KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ARTS AND SOCIAL SCIENCES

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

An Econometric Analysis of the Causal Relationship Between Gross Domestic Savings and Economic Growth in Ghana (1961-2008)

By

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August, 2009.

DECLARATION

I hereby declare that this thesis presented to the Department of Economics in partial fulfillment for the award of Master of Arts Economics Degree, is my own work and that to the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree in any university except where referees have been duly acknowledged.

……. ……..……

Student Signature

Date …….

CERTIFICATION

It is hereby certified that this thesis has been supervised in accordance with the rules and regulations of the university and that the student has my permission to present it for assessment.

……. ……

Supervisor Signature

Date…….

DEDICATION

I dedicate this thesis to my dear wife, Mrs. Saeeda Wilson Ogoe for her love, patience, support and encouragement during the course of my study.

I also dedicate this work to my father, Mr. Kofi Enyin Ogoe and my mother, Mrs. Sarah Nkrumah Ogoe as well as Mr. K.M. Ogoe who have helped me come this far.

ACKNOWLEDGEMENTS

To come out successfully with a venture like thesis writing does not depend on one's own effort only. In this regard, I would like to acknowledge many whose sacrifice and dedication have made this work a success.

First, thanks be to God for seeing me thruogh to a succcessful completion of the programme.

Second, I thank my supervisor, Mrs. Grace Ofori-Abebrese. In fact, I do not know how much thanks-giving would worth her effort. Her constructive criticisms, contributions and suggestions which have made this work possible are priceless. Her patience in supervising this thesis has really taught me how motherhood should be like.

Thirdly, I am also highly indebted to my best friend, Mr. Samuel Mensah, School of Business, Kwame Nkrumah University of Science and Technology, Kumasi, for his wonderful assistance towards the successful completion of this work and the M.A Programme. Iwould not forget my wife, Mrs. Wilson Ogoe, whose love, patience and understanding have made possible the completion of the programme. I cannot forget my brothers, Mr. John Ogoe amd Victor Ogoe , who have contributed in diverse ways to make me come this far. I will not forget also to express my deepest appreciation to friends and relations whose help and prayers have sustained me up to this time. May the good Lord bless them abundantly now and in the future.

ABSTRACT

The conventional perception is that savings contribute to higher investment and hence higher real GDP growth in the short run. Thus, higher saving rates cause higher economic growth. However, theories and empirical works have shown that the direction of causality between gross domestic savings and economic growth may run in various directions: from gross domestic savings to economic growth, from economic growth to gross domestic savings, bidirectional causality between gross domestic savings and economic growth or no causal relationship between them. The objective of this study was to find the direction of causality between gross domestic savings and economic growth (using real per capita GDP as a measure of growth) of Ghana using annual time series data from 1961-2008. In the process, three analyses were undertaken. First, the time series properties of growth rate of gross domestic savings and the growth rate of real per capita GDP were ascertained using the ADF unit root test procedure. The estimated results indicate one order of integration or *I*(1) for the series. Second, the long-run relationship between the series was explored utilizing Engel – Granger Cointegration Test procedure. The result of the test indicated that the series were not cointegrated. Finally, the causal relationship between growth rate of gross domestic savings and the growth rate of real per capita GDP was performed using the Vector Autoregressive (VAR) model and Pairwise Granger Causality Test. The results showed that there was bi-directional causal relationship between growth rate of gross domestic savings and growth rate of real per capita GDP in Ghana. Based on the findings of the study, certain monetary and fiscal policies as well as legislation and other measures have been recommended to boost gross domestic savings mobilisation and to increase growth.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Since the work of Lewis (1955) was published, many Third World countries have pursued policies aimed at raising the rate of savings in order to increase their rate of growth of real GDP. The theory behind Lewis' work is that higher rates of savings will increase the availability of loanable funds, which in turn, will increase investment. Higher rates of investment will then increase future economic growth. Recent works like Saltz (1999), Bacha (1990), DeGregorio (1992) and Stern (1991) have thrown light on the fact that increases in savings will facilitate more rapid expansion of the capital stock and, therefore, higher rates of investment that should lead to higher rates of economic growth.

From another perspective, Kenyes (1936), Japelli and Pagano (1994) argue that higher growth rates of savings may result from higher rates of growth of real income, that is, real GDP. If incomes are rising more rapidly, households can easily increase their consumption and savings levels.

Indeed, the empirical evidence to date has shown that there is a relationship between saving rates and rates of economic growth. During 1984-1994, thirty-one countries had average annual real per capita GDP growth rate of 2.5% or higher. In these successful countries the median saving rate was 24%. By contrast, the median saving rate stood at 16% in the fifty-nine countries in which per capita income grew at less than 1% a year. While there appears to be a correlation between economic growth and savings, the question is which way the direction of association runs. Theory and evidence have shown that the direction of association can run both ways

(Adebiyi, 2000). The motivation for this study is to find out whether causality exist between gross domestic savings and economic growth for Ghana and if so the direction of causality between them.

1.2 The Problem Statement

Savings naturally plays an important role in the economic growth and development process in Ghana. Savings determines the national capacity to invest and thus to produce, which in turn, affect economic growth potential of the country. Low saving rates have been cited as one of the most serious constraints to sustainable economic growth in Ghana. Growth models developed by Romer (1986) and Lucas (1988) predict that higher saving rates and the related increase in capital accumulation can result in a permanent increase in growth rates. Empirical work by Barro (1990) has provided support to the notion that capital accumulation - and savings - is central for understanding growth differentials across countries.

