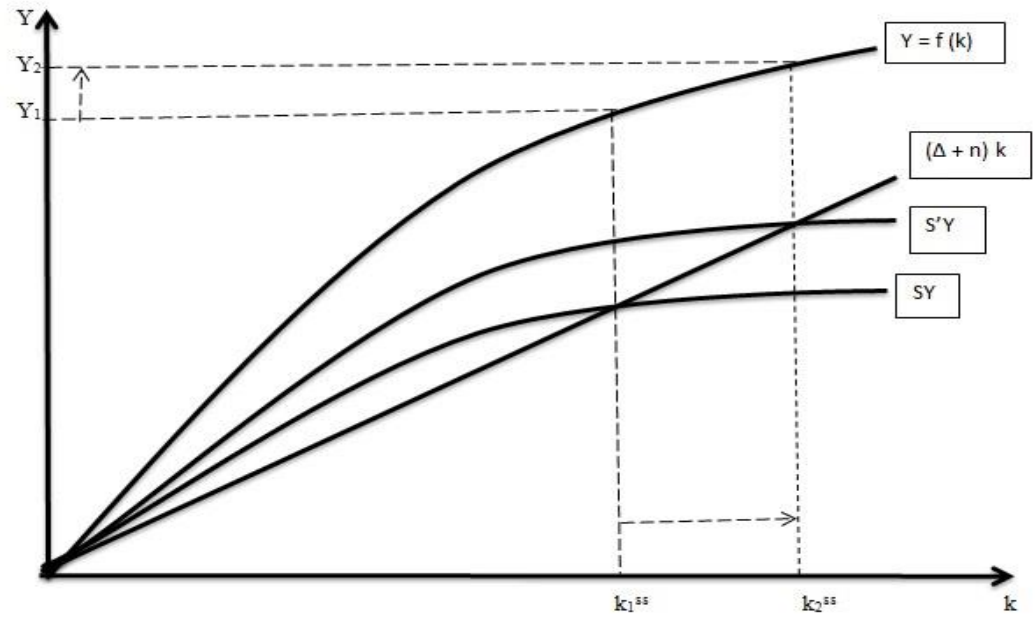


Figure 2.2: The Solow Diagram

In figure 2.2 an increase in savings rate from sY to s'Y results in higher level of steady state capital stock, from K_1^{ss} to K_2^{ss}, this eventually translates into an increase in output (growth), from Y_1 to Y_2.

The Solow diagram for a country in transition can also be used to illustrate the relationship between savings, capital and growth as shown in figure 2.3

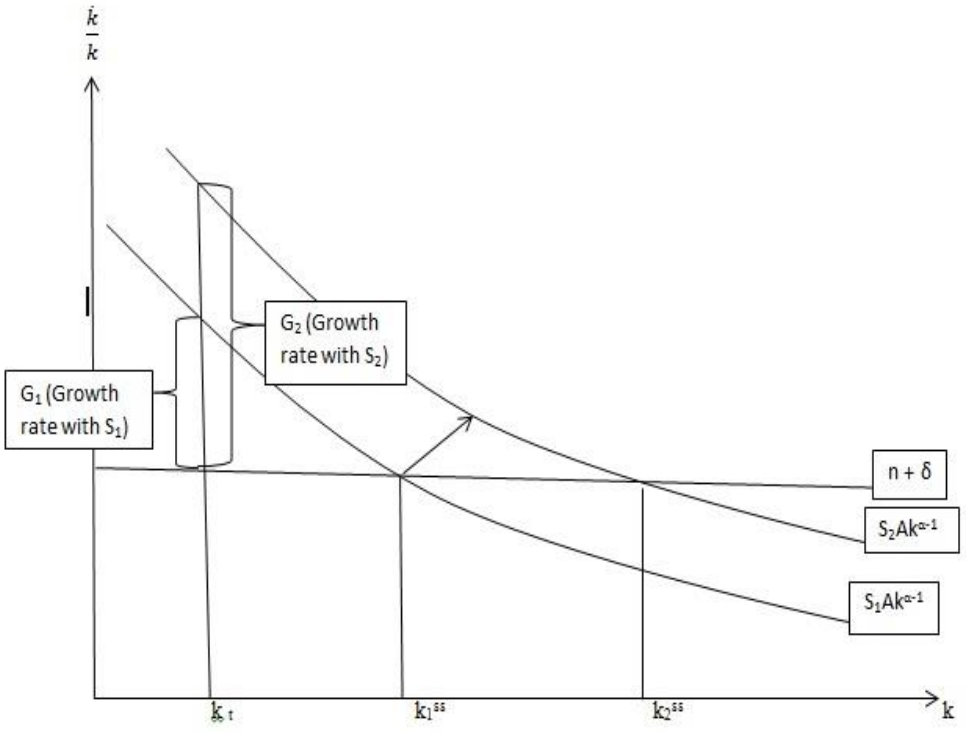


Figure 2.3: Solow Transition Diagram

In figure 2.3, assuming a country succeeds in raising its savings rate from S_1 to S_2, its steady state capital stock will move further away, from K_1^{ss} to K_2^{ss} and its growth rate will increase from G_1 to G_2.

The Solow-Swan model, in its textbook form yields a regression equation given as:

$$Log\ y_i = \beta_1 + \beta_2 \log s_i + \beta_3 \log(\delta + n_i) + \varepsilon_i \qquad (2.15)$$

This Solow-Swan regression equation shows that output/capita depends positively on savings (β_2>0) and negatively on population growth rate, n (β_3<0).

2.4.4 Solow-Swan Model with Human Capital

One of the identified weaknesses of the Solow-Swan model is its failure to acknowledge the special place of human capital in the growth equation. Savings made by societies, in addition to being invested in accumulation of physical capital are also invested in human capital; governments invest hugely in education for

example, with the belief that human capital acquired raises the productivity of each individual and ultimately, the productivity of the economy.

Because of this weakness of the Solow-Swan model, Mankiw, Romer and Weil in 1992 reformed the original Solow-Swan model to reflect the role of human capital.

The generalized production function for the model, which recognizes two types of capital (human and physical), is given as:

$$Y = AK^{\alpha}H^{\beta}L^{1-\alpha-\beta} \tag{2.16}$$

Where: A = a positive constant showing the level of technology, K = physical capital, H = human capital, L = labour.

In the model, both human and physical capital are assumed to grow in the same way that physical capital grew in the Solow-Swan model i.e.

$$\Delta K_t = s_k Y_t - \delta K_{t-1} \tag{2.17}$$

$$\Delta H_t = s_h Y_t - \delta H_{t-1} \tag{2.18}$$

It is assumed that skills become obsolete at the same rate at which physical capital depreciates.

Mankiw, Romer and Weil came up with a regression equation, which is an augmented version of the Solow-Swan regression equation. This new equation distinguished between human and physical capital. It is specified thus:

$$\log y_i = \beta_1 + \beta_2 \log S_{ki} + \beta_3 \log S_{hi} + \beta_4 \log(\delta + n_i) + \varepsilon_i \tag{2.19}$$

Where: S_k = proportion of savings invested in physical capital, S_h = proportion of savings invested in human capital.

2.5 The Golden Rule of Saving Rate

Based on the savings led theories of growth already discussed in this work, one may be tempted to conclude that increasing an economy's saving rate is always a good policy decision. This is however misleading, for example, Mankiw (2009) pointed out that assuming a country achieves a 100 % rate of saving, it will result in the largest possible capital stock and furthermore in the largest possible income, but then he queried the benefit of saving the entire income if no part of it is ever consumed. In essence, although saving more yields larger capital stock per capita and output per capita, it however also reduces consumption per capita. It is suggested that an economy should follow the Golden Rule of saving rate. This is defined as the saving rate that maximizes per capita consumption in the steady state, where the maximum amount of consumption possible per person is C_{gold}. Figure 2.4 shows the Golden Rule.

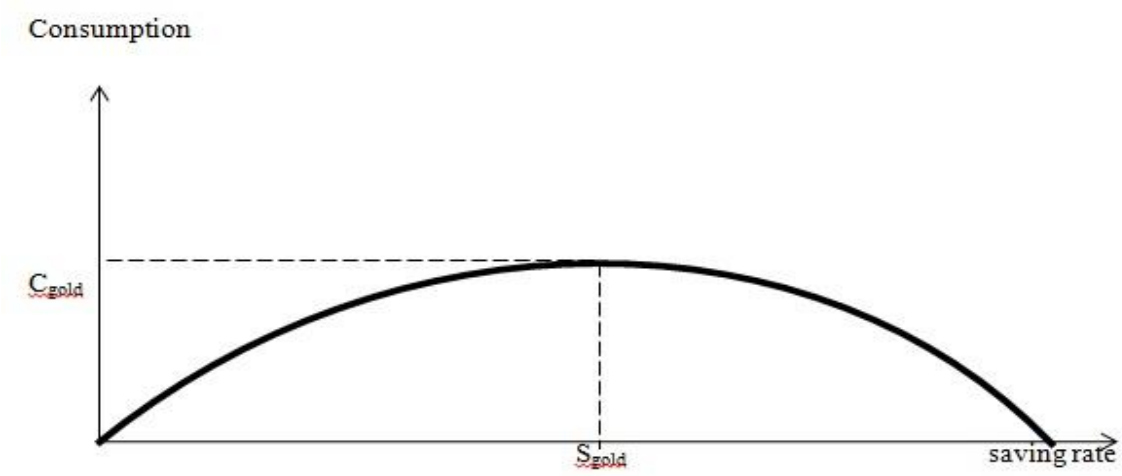


Figure 2.4: Golden Rule Diagram

In figure 2.4, the vertical axis measures steady state per capita consumption while the horizontal axis measures saving rate. S_{gold} (Golden Rule saving rate) is the saving rate that maximizes per capita consumption in the steady state (C_{gold}).