Unfortunately, one major problem facing Ghana in her attempt at accelerated growth and development is lack of capital formation. Inadequate capital formation to undertake the real investment has adversely affected the output level of the economy. Lack of adequate capital formation results from non-availability of credit to replace worn-out capital stock and addition to existing ones. Thus, gross domestic savings in Ghana is a very critical and reliable factor in capital formation process. Capital formation, whether financed from internal (savings of households, undistributed profits of firms and government surplus budget) or external sources, requires the mobilization of economic surpluses. However, World Development Indicators (2009) of the World Bank reveals that gross domestic saving rates have been very low in Ghana. Therefore, a substantial part of domestic investment has been financed from external sources de-

linking the relationship between economic growth and domestic savings. The effect is that gross domestic savings forms a small proportion of real GDP of the country. The relationship between domestic savings and economic growth has significant implications on the state of the economy. Experiences of economic crisis in Ghana in the 1970s and 1980s have highlighted the fact that low (and declining) domestic saving rates have contributed to generating unsustainable current account deficits.

Gross domestic savings rates and economic growth rates have been low in Ghana over the years, perhaps, due to the fact that government, policy-makers and other stakeholders in the Ghanaian economy are aware of the positive relationship between gross domestic saving rates and economic growth rates on the basis of economic theory but unaware of the angle of causality between them. Therefore the direction of policies and programmes over the years to improve the rate of growth of the two variables has been misplaced. While there appears to exist a correlation between growth and domestic savings, the question is the way the direction of association runs for Ghana. Since the direction of causality is not known, it is difficult to decide the direction of policies and programmes to pursue to achieve increased growth and domestic savings. It is the quest to answer this question of direction that provides the motivation for this study.

1.3 Objectives of the Study

The major objective that this research work seeks to achieve is whether or not the traditional view of growth that savings growth promotes economic growth is valid for Ghana. The specific objectives of this work are:

- to determine empirically whether there is a long run relationship between gross domestic savings and economic growth in Ghana;
- to provide empirical evidence as to whether there is a causal relationship between gross domestic savings and economic growth and the particular direction of causality between them;
- to provide the policymakers in Ghana with a planning tool that can help them in formulating their policies to promote economic growth and savings mobilization and
- offer useful policy prescriptions which can aid in savings mobilization and an accelerated growth and development of the country.

1.4 The Statement of Hypothesis

The study hypothesizes that:

- H_0: there is no direction of causality between gross domestic savings and economic growth in Ghana;
- H_1: there is a causal relationship between gross domestic savings and economic growth in Ghana at least from one direction.

1.4 The Significance of the Study

- The study shall enable policymakers to know whether there is a long run relationship between gross domestic savings and economic growth of the country.
- This study shall also enable government, policy-makers and other stakeholders to know whether or not there is a causal relationship between gross domestic savings and the economic growth of the country.

- Once a causal relationship is established, the study shall enable policymakers to know the angle of causality between gross domestic savings and economic growth in Ghana.
- This study shall further provide government, policy-makers and other stakeholders some planning tools that will be useful in policy formulations and implementations in the right direction which will help accelerate the growth of the economy.

1.6 Scope of the Study

This study is structured to cover the period of 1961 to 2008. This is a forty-eight year period of coverage. This study looks empirically at the causal relationship between growth rates of gross domestic savings and economic growth in the context of Ghana.

1.7 Limitations of the Study

Research work involving time series data is affected by lack of adequate data on some economic variables, at least in Ghana and other developing countries. This places a limitation on the scope of variables that may be incorporated in the model. In this study, for instance, per capita real GDP which measures the standard of living and the welfare of Ghanaians has been used as a proxy for economic growth. This reason is that there is lack of data on economic growth on some part of the period under study. This places limitation to use growth rate of real GDP for the study. It is believed that using per capita real GDP would serve almost the same purpose. Again, the success, of the work is to some extent, hampered by the fact that data differ from one source to the other in Ghana. Data from Bank of Ghana, for instance, may sometimes, differ from that of World Development Indicators of the World Bank or the Ghana Statistical Service. The differences in data present a problem of choice of appropriate data to use for the study.

1.8 Organization of the Study

This study is divided into five parts. Chapter one opens with introduction, background study, problem statement, objectives of the study, statement of hypothesis, significance of the study, scope of the study, limitations of the study and the study organization. Chapter two reviews the theoretical and empirical literature of the study. Chapter three looks at the methodological and conceptual framework for the study. Chapter four focuses on the presentation and interpretation of results whilst chapter five summarizes, concludes and gives recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter looks at definitions of savings and economic growth, the relationship between them, the theoretical and empirical literature of the study.

2.2. Definition of Savings

In a narrow sense, saving generally means putting money aside, for example, by investing in a pension plan or putting money at the bank. In a broader sense, saving is typically used to refer to economizing, cutting costs, rescuing someone or something. Savings, on the other hand, may be defined as accumulated money put aside by saving (Mensah, 2004).

In economics, savings may be categorized into three: personal saving, business savings and government savings. Personal savings has been defined as personal disposal income minus personal consumption expenditure. In other words, income that is not consumed by immediately buying goods and services is saved (Keynes, 1936). Business savings is the corporate retained earnings (profits minus tax payments and dividend). Businesses save when they do not distribute all their profits: these sums, however, are usually quite tiny on a macroeconomic scale. Government savings is the budget surplus. The government often runs public deficits, so that they rather dis-save. National savings is thus, the sum of personal, business, and government savings. However, the size of business and government savings lead to the conclusion that personal savings are the largest and the most important part of national savings.

In a primitive agricultural economy, savings might take the form of holding back the best of corn harvest as seed corn for the next planting season. If the whole crop were consumed, the economy would deteriorate to hunting and gathering the next season.

2.3 Definition of Economic Growth

"Economic growth refers to a rise in national or per-capita income and product. If the production of goods and services in a nation rises, by whatever means, one can speak of that rise as economic growth" (Gillis et al, 1987).