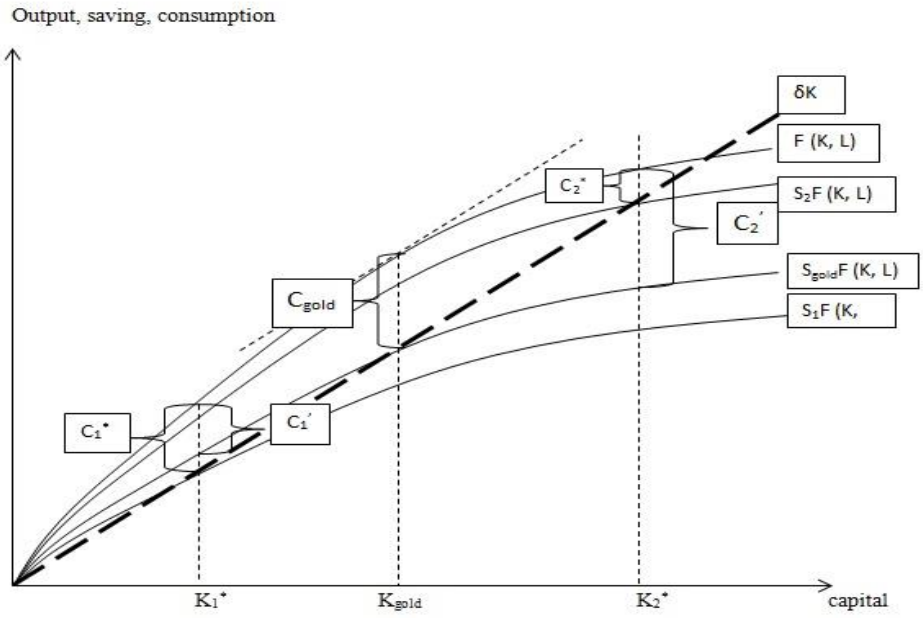


Figure 2.5: Deviations from the golden rule

Figure 2.5 shows the implication of deviations from the golden rule of saving. A reduction in any saving rate above Golden Rule saving rate (S_{gold}) such as S_2 increases both the transition and steady state per capita consumption e.g. C_2'. An increase in any saving rate below the Golden Rule saving rate (S_{gold}) increases consumption per capita in steady state but reduces it in transition. For example, per capita consumption initially falls to $C_1^{'}$ but the higher savings rate raises capital towards K_{gold} and per capita consumption, say C_{gold} eventually rises beyond C_1^{*}.

Chapter 3

EMPIRICAL LITERATURE REVIEW

Various works in the past have examined the relationship between economic growth and savings but their results have not been consistent. Some have claimed that the impact of savings on growth is positive while some others have argued that there is no significant impact of savings on growth. Some others have obtained mixed results. A few examples of such empirical works are summarized here.

3.1 Positive Impact of Domestic Savings on Growth

Feldstein and Horioka (1980) Claim that the mobility of capital, even in industrialized economies is limited, such that investment rates and consequently growth depend mainly on national saving rates. Although the authors believe that if capital mobility exists between countries then most of the additional domestic savings will either flow out of the home country (if the country is already a net exporter of capital) or will simply substitute foreign inflow of capital into the home country (if the country is already a net importer of capital), they however argue that perfect flow of capital between countries is hindered by several factors. These factors include the risks and uncertainties associated with investing abroad, official restrictions on capital export, institutional rigidities and international differences in tax rules. To prove this claim, the authors estimate cross-section regressions of gross domestic saving rates and gross domestic investment rates for 16 OECD member countries, using data from 1960 to 1974. The authors argue that if the slope coefficient is close to one, it indicates little mobility of capital and high dependence

on local savings but if much lower than one, then it indicates high mobility of capital and little dependence on local savings. The value of the slope coefficient obtained from their regression is 0.887, significantly close to one. Based on this result obtained, the authors' conclusion is that capital mobility between countries is quite low, meaning that economic growth depends mainly on local savings.

Romm (2003) in his work investigates the association between savings and growth in South Africa between the periods, 1946 and 1992. The study particularly focuses on the interaction between private savings rate, investment and growth. The author adopts The Vector Error Correction Model (VECM) technique to examine this relationship. His finding, according to the study, is that private saving rate has both direct and indirect effects on growth, with the indirect effect occurring through private investment rate. The study further finds that economic growth also exerts a positive impact on savings, thereby resulting in what is termed a virtuous cycle in which savings enhances economic growth and economic growth in turn enhances savings. Romm further concludes that factors that directly impact growth, such as human capital and technological innovations also eventually promote higher savings (as a result of the virtuous cycle) and thus promotes growth even more. Romm therefore suggests that policies aimed at enhancing growth through increased savings should also concentrate on the other factors that directly affect growth.

In the article, "The Effects of Disaggregated Savings on Economic Growth in Malaysia" Tang and Lean (2009) investigate how much of economic growth variance in Malaysia is explained by both domestic and foreign savings. The authors adopt the bounds testing approach to co-integration and the generalized forecast error variance decomposition technique in achieving their objective. The study used data from

Malaysia for the years 1961-2000. Their conclusion from the research is that domestic savings (private and public) impact growth significantly while foreign savings has no significant effect on economic growth in Malaysia. The estimation shows that public and private savings (measure of domestic savings) both have positive effect on growth but Foreign Direct Investment and private short term capital inflow (measures of foreign savings) both have negative impact on economic growth.

Tang (2010) empirically studies the savings-led growth hypothesis for Malaysia. The study analyses quarterly data for the period 1970-2008, and adopts The Pesaran et al co-integration technique with the TYDL causality test. The results show that the savings-led growth hypothesis is a long run phenomenon and that it is also stable over time. Tang claims that his findings support the New Growth Theory which suggests that increased savings impacts capital accumulation which in turn impacts long run economic growth.

3.2 Empirical Works with Mixed Results

Alomar (2013) studies the relationship between economic growth and savings in GCC (Cooperation Council for the Arab states of the Gulf, made up of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates). Alomar applied the co-integration method to time series data from 1980 to 2010, to determine the nature of relationship. The findings show that there is a relationship between savings and economic growth in all the countries, with varying degrees of significance. The empirical results show that the direction of causality is from savings to growth in only one country, from growth to savings in 4 of the countries and bidirectional in the last country. The study concludes that the income source of a nation plays a

significant role in the determination of direction of causality. For natural resource based economies, direction of causality is usually from economic growth to domestic savings

Anoruo and Ahmed (2001), investigate the causal relationship between domestic savings growth rate and economic growth in seven African countries (Zambia, South Africa, Kenya, Ghana, Ivory Coast, Congo), from 1960-1997, through the use of co-integration and Vector Error Correction Model (VECM) approach. The authors specifically examine the following; with the aid of augmented Dickey-Fuller unit root test, they attempt to determine the time series properties of both economic growth and domestic savings growth rate, they also attempt to determine the long run relationship between both economic growth and domestic savings growth rate, lastly, they try to identify the direction of causality through the use of a granger causality test. Their results show that economic growth granger causes domestic savings growth rate in four of the seven countries, domestic savings growth rate granger causes economic growth in one of the seven countries and the last two countries show bidirectional causality.

Mavrotas and Kelly (2001) study the relationship among Gross Domestic Product, and savings (disaggregated into Gross Domestic Savings and private savings), using data from India and Sri Lanka for the years between 1960 and 1997. The authors apply the Toda and Yamamoto approach to test for causality in both countries. The authors' findings show no causality between private savings and GDP in India but detect bidirectional causality in Sri Lanka.

Aghion et al.(2009) both theoretically and empirically examine if countries can grow faster by saving more. In their model, Aghion et al. argues that in poor countries, growth occur mainly from innovations that make it possible for local sectors to catch up with the current frontier technology. They argue further that the process of catching up requires cooperation between domestic entrepreneurs that are familiar with the local terrain (to which frontier technology must be adopted) and foreign investors that are familiar with the required frontier technology. The summary of their claim is that in poor countries, domestic savings is needed to access frontier technology which is a key factor in achieving growth. To prove their claim, the authors carry out a cross-country panel regression analysis. The results show that lagged savings is positively associated with economic growth in poor countries but not positively related with growth in rich countries. The reason put forward by Aghion et al for this difference is that, savings has a positive impact on growth in countries that are not close to the technological frontier, like most poor countries but has no positive impact on growth in countries that are close to the technological frontier, like most rich countries.

3.3 No Significant Positive Impact of Savings on Growth

Baharumshah et al. (2003) examine growth rate of savings behavior in five Asian countries for the period between 1960 and 1997 using VECM approach. Baharumshah et al. in this work discover that growth rate of savings does not granger cause economic growth in four of the five Asian countries studied.

Claus et al. (2001) investigate the link between savings, investment and growth in New Zealand, their research was triggered by the apparent lack of saving in the country. In order to empirically examine the link between these three variables, the

authors estimated the Feldstein-Horioka equation for the period between 1980 and 2000. Their regression of Investment-output ratio on a constant and saving-output ratio through the use of Ordinary Least Squares (OLS) yielded a slope coefficient of 0.548 on the saving-output ratio variable. Claus et al conclude that since the value of the slope coefficient is significantly less than 1, the empirical results do not show any specific link between domestic saving, investment and economic growth.

Andrei and Huidamal-Petrescu (2013) in their work, "Saving and economic growth: an empirical analysis for Euro area countries" examine the long run relationship between savings and real economic growth for Euro area (EU-17 countries). The authors used time series data for the period of 1960-2011 and econometric techniques such as Johansen co-integration procedure, Granger causality and panel data models. The study particularly tries to determine whether savings and GDP are co-integrated and also tries to determine the direction of causality between GDP and savings. From their findings the conclusion is that although a relationship exists between both variables, the direction of causality is however from growth rate of GDP to Gross National Savings and not the other way round.

Table 1: Summary of Selected Empirical Studies

no	AUTHOR(S)	RESEARCH PERIOD	CASE STUDY	ECONOMETRICS METHOD	EMPIRICAL RESULTS
1	Feldstein & Horioka (1980)	1960-1974	16 OECD countries	Cross-section regression	Slope coefficient of 0.887 (close to 1) indicating relative immobility of capital and high dependence on domestic savings
2	Anoruo & Ahmed (2001)	1960-1997	7 African countries	• Co-integration: Johansen& Juselius(1990) • Causality: Granger(1988) VECM	growth→ savings in 4 countries savings→ growth in 1 country savings↔growth in 2 countries
3	Claus, Haugh, Scoble & Tornquist (2001)	1980-2000	New-Zealand	Cross-section regression	Slope coefficient of 0.548 (significantly less than 1) indicating relative mobility of capital and little dependence on domestic savings
4	Mavrotas & Kelly (2001)	1960-1997	India & Sri Lanka	TYDL	No causality in India Bidirectional causality in Sri Lanka
5	Baharumshah et al (2003)	1960-1997	5 Asian countries	• Co integration: Johansen& Juselius(1990) • Causality: Granger(1988) VECM	Savings growth rate did not granger cause economic growth in 4 of the 5 Asian countries
6	Romm (2003)	1946-1992	South-Africa	• Co-integration: Johansen& Juselius(1990) • Causality: Granger(1988) VECM	• Co integrated • savings→ growth
7	Aghion, Comin, Howitt & Tecu (2009)	1960-2000	Sample of 118 countries	Cross-country, non-overlapping panel regression	1% increase in savings rate leads to: • 0.0463% increase in growth for poor countries • 0.0467% decrease in growth for rich countries

8	Tang & Lean (2009)	1961-2000	Malaysia	• Bounds testing approach to co-integration. • generalized forecast error variance decomposition technique	Domestic savings have a significant, positive impact on growth Foreign savings have no significant impact on growth
9	Tang (2010)	1970-2008	Malaysia	• Co-integration: Pesaran et al (2001) • Causality: TYDL approach	• Long run relationship • savings↔growth
10	Andrei& Huidamal-Petrescu (2013)	1960-2011	EU-17 countries	• co-integration: Johansen& Juselius(1990) • causality: Granger(1988) • panel data regression	• Co integrated • growth→ savings
11	Alomar (2013)	1980-2010	GCC countries	• Time series regression	• growth→ savings in 4 countries • savings→ growth in 1 country

Chapter 4

ECONOMETRIC SPECIFICATION

This chapter presents a detailed description of the empirical specification for this study. Information is provided on the functional form of the model, the expected outcomes based on economy theory and the hypothesized model.

4.1 Theoretical Expectations

The general functions specified for this study are:

i. $\mathrm{GDPPC}_{it} = \mathrm{F}(\mathrm{LP}_{it}, \mathrm{TINV}_{it}, \mathrm{RRD}_{it}, \mathrm{TO}_{it}, \mathrm{GNS}_{it}, \mathrm{CM}_{it})$ (4.1)

ii. $\mathrm{GDPPC}_{it} = \mathrm{F}(\mathrm{LP}_{it}, \mathrm{TINV}_{it}, \mathrm{RRD}_{it}, \mathrm{TO}_{it}, \mathrm{GNS}_{it}, \mathrm{D}_{it})$ (4.2)

Where: GDPPC = Gross Domestic Product per capita, TINV = Total Investment, LP = Labour Productivity, RRD = Researchers in Research and Development, TO = Trade Openness, GNS = Gross National Savings, CM = Capital Mobility, D = Development dummy, i = countries 1… 20 and t = time.

Based on economic theory and past-related research, the expected relationships between the explanatory variables and the dependent variable are explained in Table 2.

Table 2: Apriori Expectations

DEPENDENT VARIABLE		GDP PER CAPITA
INDEPENDENT VARIABLE	APRIORI EXPECTATION	EXPLANATION
LABOUR PRODUCTIVITY	+	The effect of labour productivity on growth should be positive. i.e. the greater the efficiency of labour the greater should be the level of productivity in an economy
TOTAL INVESTMENT	+	A positive relationship is envisaged between physical asset net increase and output. This is because the more physical assets are available for production, the more the output the economy will be able to produce.
RESEARCHERS IN RESEARCH AND DEVELOPMENT	+	It is expected that increases in the quantity of available human capital, especially the type closely related to growth such as researchers in R & D should result in higher productivity for any economy.
TRADE OPENNESS	+	Trade openness should affect growth positively. Higher cross-country trade volume should result in higher income for the countries involved.
NATIONAL SAVINGS	+	Higher savings leads to higher investment and consequently higher economic growth.

INTERACTION BETWEEN GROSS NATIONAL SAVINGS AND CAPITAL MOBILITY	-	The impact of national savings on growth should be lower for countries with higher degree of capital mobility and vice versa.
INTERACTION BETWEEN NATIONAL SAVINGS AND DEVELOPMENT DUMMY	-	It is expected that the impact of national savings on growth should be lower for developed countries as they have larger levels of accumulated capital and are thus closer to their steady state. A second reason is that developed countries generally have greater degrees of capital mobility. The opposite result is expected for less developed countries.

4.2 Hypothesized Model

The estimated econometric models for this research are:

$$LGDPPC_{it} = \beta_0 + \beta_1 LLP_{it} + \beta_2 LTINV_{it} + \beta_3 LRRD_{it} + \beta_4 LTO_{it} + \beta_5 LGNS_{it} - \beta_6 S\_D_{it} + U_{it} \quad (4.3)$$

$$LGDPPC_{it} = \beta_0 + \beta_1 LLP_{it} + \beta_2 LTINV_{it} + \beta_3 LRRD_{it} + \beta_4 LTO_{it} + \beta_5 LGNS_{it} - \beta_6 S\_CM_{it} + U_{it} \quad (4.4)$$

Where:

LLP = log of labour productivity

LTINV = log of total investment

LRRD = log of researchers in research and development

LGNS = log of gross national savings

S_D = Interaction between gross national savings and development dummy

S_CM = Interaction between national savings and capital mobility

LGDPPC = log of GDP per capita.

The specified econometric models are derived from economic theory and various studies on this topic. Both models also include the stochastic error term $u_{it,}$ which captures the variation in GDP per capita that is not explained by the explanatory variables used in the models.

The analysis used log-transformed variables. This was done for two reasons. First, to control for the non-linear nature of data and generate data with more normalized distributions. Second, is to ensure that results are in form of elasticities, thereby allowing for comparison with other studies.

Table 3: Hypotheses to be tested

HYPOTHESIS ONE	HYPOTHESIS TWO
H_0: $\beta_5 = \beta_6 = 0$	H_0: $\beta_5 = \beta_6 = 0$
H1 : $\beta_5 > 0$, $\beta_6 < 0$	H1 : $\beta_5 > 0$, $\beta_6 < 0$

Chapter 5

DATA & DESCRIPTIVE STATISTICS

The increasing integration of world economies and the resulting rise in capital mobility across nations of the world has given rise to serious questions about the importance of national savings for growth in the modern world. In this context, the interest of this research is to examine the role of national savings in economic growth in the world. This section provides details about the data applied in this work.