Todaro (2003) defines economic growth as "a long-term rise in capacity to supply increasing diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands." According to him, there are three principal components that are inherent in the definition:

- the sustained rise in the national output is a manifestation of economic growth, and the ability to provide a wide range of goods is a sign of economic maturity;
- advancing technology provides the basis or preconditions for continuous economic growth; and
- the realization of the potential for growth inherent in new technology, institutional and attitudinal adjustment that must be made- technological innovation without concomitant social innovation is like a bulb without electricity, the potential exists but without the complementary inputs, nothing will happen.

Economists draw a distinction between short-term economic stabilization and long-term economic growth. The topic of economic growth is primarily concerned with the long run. The short-run variation of economic growth is termed the business cycle.

The long-run path of economic growth is one of the central questions of economics; in spite of the problems of measurement, an increase in real GDP of a country is generally taken as an increase in the standard of living of its inhabitants. Over long periods of time, even small rates of annual growth can have large effects through compounding. A growth rate of 2.5% per annum in Ghana, for example, will lead to a doubling of real GDP within 28 years, whilst a growth rate of 8% per annum (experienced by some Four Asian Tigers) will lead to a doubling of real GDP within 9 years. Thus, exponential characteristic can exacerbate differences across nations.

In terms of the Aggregate Supply and Demand (ASR/ADE) graphs, economic growth can be shown as a rightward shift of the aggregate supply curve (ASR), increasing the economy's maximum capacity. This is shown in figure 2.3.

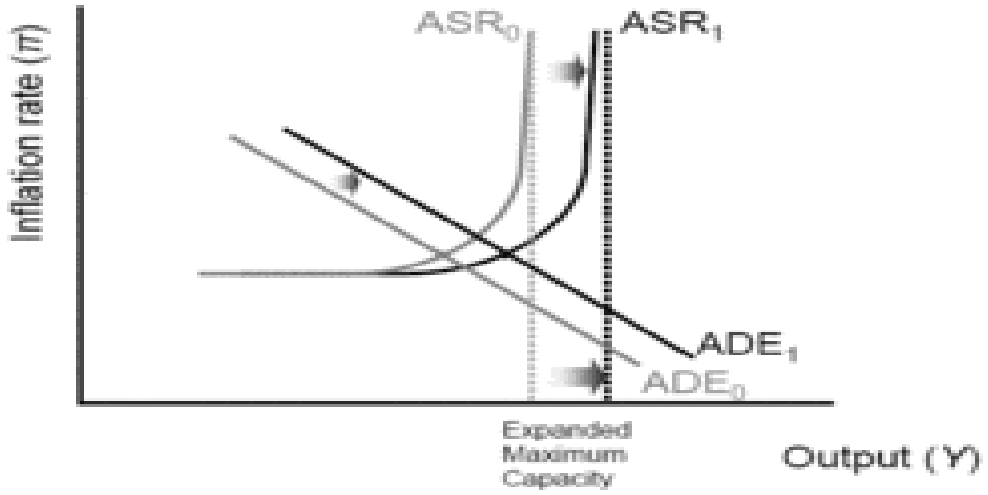


Figure 2.3: Economic Growth in the ADE/ASR model.

Economic growth increases the maximum capacity of the economy. It involves both supply-side and demand-side expansions, and does not necessarily involve a change in the rate of inflation. If this kind of increase in aggregate supply took place without any shift in aggregate demand (ADE), its effects would include growth in output and a declining rate of inflation. In practice, however, economic growth is usually accompanied by, and at least in part, is often caused by, an increase in aggregate demand. Thus, a more typical pattern for economic growth would be for both the ADE and ASR curves to shift to the right as figure 2.3 illustrates.

One way that output can increase is if there is an expansion in the inputs used to produce it. There are five kinds of capital. Human-produced capital is called manufactured capital to distinguish it from the other kinds of capital. Land and other natural resources are natural capital, and all the skills and knowledge possessed by humans are also a kind of capital – human capital. We also note the importance of social and financial capital, which both refer to institutional arrangements that make production possible.

One very influential, and more specific, model of economic growth was developed by an economist, Solow (1957). In his model, he says that an economy's production function can be written in the simple form:

$$Y = AK^{\alpha}L^{\beta}) \quad \text{.....(2.1)}$$

where Y is aggregate output, A is a number based on the current state of technology, K is a quantitative measure of the size of the stock of manufactured capital, and L, the quantity of labour used during a particular period of time. K and L are the only factors of production

explicitly included in the model. Both capital and labour are needed for the production of output, with the exponents in the equation reflect their relative contributions.

A is called total factor productivity, and includes all contributions to total production not already reflected in levels of K and L. Often, "total factor productivity" has been interpreted as reflecting the way in which technological innovation allows capital and labour to be used in more effective and valuable ways. For example, the development of computer word-processor greatly increased efficiency compared to the use of typewriters. Typewriters, which seem antique to us today, were themselves a huge productive advance over clerical work using pen and paper. This process of improved technological methods has resulted in an increase in labour productivity – more output can now be produced with fewer labour hours. If we divide both sides of the equation (2.1) by L, we get

$Y/L = A\ (K^{\alpha}/L)$.....(2.1')

If we define y as Y/L and k as K/L, then equation (2.1') may be rewritten as:

$$y = A\ k^{\alpha} \text{.....} (2.1'')$$

where: **y** is output per worker, **A** is called total factor productivity and **k** is capital per worker. If we log both sides of the equation (2.1''), we have:

$\log y = \log (Ak^{\alpha})$.....(2.1''')

$\Rightarrow \log y = \log A + \alpha \log k$ .....(2.1'''')

where: $\log y$ is the growth rate of output per worker, $\log A$ is the growth rate of total factor productivity, $\log k$ is the growth rate of manufactured capital per worker and α is a number less than 1. Assuming that $\alpha = 0.3$, we say that:

Growth rate of output per worker = growth rate of total factor productivity + 0.3 (growth rate of manufactured capital per worker) …….....…… (2.2)

For example, if “total factor productivity” grows at 1% per year and manufactured capital per worker grows at 2% per year, this equation says that output per worker will grow at 1.6% per year (1% + (0.3)2% = 1.6%). This is known as the “growth accounting” equation.