5.1 Data

The data is a panel data of 20 randomly selected countries for a period of 15 years. A stratified random sampling of 20 countries, comprising of 10 developing countries and 10 developed countries with sufficient data was chosen for this study. see (Table 4). The reason for breaking the countries into strata is to allow for variation in the analysis based on levels of development and degree of capital mobility. Also, data on the chosen countries for a period of 15 years (from 1998-2012) was used in this study. Due to the bias for countries with sufficient data on the variables used, the panel data is a strongly balanced panel data set. Statistical data on growth per capita (the dependent variable), Gross national savings and Total investment were taken from the World Economic Outlook database of the International Monetary Fund (IMF). Data on Labour productivity, Number of researchers in Research & Development and Trade openness were all taken from World Development indicators of the World Bank. Data on capital mobility was taken from the Chinn-Ito

index of financial openness. A dummy variable was generated for the countries based on their levels of development.

Table 4: Countries selected for econometric analysis

DEVELOPING COUNTRIES	DEVELOPED COUNTRIES
Argentina	Canada
China	U.S.A
Croatia	U.K
Lithuania	Germany
Mexico	France
Poland	Japan
Romania	Korea, republic
Turkey	Spain
Venezuela	Denmark
Bulgaria	Belgium

5.2 Description of Variables

The definitions of the variables used in this study as well as the sources from which they were obtained are given in this section.

Table 5: Description and sources of variables

DEPENDENT VARIABLE	DEFINITION & SOURCE OF VARIABLE DATA
GDP PER CAPITA	GDP per capita measures economic growth. It is defined as an approximation of the value of goods produced per head in a nation. It is calculated by dividing the Gross Domestic Product (GDP) with the population of the country. Data on GDP per capita was taken from the World Economic Outlook database of the International Monetary Fund (IMF)
INDEPENDENT VARIABLES	DESCRIPTION AND SOURCE OF DATA
LABOUR PRODUCTIVITY (control variable 1)	This is a measure of the efficiency of labour units in the production of goods and services in an economy. It is calculated as the ratio of a measure of output (usually GDP) to a measure of input (usually either number of hours worked or total employment). See Freeman. 2008. For this particular study, total employment is used as the denominator. Data on labour productivity (GDP per person employed) was taken from the World Development Indicators of the World Bank.
TOTAL INVESTMENT (control variable 2)	Total Investment is measured as the total value of the gross fixed capital formation and changes in inventories and acquisitions minus disposals of valuables for each sector or unit. (IMF World Economic Outlook, 2014). Data on total investment was taken from World Economic

	Outlook database of IMF.
NUMBER OF RESEARCHERS IN RESEARCH AND DEVT (control variable 3)	This is used as a proxy for level of human capital development since it is assumed that research and development is strongly correlated with economic growth. It is a measure of the number of professionals involved in conceptualization and creation of new knowledge, methods, products etc. for each country. Data on researchers in R&D was taken from World Development Indicators of the World Bank.
TRADE OPENNESS (control variable 4)	Trade openness refers to the extent to which a country allows foreign trade. The more open an economy is, the more foreign trade it allows. Trade openness is measured as the sum of imports and exports as a share of GDP. Data of trade openness was taken from World Development Indicators of the World Bank.
GROSS NATIONAL SAVINGS	Gross national saving is obtained by deducting final consumption expenditure from Gross national disposable income It is made up mainly of the addition of personal saving, investment saving and government savings in a country. Data on GNS was taken from World Economic Outlook database of IMF.
CAPITAL MOBILITY (control variable 5)	This refers to the ability of capital to move across countries for the purpose of earning higher returns. Capital mobility

	is used as a proxy for Degree of financial openness of each country in this work. Data on capital mobility was taken from the Chinn-Ito (KAOPEN) index of financial openness. See Chinn & Ito (2006).
DEVELOPMENT DUMMY (control variable 6)	This is a dummy variable, which distinguishes between developing and developed countries. For this study, developed countries take the value of 1 while developing countries take the value of 0.
INTERACTION VARIABLES	DESCRIPTION OF VARIABLES It often happens that the effect of an independent variable further depends on the magnitude of yet another independent variable. See Wooldridge, 2006. In such cases the use of interaction terms are required.
INTERACTION BETWEEN GROSS DOMESTIC SAVINGS AND CAPITAL MOBILITY	The reason for introducing this interaction variable is that domestic savings might have a different effect on growth of countries with different levels of capital mobility. This captures the effect of openness on impact of national savings on economic growth.
INTERACTION BETWEEN DOMESTIC SAVINGS AND DEVELOPMENT DUMMY	This interaction variable is introduced because national savings might have different effects on growth of countries based on their levels of development.

5.3 Descriptive Statistics

This section provides descriptive statistics on GDP per capita and savings data for each of the 20 countries.

Table 6: Summary statistics

COUNTRIES	VARIABLES	MEAN	STD. DEV	MIN	MAX
ARGENTINA	GDPPC	20232.84	14655.85	7417.62	52719.59
	GNS	20.64647	4.732615	12.837	26.712
BELGIUM	GDPPC	28812.95	3850.242	22564.96	33878.87
	GNS	23.65067	2.712025	19.016	29.291
BULGARIA	GDPPC	6403.969	2791.039	2833.01	10723.54
	GNS	16.16847	3.815631	8.891	22.024
CANADA	GDPPC	42755.07	6847.454	31095.93	52446.12
	GNS	22.18827	1.998137	18.858	25.131
GERMANY	GDPPC	27802.09	2902.841	23888	33113.21
	GNS	22.62533	2.249782	19.74	26.71
DENMARK	GDPPC	2810072	36465.89	219763.3	327135
	GNS	23.2536	1.565882	20.326	25.692
SPAIN	GDPPC	19709.82	3380.654	13574.03	23656.22
	GNS	21.17973	2.043259	17.441	23.899

FRANCE	GDPPC	27954.23	3149.146	22660.85	32066.01
	GNS	19.82073	1.363263	17.611	21.955
UK	GDPPC	20642.34	3261.198	15259.02	24600.42
	GNS	14.7838	1.770918	10.925	18.092
JAPAN	GDPPC	3898773	125267.8	3679290	4055585
	GNS	25.6298	2.17531	21.813	29.145
LITHUANIA	GDPPC	23887.11	9156.184	12452.6	38067.01
	GNS	15.00953	2.101496	10.417	18.078
POLAND	GDPPC	27419.9	8402.401	15543.26	41393.09
	GNS	17.21133	1.466372	14.829	21.049
ROMANIA	GDPPC	14281.91	9277.049	1658.22	27500.3
	GNS	17.61907	3.497261	10.68	22.342
TURKEY	GDPPC	9327.993	5734.752	1123.9	18906.14
	GNS	16.0706	2.482188	12.964	22.912
USA	GDPPC	42958.65	6066.132	32928.95	51708.98
	GNS	17.744	2.116754	14.369	21.26
VENEZUELA	GDPPC	17386.93	16962.2	2162.2	55407.11
	GNS	32.00053	5.27978	24.953	41.344

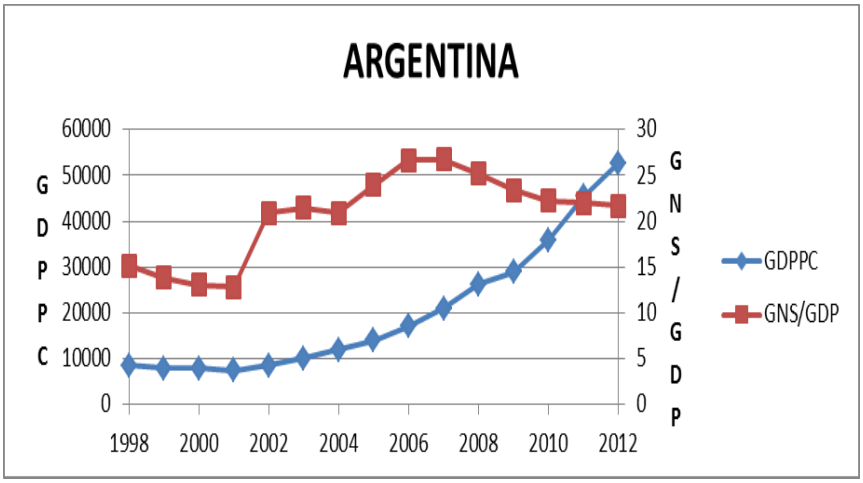
Table 6 shows the mean, standard deviation, minimum and maximum values for both the dependent variable (GDPPC) and the key independent variable (GNS) for all the 20 countries studied.

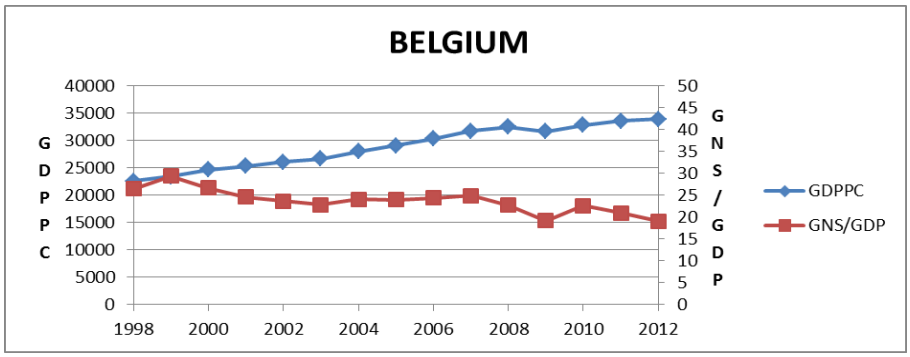
The countries with the highest gross domestic product per capita on the average for the years studied are Korea republic, Japan, Denmark, Mexico and Croatia respectively. The countries with the lowest gross domestic product per capita on the other hand are Bulgaria, Turkey, Romania, China and Spain respectively.

The countries with the highest gross national savings on the average for the years studied are; China, Korea republic, Venezuela, Japan and Germany respectively while those with the lowest average national savings are; United Kingdom, Lithuania, Turkey, Bulgaria and Poland respectively.

5.3.1 Graphs Showing GDPPC and GNS Trend over Time

The primary vertical axis (left axis) measures gross domestic product per capita while the secondary vertical axis (right axis) measures gross national savings.

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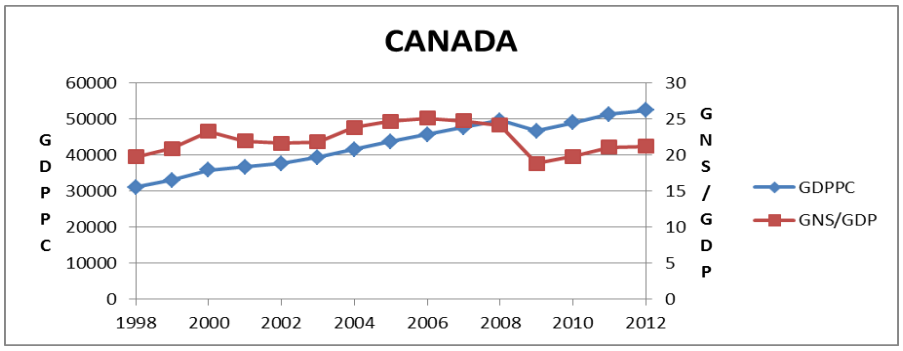
GDPPC
GNS/GDP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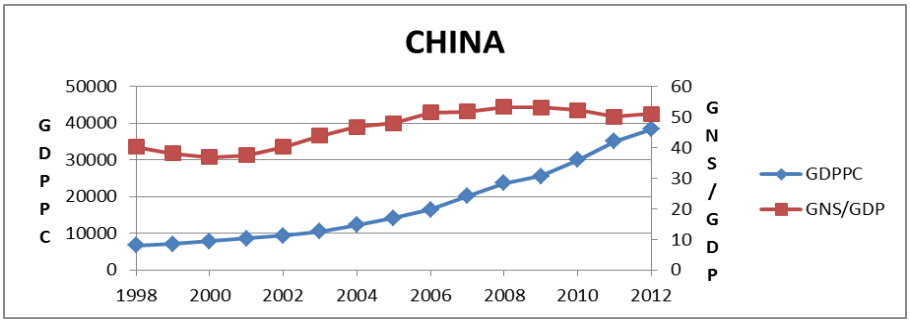
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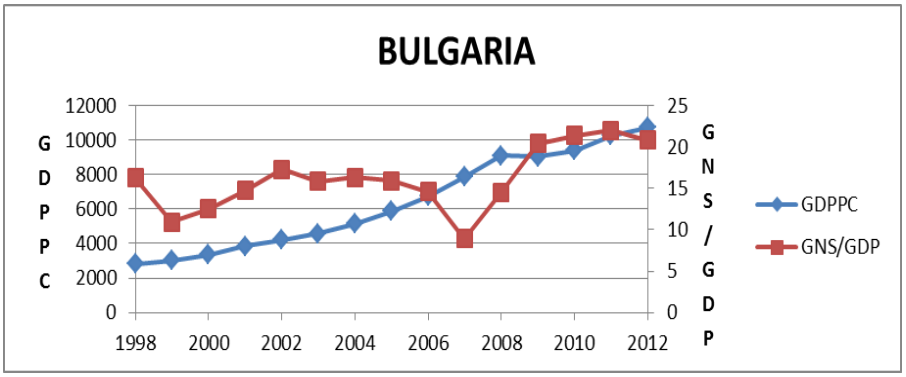
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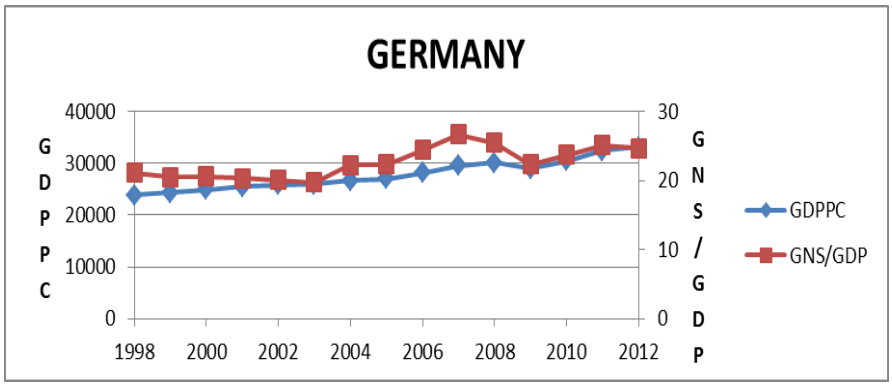
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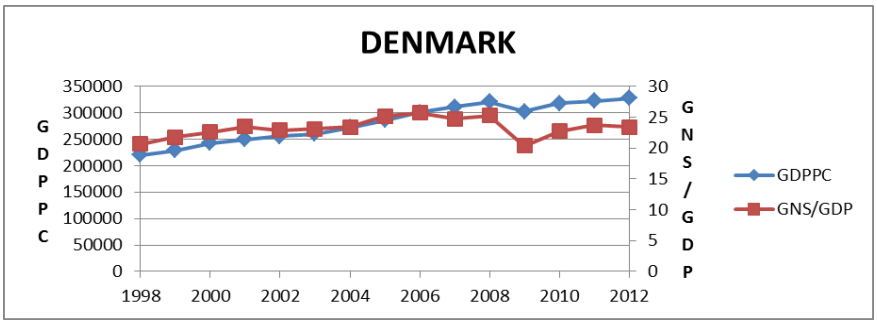
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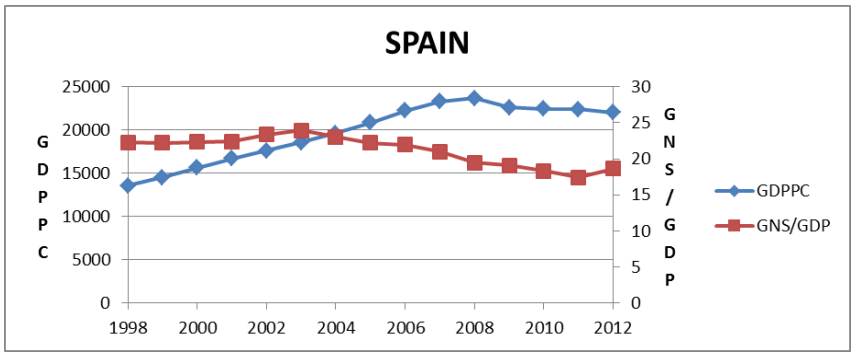
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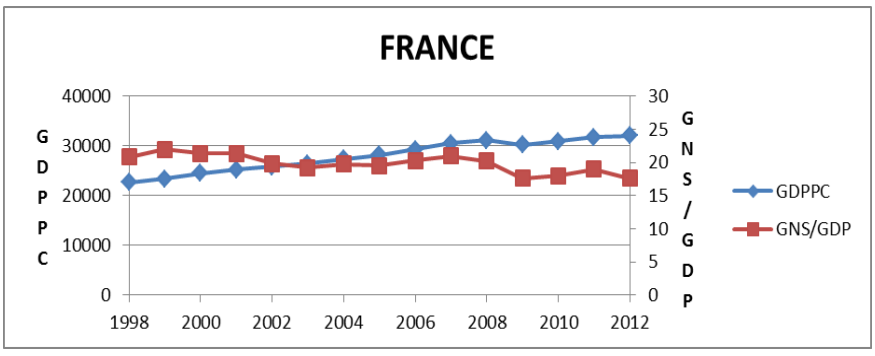