The output per worker is what is commonly referred to as “labour productivity”. While labour productivity and real GDP per capita are not quite equivalent (some people in the population do not work, for example), they are obviously closely related. Thus, this model implies that the way to raise income per capita—to achieve economic growth—is to increase the amount of capital that each person works with (the second term) and improve technology (the first term). This study uses income per capita to represent economic growth because it takes into consideration the total population of Ghana.

The use of the Solow (1957) growth model served to highlight some important factors in economic growth. In particular, the model led to much discussion of the role of savings in providing the basis for growing levels of manufactured capital per worker. Technological change also received attention, since this was thought to be the main driver behind growth in the value of "A." For many years, economists tended to treat growth as primarily a matter of encouraging savings, investment, and the creation and dissemination of technology.

In more recent years, however, other economists have suggested that perhaps this model has directed too much attention to savings and technology. Some have argued that other factors such as good institutions that support markets, innovations in the organization of work, or access to global markets should be thought of as equally important in promoting economic growth. It is not helpful, they suggest, folding all issues of social, human, financial and natural capital into just one, rather vague, "A" term.

Economic growth has undeniable effects on the living conditions of the peoples of the earth. However, whether these effects are on balance positive or negative is currently open to debate. Economist, Xavier (2007), argues that global income inequality is diminishing, and the World Bank argues that the rapid reduction in global poverty is, in large part, due to economic growth. The decline in poverty has been the slowest where growth performance has been the worst (that is, in Africa). Happiness increases with a higher GDP/capita, at least up to a level of $15,000 per person.

Many earlier predictions of resource depletion, such as The Population Bomb (1968), predictions about approaching famines in Europe and *Limits to Growth* by Meadows et al (1973) have been proven false, one reason being that advancements in technology and science have continually allowed previously inadequate resources to be utilized more economically. The book *The Improving State of the World* argues that the state of humanity is rapidly improving.

Those more optimistic about the environmental impacts of growth believe that, although localized environmental effects may occur, large scale ecological effects are minor. The argument as stated by economists such as Fisher (2003) is that if those global-scale ecological effects exist, human ingenuity will find ways of adapting to them. Economists theorize that

economies are driven by new technology and ongoing improvements in efficiency — for instance, we have faster computers today than a year ago, but not necessarily computers requiring more natural resources to build.

Five major critical arguments, however, have been raised against economic growth.

- Growth has negative effects on the quality of life such as crime, prisons or pollution.

- Many aspects of economic growth that affect the quality of life, such as the environment are not traded or accounted for in the market.

- Growth encourages the creation of artificial needs: industry causes consumers to develop new tastes and preferences for growth to occur. Consequently, "wants are created, and consumers have become the servants, instead of the masters, of the economy."

- Over-stretched resources: The 2007 United Nations GEO-4 report warns that we are living far beyond our means. The report says that the human population is now larger and that the amount of resources it consumes take up a lot of resources available. Humanity's environmental demand is purported to be 21.9 hectares per person while the Earth's biological capacity is purported to be 15.7 hectares per person. This report supports the basic arguments and observations made by Thomas Malthus in the early 1800s that economic growth depletes non-renewable resources rapidly.
- Distribution of income: The gap between the poorest and richest countries has been growing. Although mean and median wealth has increased globally, it adds to the inequality of wealth.

2.4 The Relationship between Gross Domestic Savings and Economic Growth

There have been numerous studies on the relationship between savings at the domestic level and economic growth. The conclusions arising out of these studies depend on the data collected from various income classes of the economy such as low-income group, low- middle income group, upper -middle income group and high- income group.

One of such conclusions is that with economic growth, an economy can invariably experience a growth in the personal income and per capita consumption expenditure. The impact of economic growth on a particular country can be very well felt in the increase in the disposable income of an individual. According to the concept of marginal propensity to save (MPS), savings increases with additional increase in income. Hence, it can be easily understood that with an increase in economic growth, the amount of savings also increases, other things being equal.

The other conclusion from the studies is that governments of some countries offer a number of saving and investment schemes that are tax exempt in order to promote the practice of saving in the country. By investing in such saving schemes, individuals can save a considerable amount of money. Governments borrow and invest such money in various development projects that help build a better economy.

In Ghana, available data indicate that there is a positive relationship between gross domestic savings and economic growth. This is shown in table 2.4.

Table 2.4 Growth Rates of real GDP and Gross Domestic Savings

Year	Growth Rate of real GDP (%)	GDS (% of GDP)
1961-1965	3.1	11.8
1966-1969	1.2	9.4
1969-1972	7.0	11.6
1972-1978	0.3	10.4
1979-1983	-3.4	4.5
1984-1992	5.2	5.1
1993-2000	4.2	8.4
2001-2008	5.7	21

[The data are researcher's own calculation from World Development Indicators (2009) of World Bank and Bank of Ghana]

Table 2.4 reflects the various governments at different times. The table indicates that periods of high economic growth rates are marked by high savings rates and vice-versa. For instance from 2001-2008, the average annual growth rate of real GDP is 5.7 per cent and the average annual gross domestic savings as a percentage of real GDP is 21 per cent. On the other hand, from 1979-1983 the average annual growth rate of real GDP is -3.5 per cent with the average annual savings of 4.5 per cent of real GDP. When the table is plotted on a diagram, we have figure 2.4.

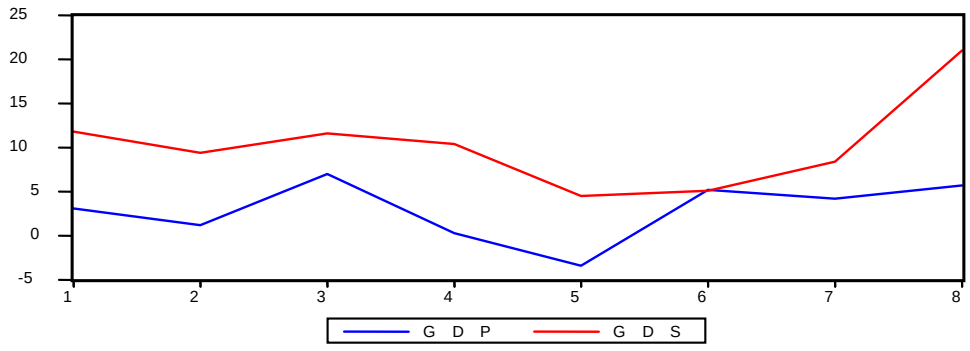


Figure 2.4 - Relationship between Savings and Economic Growth from 1961-2008 in a diagram.

Thus, in one breathe economic growth leads to savings whilst in another breathe savings leads to economic growth.

2.5.0 Theoretical Review

This section provides a theoretical review of the causal relationship between gross domestic savings and economic growth in various models. An important distinction arises in the different models with regard to the effects of gross domestic savings and economic growth on each other.

2.5.1.0 Financial Liberalisation Theory and Financial Repression Theory

This section presents a broad discussion on the debate between the financial liberalisation theorists and the financial repression theorists. These views are an extension of the Classical - Keynesian debate in which the Classical economists maintain that the direction of association runs from savings to investment and hence growth while the Keynesians maintain that the direction of association runs from investment to savings. The implication of the Classical standpoint is that saving is a pre-requisite for investment and, hence, growth, while that of the Keynesians is that what is important for growth is not prior savings, but rather the prospect of profit and the elastic supply of credit to the private sector (Adebiyi, 2000).

2.5.1.1Financial Repression Theory

One of the theories on the causal relationship between gross domestic savings and economic growth is the Financial Repression Theory. Advocates of financial repression argue that savings are not necessarily channelled into investment. Tobin (1965) argues that the development of a monetary sector could be damaging. With the introduction of money balances, agents face the

choice of allocating resources not used for consumption either to the purchase of physical capital or to money balances. Since it is physical investment that is the source of economic growth, if money balances are not made available for investment, but rather held as a stock of purchasing power, the equilibrium growth path of an economy will occur at a lower level of per capita output than before.

2.5.1.2. Financial Liberalisation Theory

Advocates of financial liberalization theory {Levhari & Patinkin (1968), McKinnon (1973) and Shaw (1973)} have, however, argued for financial liberalization on the basis that saving is complementary to investment in the development process, even with a money economy where saving can go either into the accumulation of money balances or the accumulation of physical capital.

Levhari & Patinkin (1968) see money as a factor of production. The production function can be written as output, a function of capital, labour and real money supply. Thus, production depends on working capital in the same way as it depends on fixed capital. If money were not productive there would be no point using it in production and the economy would revert to a barter system. Money, being a productive factor of production, allows the economy to realize a higher level of per capita output than in its absence.

McKinnon (1973) argues that money holdings and capital accumulation are complementary in a development process. Because of the lumpiness of investment expenditure and the reliance on self-finance, agents need to accumulate money balances before investment takes place. Positive

(and high) real interest rates are necessary to encourage agents to accumulate money balances, and complementarity with capital accumulation will exist as long as the real interest rate does not exceed the real rate of return on investment.

Shaw (1973) stresses the importance of financial liberalization for financial deepening, and the effect of high interest rates on the encouragement to save and the discouragement to invest in low-yielding projects. The increased liabilities of the banking system resulting from higher real interest rates, enables the banking system to lend more resources for productive investment in a more efficient way.

The implication of financial liberalization theory is that saving will drive the growth process, through its positive effect on investment rate.

2.5.2 The Solow-Swan Model

The Solow-Swan (1956) model presents the case in which a rise in the saving rate affects the stock of capital and the level of per-capita income, but does not affect the *rate* of economic growth. An increase in the saving rate increases per capita output and per capita capital stock in steady- state. A higher savings rate will generate more investment per unit of output than it did before- which in turn will lead to an expansion of capital per worker. The process, however, comes to a halt since for a given growth rate of labour, an increasing proportion of investment will be devoted to maintaining this higher capital-labour ratio. The saving rate thus influences the level of per capita capital stock and thus per capita output towards which the economy gravitates in equilibrium, rather than the rate at which either magnitude changes.

In sum, the Solow-Swan model says a change in the saving rate changes the economy's balanced growth path and hence per capita output in steady state, but it does not affect the growth *rate* of output per worker on the balanced growth path. Only an exogenous technological change will result in a further increase in output per worker in steady state.

2.5.3 The Romer Model

By contrast, in the Romer (1986) growth model in which technology is endogenized, an increase in the saving rate not only increases per capita output in steady state but also increases the growth rate of per capita output. Thus, since the growth rate of the capital-labour ratio is not declining, it follows that the growth rate of per capita output is not declining in the capital-labour ratio either. Thus an increase in the saving rate, not only increases the growth rate of the capital-labour ratio, and per capita output, but also the increase in the growth rate would persist indefinitely.