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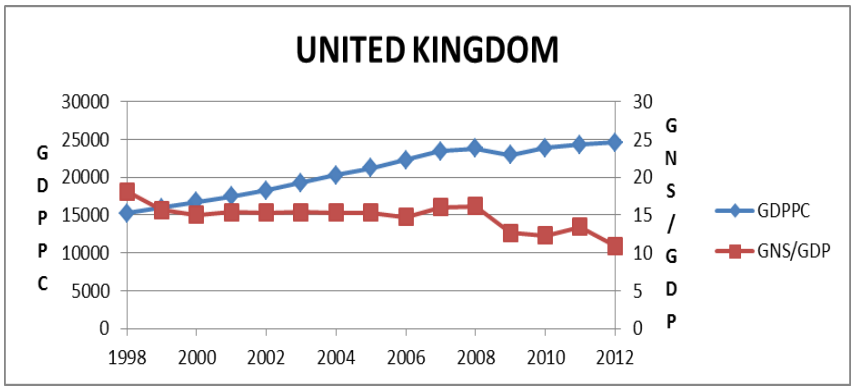
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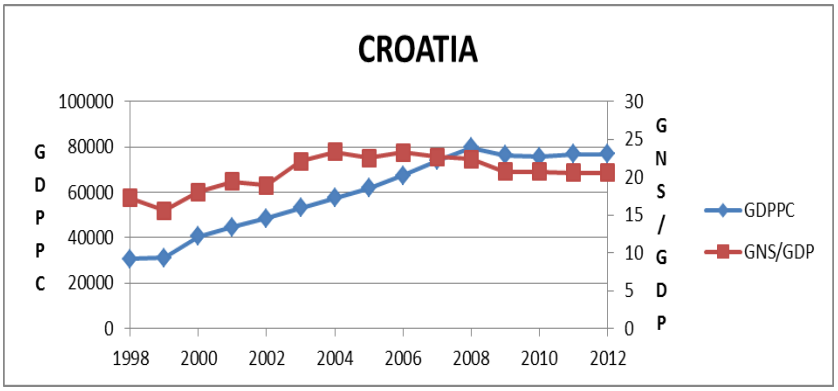
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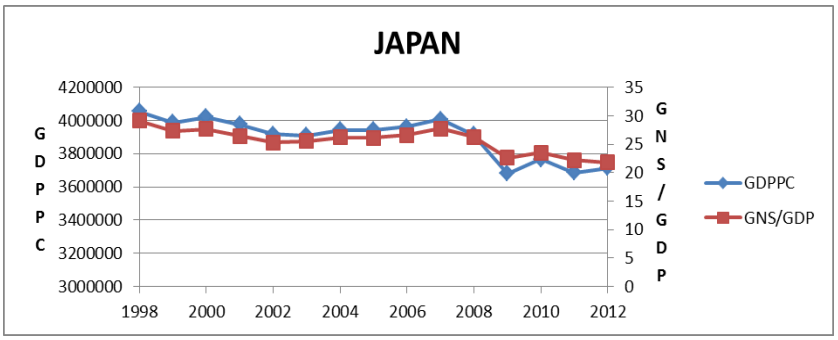
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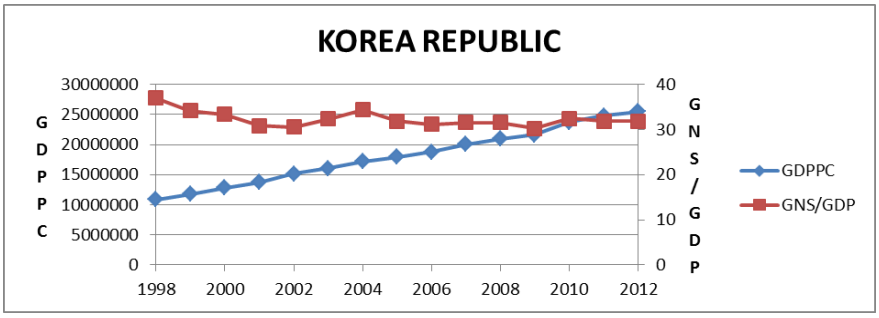
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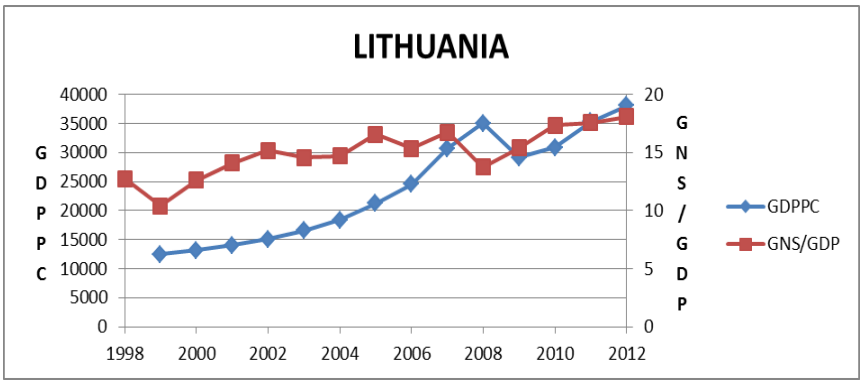
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GDPPC
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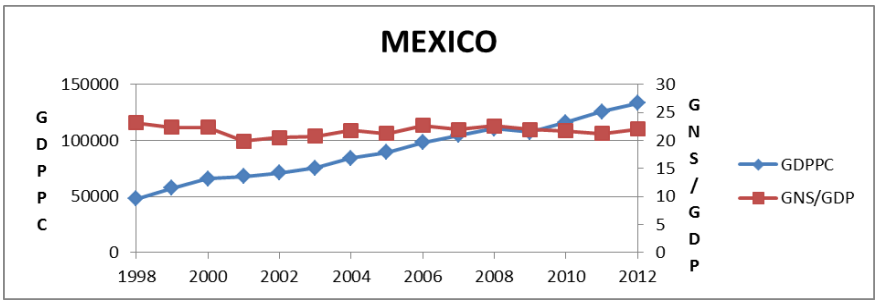
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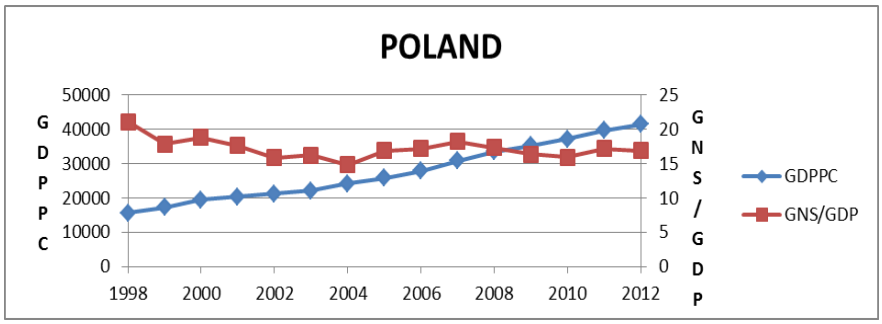
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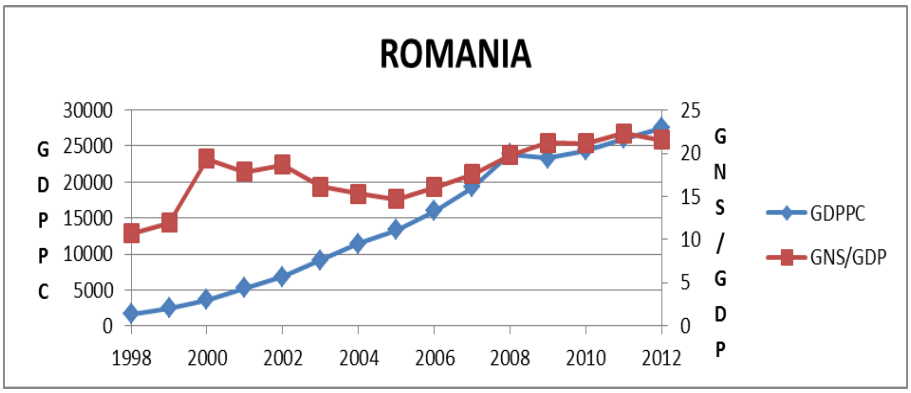
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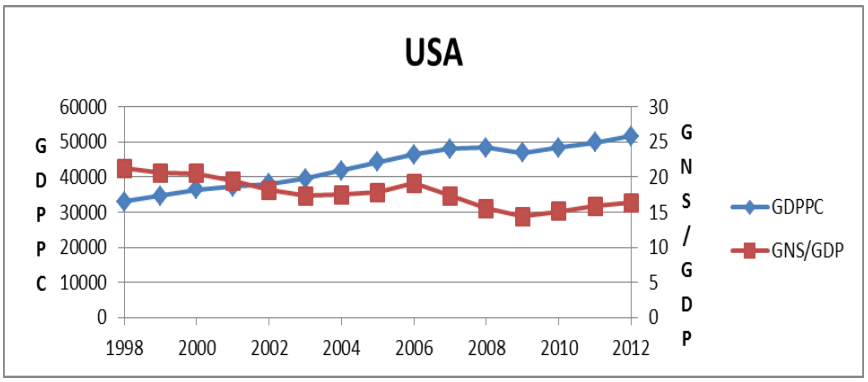
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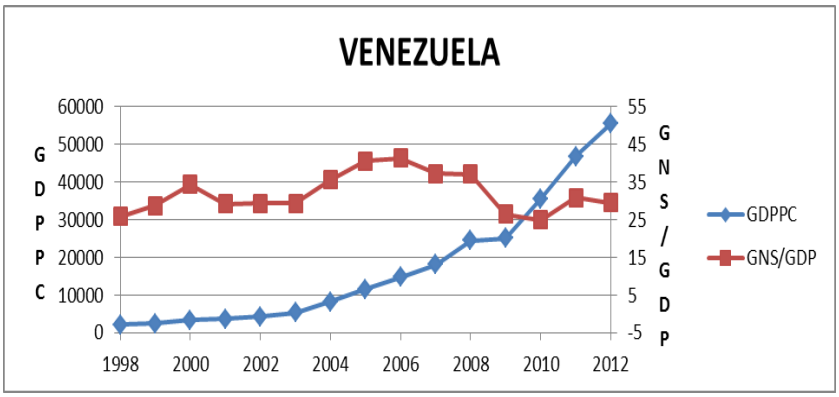
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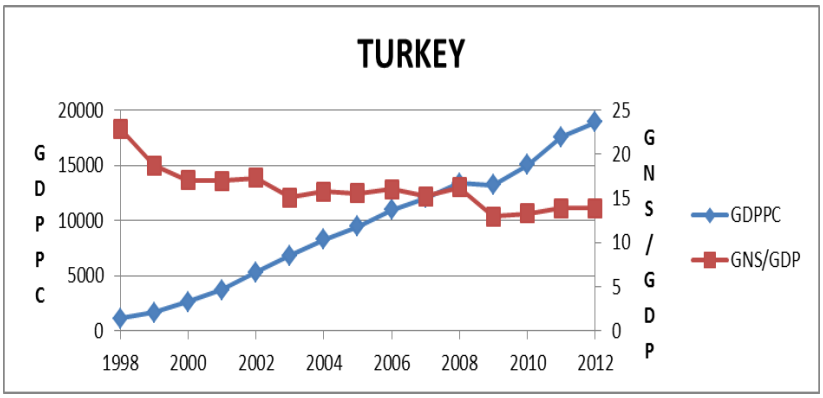
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Chapter 6