The difference between the Solow-Swan model and the Romer model relates to the nature of the capital stock. Since, in the Romer model, the social returns to scale in capital are constant, the marginal product of capital is also constant. Unlike in the Solow-Swan model, there is no incentive in the Romer model to discontinue investing in capital as the capital-labour ratio increases. Thus, there is no incentive for the economy to stop expanding. The above discussion illustrates how an increase in the saving rate can indeed lead to growth and more so, when technological change is seen as being endogenous, the increase in the growth rate will persist indefinitely. Thus, while the Solow-Swan model shows the saving rate to have a temporary effect on the growth rate, the Romer model shows the effect to be permanent.

2.5.4 Harrod-Domar Growth Model

The Harrod-Domar (1956) model may also be used to illustrate the inter-relationship between savings and economic growth from the point of view of economic theory. The Harrod-Domar growth model, in simple terms, states that the growth of output is equal to the rate of savings divided by the incremental capital-output ratio as follows:

$$g = s / v \quad \text{.....(2.3)}$$

where: g is the rate of economic growth, s is savings ratio and v is the incremental capital- output ratio (defined as "i"/change in y; where "i" is investment and change in y is the change in output). According to this model, the government objective is to achieve a target rate of growth of the net national product. For example, assume that the government target rate of growth is 5 percent per annum and its capital-output ratio is 4: 1. For the government to achieve its objective of 5 percent growth rate, it requires a rate of investment of 20 percent. So if the average or marginal rate of domestic savings is less than the rate of investment (20 percent), then obviously domestic saving by itself cannot sustain the desired rate of growth of 5 percent per annum.

In the light of the Harrod-Domar growth model, governments faced with low savings have a number of alternatives. They can adjust the growth rate downwards so that the domestic saving rate exactly balances the rate of investment required to sustain the modified rate of growth. The other alternative can be to raise domestic savings (e.g. through taxation). Finally, they can go for commercial borrowing both domestically and abroad.

Given the desire for fast growth and attainment of better standards of living, it is very difficult for the government to reduce the desired rate of growth. Also, given the extreme inequalities in

income and wealth and majority of the population living below subsistence level, government may be reluctant to raise domestic savings through taxation because that would mean pushing up taxation effort. Because of the low standard of living of the bulk of the population, imposing taxation (whether direct or indirect) would only place the burden on the few rich people by reducing their growth in consumption which will negatively affect the growth rate.

The chief appeal of the Harrod-Domar model lies in its simplicity. Given a target growth rate, "g*" and the incremental capital-output ratio, "v", it is easy to find out the level of savings that must be realized to attain "g*". If sufficient level of domestic savings are not forthcoming to match a certain level of investment "i" to attain "g*", then the model states the required amount of capital flows which should be borrowed from abroad. The model also predicts that the higher the savings rate, the higher the rate of economic growth, other things being equal.

2.5.5 The New Growth Theory

The causal links between saving rates (i.e. financial development) and economic growth has been treated extensively in the new growth theory. This theory yields two competing predictions that boil down to the supply-leading and demand-following controversy. Following Pagano (1993), the supply-leading hypothesis is explained as follows.

Aggregate output (Y) is taken to be a linear function of the aggregate capital stock (X). Thus:

$Y_t = \alpha X_t$.....(2.4)

In an open economy with external economies it is assumed that firms and households are identical so that per firm and per capita values coincide. Each firm faces a technology with

constant returns to scale but productivity is an increasing function of the capital stock. Thus, the firm's output is given by:

$$y_t = Bx_t^n \quad \text{.....(2.5)}$$

where y_t is firm-specific output, x_t is firm-specific capital stock and B is a parameter that responds to the average capital stock according to $B = \alpha x_t^{1-n}$. Assuming P is identical firms, aggregate output in equation (2.5) will be a summation of individual firm output:

$$Y_t = Py_t \quad \text{..... (2.6)}$$

It is assumed that X_t is a composite of physical and human capital (J_x and H_x respectively) and that J_x and H_x are reproducible with identical technologies (Lucas (1988), thus:

$$X = J_x + H_x \quad \text{..... (2.7)}$$

By further assuming a stationary population with one good being produced, which is either consumed or invested and depreciated at the rate π per period, the gross investment (I) can be stated as:

$$I_t = X_{t-1} - (1-\pi) X_t \quad \text{.....(2.8)}$$

If a closed economy with no government is assumed, capital market equilibrium requires that gross savings (S) equal gross investment (I). However, a proportion of savings (1-Φ) leaks from the process of financial intermediation; hence capital market equilibrium is given by:

$$\Phi S_t = I_t \quad \text{..... (2.9)}$$

from equation (2.8) the growth rate at time t+1 is given by:

$$g_{t+1} = (Y_{t+1}/Y_t) - 1 = (X_{t+1}/X_t) - 1 \quad \text{..... (2.10)}$$

If we re-arrange equation (2.8), it yields $X_{t+1} = I_t + (1-\pi)X_t$ and substituting into the above yields:

$$g_{t+1} = \frac{I_t + X_t - \pi X_t}{X_t} = \frac{I_t}{X_t} - \pi \quad \text{.....(2.11)}$$

If we re-arrange equation (2.4), it yields $X_t = Y_t/\alpha$ and then by substituting into the above, we obtain:

$$g_{t+1} = \alpha(I_t/Y_t) - \pi \quad \text{.....(2.12)}$$

If we substitute capital market equilibrium in equation (2.9) into equation (2.12), we obtain:

$$g_{t+1} = \alpha\phi(S_t / Y_t) - \pi \text{.....(2.13)}$$

From equations (2.12) and (2.13), we can sum up the steady state solution as follows:

$$g_{t+1} = \alpha(I_t/Y_t) - \pi = \alpha\phi\tau - \pi \quad \text{.....(2.14)}$$

where $\tau = S_t / Y_t$. In the context of this study, equation 2.14 predicts that financial development affects growth by raising the coefficient of savings, increasing the social productivity of capital (α), or influencing the saving rate (τ).

2.5.6 The Life-Cycle Theory of Consumption and Saving

This model developed by Japelli & Pagano (1994), supports the notion of the direction of association running from growth to saving. The life-cycle saving model has income-earning households saving to finance consumption when they become old - non-earning households. The theory assumes individuals live for three periods and this provides an incentive for intergenerational borrowing. Individuals borrow to finance current consumption when they are young and repay the loan and save for retirement in their middle age. They consume the assets accumulated in the second period of their life when they grow old. Thus, the volume of their savings depends on how much they earn during the middle age.

2.5.7 The Absolute Income Hypothesis (AIH)

This was developed by Keynes (1936) in his book titled *The General Theory of Employment, Interest and Money*. According to him, many factors such as wealth, interest rate, income, expectations, demography (household sizes) etc. may influence consumption but the basic determinant of consumption is current income or current disposable income. This is based on introspection and casual observation. As income increases, consumption, on the average increases, but the increase in consumption is less than the increase in income. This means that the marginal propensity to consume (MPC) – the amount consumed out of an additional unit of income - is between zero and one. This, he referred to, as the “Fundamental Psychological Law”. The "fundamental psychological law of any modern community is that, when its real income is increased, it will not increase its consumption by an equal absolute amount," and stated that "as a rule, a greater proportion of income is saved as real income increases."

Keynes (1936) posits that the ratio of consumption to income, called the average propensity to consume (APC) falls as income rises. This is interpreted to imply that at any point in time, he expected the rich to save a higher proportion of their income than the poor; or that at a very low level of income, people will dis-save. This implies that MPC < APC. The acceptance of the theory that MPC < APC and that as income increases APC falls, led to the formulation of the stagnation thesis in 1940. According to this theory if APC falls and private investment is constant, government spending should increase faster than the increase in income otherwise the economy will decline or stagnate. Keynes admitted that interest rate could influence consumption as a matter of theory. But his main conclusion was that the influence of interest rate on individual spending out of a given income is secondary and unimportant. This view contrasts

with the classical notion that a higher interest rate encourages saving and thus discourages consumption. Thus, according to Keynes, it is the increased growth, measured in income that leads to increased savings. Increased savings is impossible without increased growth of the economy.

2.5.8 The Permanent Income Hypothesis (PIH)

Friedman (1957) develops the Permanent Income Hypothesis. According to him, current income (Y) should be viewed as the sum of two components: permanent income (Y^P) and transitory income (Y^T) that is: $Y = Y^p + Y^T$ ……..... (2.15)

Permanent income is that part of income that people expect to persist into the future. On the other hand, transitory income is that part of income that people do not expect to persist. For example, a good education provides a permanently higher income whereas a good weather provides only transitory higher income. Friedman assumes that consumption is planned on the basis of permanent income and that the relationship between the two variables is proportional:

$C = k Y^P$……..... (2.16)

where: k is the coefficient of proportionality, which Friedman assumed, depends on factors like household preferences, rate of interest, demographic factors, human wealth etc.. For example, if a person received a permanent pay rise of two million Ghana cedis, his consumption would rise by as much. However, if the person won a lottery of the same amount, he would not consume all in one year. He is likely to spread the extra consumption over the rest of his life. It is out of income that people save.

2.5.9 The Relative Income Hypothesis (RIH)

The relative income hypothesis was proposed by Duesenberry (1949). Relative income hypothesis states that an individual's attitude to consumption and savings is guided by an abstract standard of living. "Keeping up with the joneses" may be a more powerful incentive than the pursuit of wealth for its own sake.

Duesenberry's analysis is based on two premises. The first premise is with respect to the consumption behaviour of an individual. It states that the consumption behaviour of individuals is interdependent. An individual is not so much concerned with his absolute level of consumption as he is with his consumption relative to the rest of the population, thus, the percentage of income consumed by an individual depends on his percentile position in the income distribution.

The second premise states that the present consumption is not influenced merely by present levels of absolute and relative income, but also by levels of consumption attained in previous periods. He argues that consumption relations are irreversible over time. It is difficult for a family to reduce the level of consumption once attained. The aggregate ratio of consumption to income is assumed to depend on the level of present income relative to past peak income. Duesenberry's approach says that people are not just concerned about absolute levels of possession. They are in fact, concerned about their possessions relative to others, "keeping up with the joneses." People are not necessarily happier if they have more money. They do however report higher happiness if they have more relative to others.

He argues further that people are more reluctant to reduce their spending in relation to a fall in income than to increase spending in relation to increases in income. The reason is that we do not want to alter our standard of living downward. When the World War II ended, a significant number of economists believed that there would be a consumption decline and a drop in aggregate demand, but that did not occur. This provided supporting evidence to Duesenberry's argument that people do not want to alter their standard of living downwards. This approach therefore, assumes that savings in out of income. It is that part of income not consumed that is saved.

2.6 Empirical Literature

Some empirical studies (Adebiyi, 2000) have used cross-section data to study the direction of causality between the two variables whilst others [Carrol and Weil (1993), Mohan (2006), Lean and Song (2009)] have used time series data to study the causality between the gross domestic savings and economic growth. Again, some studies have used both the growth rates of gross domestic savings and the growth rate of real GDP as dependent variables and have used the lags of growth rates of gross domestic savings and real GDP as explanatory variables. With regards to the gross domestic saving rate, some studies (Adebiyi, 2000) have used gross domestic savings as a ratio of real GDP (Saving-GDP ratio) whilst others [Mohan (2006), Lean and Song (2009)] have used the logarithm of gross domestic savings as both dependent and independent variables.