METHODOLOGY

6.1 Panel Data Regression

Panel data is also referred to as cross-sectional time series data. This means that a panel data has both cross-sectional data and time series data components. In this study, the time series variable observations stretch from the year 1998 to the year 2012. For the countries included in the cross-section data, see Table 4. The data is a strongly balanced panel data with very few missing observations. Panel data models are used to describe individual behavior across time and across individuals. There are three types of panel data models, the pooled-OLS model, the fixed-effects model and the random-effects model.

6.1.1 Pooled Model

The pooled model specifies constant coefficients, which is the usual assumption for a cross-sectional analysis. The model in general is described thus:

$$Y_{it} = \alpha + \beta x_{it} + u_{it} \quad (6.1)$$

Here, Y_{it} and X_{it} are the dependent and independent variables respectively while α and β are the coefficients that do not vary. The model simply applies OLS to the data, neglecting the cross-sectional and time series nature of the data.

It is regarded as the most restrictive panel data model because it ignores the heterogeneity or individuality that may exist in the data. It is therefore not used much in literature.

6.1.2 Individual-Specific Effect Models

The other two models are classified under individual-specific effect models. Here, it is assumed that unobserved heterogeneity exists across individuals (in this case, countries). In a case where these individual-specific effects have correlation with the independent variables, it results in fixed-effects models, but when they are not correlated with the independent variables then it results in random effects models.

i. Fixed-Effects Model

This model takes into consideration the heterogeneity or individuality in the data by allowing each individual (in this case each country) to have its own intercept value. I.e. each individual has a different intercept term but same slope parameter. The Fixed-effects model further allows individual-specific effects to be correlated with the independent variables. The term "fixed-effect" arises from the fact that although intercept may not be same across individuals, it however does not vary over time (time invariant). A fixed-effect model in general is given as:

$$Y_{it} = \alpha_i + \beta x_{it} + u_{it} \quad (6.2)$$

Here, α_i captures the unobserved heterogeneity across individuals.

ii. Random-Effects Model

Random-effects models also take into account the issue of heterogeneity, they however assume that the individual-specific effects α_i, are distributed independently of the regressors. There is a common mean value for the intercept in this case.

The general form of the model is given as:

$$Y_{it} = \alpha + \beta x_{it} + u_i + \varepsilon_{it} \quad (6.3)$$

Where α = mean intercept value, u_i = random disturbance for ith observation. It may also be rewritten in a simpler form as:

$$Y_{it} = \beta x_{it} + (\alpha_i + u_{it}) \quad (6.4)$$

Where, α_i is individual-specific effect while u_{it} is the normal error term.

For random-effects models, α_i is included in the error term and each individual has the same slope parameter and a composite error term with two parts.

6.2 Panel Data Estimators

Panel data models can be estimated with several different estimators such as Pooled OLS estimator, between estimator, within or Fixed-effects estimator, First differences estimator and Random-effects estimator. For research, the most preferred estimator is always the one that is most consistent (based on law of large numbers; $\rho lim\hat{\beta}n = \beta$) and most efficient (with minimum variance).

Table 7: Models and estimators

ESTIMATOR/TRUE MODEL	POOLED MODEL	RANDOM-EFFECTS MODEL	FIXED-EFFECTS MODEL
Pooled OLS estimator	Consistent	consistent	Inconsistent
Between estimator	Consistent	consistent	Inconsistent
Within or Fixed effects estimator	Consistent	consistent	Consistent
First differences estimator	Consistent	consistent	Consistent
Random-effects estimator	Consistent	Consistent	Inconsistent

For any panel regression analysis, the Fixed-effects estimator will always give consistent estimates but may not always be the most efficient, on the other hand however, the Random-effects estimator is consistent and most efficient of all if the appropriate model is a random effects model, but inconsistent if the appropriate model is a fixed effect model.

6.3 Fixed-Effects versus Random-Effects (Diagnostic Tests)

In order to determine the most appropriate between the fixed-effect and the random-effect estimation, the following tests are carried out.

6.3.1 Breusch-Pagan Lagrange Multiplier Test

This is used to test for the Random-effects model based on the OLS residual. The test is used to decide between random-effects regression and simple OLS regression. In the case of this study, the test indicated the Random-effects regression as preferable to the OLS regression for both regression models specified.

6.3.2 Hausman Test

A Hausman test tests whether random effects estimation would be almost as good as fixed effects estimation for any data and model in which the fixed effects estimation is deemed appropriate. Hausman test is carried out to determine whether there is significant difference between Fixed and Random effects estimators. When there is no significant difference between them, the Random effects estimator is preferable since it is more efficient, but if they differ significantly, then the fixed effects estimator is preferable.

Table 8: Hausman test hypothesis

	H_0 is true	**H_1 is true**
b_1 (RE estimator)	Consistent Efficient	Inconsistent
b_0 (FE estimator)	Consistent Inefficient	Consistent

In table 8, under the null hypothesis stated, Random effects model is preferred due to higher efficiency, while under the alternate hypothesis, fixed effects model is preferred since it is at least consistent.

For this study, the Hausman test showed that there are no significant differences in the coefficients of the fixed effects and rand effects models in both cases. The random-effects estimators are therefore the most appropriate for both regressions.

6.4 Other Diagnostic Tests

- **Serial Correlation Test**

  In panel data, serial correlation causes bias in the reported standard errors. This causes inefficiency in the results. Serial correlation in panel models can be detected with the use of the Breusch-Godfrey/Wooldridge test. For this study, however the test was not conducted because serial correlation is not a problem in micro panels with short time series like the one used in this study. See Oscar Torres-Reyna, 2010.

- **Contemporaneous Correlation/ Cross Sectional Dependence Test**

  Contemporaneous correlation or cross sectional dependence refers to a situation where residuals are correlated across entities. The existence of contemporaneous correlation results in bias in the test results. The Pesaran CD test and Breusch-Pagan LM test of independence can be applied to determine the existence of cross sectional dependence. The tests were not conducted because according to Baltagi (2008), contemporaneous correlation is mainly a problem in macro panels with long time series and not in micro panels like the one used in this study.

- **Heteroscedasticity Test**

  The problem of heteroscedasticity occurs when the variance of errors vary across observations. Although heteroscedasticity does not lead to biases in the OLS estimates, it however causes inefficiency in the tests of significance such that their use may result in incorrect inferences. The Breusch-pagan test for heteroscedasticity can be used to detect if heteroscedasticity exists and if it does, the robust covariance matrix may be used to account for it.

Chapter 7

RESULTS AND DISCUSSIONS

This chapter presents and discusses the results obtained from the regression analysis. As previously introduced, two econometric models were formulated. The difference between the two models is that model 1 includes a variable named S_D, which was created by interacting GNS with a dummy variable generated, based on the level of development of countries. Model 2, on the other hand, includes another interaction variable named S_CM, which was created by interacting GNS with the level of capital mobility of each of the 20 countries analyzed. The models are restated here as follows:

$$LGDPPC_{it} = \beta_0 + \beta_1 LLP_{it} + \beta_2 LTINV_{it} + \beta_3 LRRD_{it} + \beta_4 LTO_{it} + \beta_5 LGNS_{it} - \beta_6 S\_D_{it} + U_{it} \quad (7.1)$$

$$LGDPPC_{it} = \beta_0 + \beta_1 LLP_{it} + \beta_2 LTINV_{it} + \beta_3 LRRD_{it} + \beta_4 LTO_{it} + \beta_5 LGNS_{it} - \beta_6 S\_CM_{it} + U_{it} \quad (7.2)$$

Where:

LGDPPC = log of GDP per capita

LLP = log of labour productivity

LTINV = log of total investment

LRRD = log of researchers in research and development

LGNS = log of gross national savings

LTO = log of trade openness

S_D = Interaction between gross national savings and development dummy

S_CM = Interaction between national savings and capital mobility

The random effects panel estimation was carried out using STATA 11 statistical software.

7.1 Results

The results obtained are shown in this section.

Table 9: Random Effects Model Estimation Results

DEPENDENT VARIABLE: LGDPPC		
INDEPENDENT VARIABLES	MODEL 1	MODEL 2
LGNS	0.7803717*** (0.1789601)	0.370338*** (0.1211964)
LTINV	0.307*** (0.1140251)	0.3684633*** (0.1162661)
LRRD	0.9471841*** (0.0767304)	0.8715514*** (0.0864603)
LLP	1.543684*** (0.0767304)	1.511448*** (0.1382675)
LTO	0.0585187 (0.1179484)	0.0324023 (0.1188233)
S_D	-0.0325653*** (0.0096826)	
S_CM		-0.004305** (0.004305)
CONSTANT	-15.43263*** (1.273354)	-13.6065*** (1.10433)
Number of observations R^2 within R^2 between R^2 overall F- stat (p-value) Theta (λ) Rho (variance due to differences across panels)	288 0.7698 0.2531 0.2664 0.0000 0.9631 0.98063415	288 0.7586 0.2380 0.2579 0.0000 0.9653 0.9653

Standard errors in parentheses

*** (p<0.01), ** (p< 0.05), * (p< 0.1)

Findings from model1 exhibit high conformity with apriori expectations, the key independent variable, national savings has a positive impact on GDP per capita.The result shows that a 1% increase in national savings causes GDP per capita to increase by about 0.78%. The estimated result is significant at 1%. Furthermore, the negative coefficient on the S_D (-0.0325653), which is also significant at 1% indicates that national savings has a greater effect on GDP per capita for less developed countries than it has on GDP per capita for more developed countries.

The impact of total investment on GDP per capita is also positive. The result indicates that if the amount of total investment in a country is raised by 1%, GDP per capita will rise by about 0.307%. The estimated result is significant at 1%.

Labour productivity and number of researchers in research and development also have positive effects on GDP per capita. A 1% increase leads to a 1.54% increase in GDP per capita in the case of labour productivity and leads to a 0.95% increase in GDP per capita in the case of number of researchers engaged in research and development. Both findings are significant at 1%.

Trade openness also reports a positive impact on GDP per capita although the obtained result is not significant. An increase of 1% in trade openness results in an increase of 0.059% in GDP per capita.

The R^2 result for model one shows that the Random Effect estimator can explain about 76.98% of the within variation and 25.31% of the between variation in GDP per capita.

The Rho value of 0.98063415 indicates that about 98% of the variation in the overall error is explained by individual specific terms while the rest is due to idiosyncratic error.

λ is approximately 96%, this shows that the Random Effects estimates are closer to the within (Fixed-Effects) estimates than to the pooled OLS estimates.

The second model also reports findings that conform significantly to expected outcomes. In this model, national savings also has a positive effect on GDP per capita. For every percentage increase national savings there is a 0.37 percent increase in GDP per capita. This result is significant at 1%. Moreover, the negative coefficient on the interaction term (-0.0082953) shows that the greater the degree of capital mobility, the lower the impact of national savings on GDP per capita.

The findings also show a positive relationship between total investment and GDP per capita. A 1% increase in total investment results in a 0.368% increase in GDP per capita. The result is significant at 1%.

The impacts of both labour productivity and number of researchers engaged in research and development are likewise positive. While a percentage increase in labour productivity yields a 1.51% increase in GDP per capita, a percentage increase in number of researchers in research and development leads to a 0.872 percentage rise in GDP per capita.

Just like the case in model one, trade openness although shows a positive relationship with GDP per capita, the result is however not significant. A 1% increase in log of trade openness results in 0.083% increase in log of gross domestic product per capita.

The R^2 results show that the Random Effect estimator is successful in explaining 75.55% of the within variation and 23.82% of the between variation.

The value of Rho is 0.98284893. This means that individual specific effects explain approximately 98% of the estimated overall error variance while approximately 12% is due to idiosyncratic error.

Theta (λ) value is about 96.31%, showing that the Random Effects estimates are closer to the within (Fixed-Effects) estimates than to the pooled OLS estimates.

7.2 Discussions

The result from this work shows that improvements in saving rates drive improvements in economic performance. It however further shows that the impact of national savings on economic performance declines as the degree of capital mobility increases. This can be deduced mainly from the negative coefficient on the interaction term between gross national savings and capital mobility. It can also be deduced from the fact that the coefficient of Log of gross national savings reduced significantly from 0.7803717 in model 1 to 0.370338 in model 2 when capital mobility was introduced into the regression equation. This shows that the impact of gross national savings falls in the presence of capital mobility. The result also shows that the impact of national savings declines as a country moves from underdevelopment to development. These findings are in tandem with previous

empirical findings. See Solow (1956), McKinnon & Shaw (1973), and Aghion et al (2009).

In addition, results on investment, labour productivity and human capital (proxied with number of researchers involved in research and development) lend credence to growth theories such as Harrod-Domar model, Solow-Swan model and M-R-W model. They all show positive relationships with gross domestic product per capita.

The impact of trade openness on gross domestic product is inconclusive in this research. The result obtained is positive but insignificant.

The R^2 results from both models show that the Random Effect estimator explains the variation in gross domestic product per capita within each country over time quite well (76.98% in model 1 and 75.55% in model 2). Rho is the share of estimated variance of the overall error due to individual specific effect. The Rho results from both models are quite good, approximately 98% in both cases. This shows that just about 12% of the estimated overall error variance is due to idiosyncratic error in both regressions. The large Theta (λ) values also prove that the random effect estimates are the best for this analysis since the theta values indicate that the Random Effects estimates are closer to the Fixed-effects estimates than to the pooled OLS estimates.

Table 10: Country Specific Effects

COUNTRY	ALPHAREHAT -	COUNTRY	ALPHAREHAT+
Argentina	-0.1515008	China	1.092005
Belgium	-1.934399	Denmark	0.151567
Bulgaria	-0.9117889	Croatia	0.7803039
Canada	-1.589044	Japan	2.844718
Germany	-1.590412	Korea, rep	4.648572
Spain	-1.603501	Mexico	2.833658
France	-1.805444	Romania	0.8466458
United Kingdom	-1.959585	Venezuela	1.076203
Lithuania	-0.5574601		
Poland	-0.0173263		
Turkey	-.3782529		
USA	-1.774959		

Twelve of the countries studied (Argentina, Belgium, Bulgaria, Canada, Germany, Spain, France, United Kingdom, Lithuania, Poland, Turkey, USA) show average gross domestic product per capita values that are below the overall predicted average while the remaining eight countries (China, Denmark, Croatia, Japan , Korea, rep, Mexico, Romania, Venezuela) have average values that are above the overall predicted average. We do not know what is responsible for these differences in performance because we do not have the variables that can help us explain these differences in the model. We however know that there is something specific about each country that makes them get gross domestic product per capita that is either higher or lower than what is predicted by the model.

Chapter 8

CONCLUSION AND RECOMMENDATION

This study empirically examined the role of savings in economic growth of countries. The study covered the sample period from 1998 to 2012. Twenty countries were analyzed. The countries were divided into 2 groups based on their levels of development. The conclusion is that national savings is an important driver of economic growth for all countries.

We can deduce from the study that savings affect economic growth both directly and indirectly. The indirect effect is majorly through the impact of investment in both physical and human capital. This can be inferred from the positive coefficients on both Total Investment and Number of Researchers in R & D. (savings are principally channeled into investments).

These findings have significant policy implications. Firstly, the work establishes that countries can improve their economic performance by saving more; therefore, governments and policy makers should actively pursue policies that encourage more savings. This is even more important for developing countries because the results show that the impact of saving on growth is greater in developing countries than in developed countries.

However, because in reality it is often difficult for developing countries to raise their savings rate due to limited resources, they can alternatively explore the option of

foreign capital. Foreign capital can be in form of foreign direct investment, foreign borrowing, foreign aid, grants etc. this suggestion comes is based on the findings from this study. The findings show that greater capital mobility lowers the importance of national savings, which implies that foreign capital inflow can serve as substitute to local savings.

Secondly, because financial intermediaries play a crucial role in channeling savings in form of credit to investment, thereby ensuring that increased savings generate higher return on capital, it is important for government and policy makers to look critically into the quality and efficiency of these financial intermediaries in credit allocation. The more efficient financial intermediaries are in this duty, the greater will be the impact of savings on economic growth.

Thirdly, possible leakages in the credit-investment channel need to be identified and plugged. This is especially important for developing countries where corruption is a major source of leakage. The larger the size of leakages in the credit-investment channel, the lower the impact of savings on growth will be.

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