Carrol and Weil (1993) examine the causal relationship between income growth rate and growth rate of savings using both cross-country and household data in OECD countries (Japan, Hong Kong, South Korea, Singapore etc.) using VAR model of Granger causality (GC) test. They find

that income growth rate granger causes growth rate of gross domestic savings but gross domestic savings does not granger cause income growth. According to them the positive effect of growth on saving implies that previous estimates of saving on growth may be overstated.

Lean and Song (2009) has examined the short-run and long-run relationship between savings and economic growth in China using Granger causality test via time series annual data. They find bi-directional causality between gross domestic savings and economic growth in the short-run. In the long-run, a unidirectional causality exists running from the gross domestic savings to economic growth.

Mohan (2006) uses Granger causality tests to determine the relationship between gross domestic savings and economic growth for various economies with different income levels using time series annual data. The study seeks to determine whether the direction of causality in these economies is based on their income class: namely low-income, low-middle income, upper-middle income, and high-income countries. His paper differs from other studies in the literature primarily in dividing the twenty-five countries he investigates into low-income countries (LIC) - India, Senegal, Cote d'Ivoire and Nigeria; low-middle income countries (LMC) – Algeria, Thailand, Colombia, Ecuador and Egypt; upper-middle income countries (UMC) – Malaysia, South Africa, Brazil, Argentina and Chile; high-income countries (HIC) – United States, Norway, Canada, Japan, Singapore, Korea, United Kingdom, Finland, Iceland and Sweden. For nine HICs under investigation (United States excluded), the empirical results showed that for eight out of the nine countries, the causality runs from economic growth rate to growth rate of gross domestic savings. Only in Singapore does the causality run from growth rate of gross

domestic savings to economic growth rate. In UMCs (excluding Malaysia), the empirical results indicate that all of the countries show bidirectional causality. This is an interesting finding since World Bank (1999) shows that the savings and economic growth for UMCs are generally high. The empirical results perhaps suggest that the countries are in transition to reach a similar steady state as the HICs. This is consistent with Quah's (1993) study, which reveals that middle-income countries are slowly vanishing. Empirical results for LMCs also favour the notion that the causality runs from economic growth rate to growth rate of gross domestic savings in Algeria, Thailand, and Colombia. However, there appears to be no causal relationship between the two variables in Ecuador. In all the LMCs under investigation (excluding Egypt), none shows a causality that runs from growth rate of gross domestic savings to economic growth rate. In LICs, the empirical results are mixed. Senegal and Nigeria have a causality that runs from economic growth rate to growth rate of savings. However, no causal relationship exists in India. In Cote d'Ivoire, bi-directional relationship is found.

Pahlavani et al, (2007) have explored the relationship between gross domestic savings and economic growth for Iran using Granger causality test. The result indicates that there is positive relationship between economic growth and gross domestic savings and that the direction of causality runs from gross domestic savings to economic growth.

Sinha (1999) has examined the relationship between the growth rate of gross domestic savings and economic growth rate in Sri Lanka using GC test. In this study, the causality is from growth rates of gross domestic savings to economic growth rates. However, Sinha (2000) does a similar

study in the Philippines and finds causality from economic growth rate to growth rate of domestic savings.

Saltz (1999) uses both the VECM and VAR model of the Granger causality method to examine the causal relationship between savings and economic growth of seventeen Third World countries. For nine countries whose variables were cointegrated, he used the VECM. For other eight countries whose variables are not cointegrated, he used the Vector Autoregressive (VAR) model to find the causality. The results are that in four countries (Colombia, Jamaica, Peru, and the Philippines) no causality is detected in either direction. For eight countries the empirical results indicated that the growth rate of real GDP positively granger causes the growth rate of gross domestic savings. For two countries (Argentina and Taiwan), it is the growth rate of gross domestic savings which granger causes the growth rate of real GDP. Finally, for two countries (Dominican Republic and Mexico), there is bi-directional causality.

Mavrotas and Kelly (2002) examine the causal relationship between gross domestic product, gross domestic savings and private savings for India and Sri Lanka using the GC method. They find no causality between GDP growth and private savings in India. But there appears to be bi-directional causality between private savings and growth in Sri Lanka.

Baharumshah et al. (2003) have investigated the relationship between the growth rate of gross domestic savings and the growth rate of real GDP in five Asian countries: Singapore, South Korea, Malaysia, Thailand and the Philippines using Granger causality method based on time series data from 1960-1997 using the Vector Error Correction model. The authors find that the growth rate of gross domestic savings does not granger cause economic growth rate in the countries except Singapore.

Kumar et al. (2008) studies the relationship between economic growth and gross domestic savings in South East Asian countries in respect of the Granger causality test. The relationship between gross domestic savings and economic growth is found to be bi-directional.

Aylit (2003) have also studied the relationship between private savings and economic growth in South Africa using the Granger causality method of causality. He finds that the private saving rate has a direct as well as an indirect effect on growth. The indirect effect is through the private investment rate. In turn, he also finds that growth has a positive effect on the private saving rate. Thus, there is a virtuous cycle as growth enhances saving, which in turn further enhances growth.

Dawit (2005) has investigated the causal relationship between the real economic growth and the growth rate of real gross domestic savings in Ethiopia for the period 1960-2003 using annual time series data and Granger causality method. The findings lend support to the hypothesis that faster growth of real gross domestic savings (RGDS) granger causes higher growth rates of real gross domestic product (RGDP) in Ethiopia. Also to the lesser extent, a higher rate of growth of real GDP granger causes a faster growth of real GDS. Thus, he finds bi-directional (feedback) causality in Ethiopia.

Adebiyi (2006) has examined the empirical evidence regarding the gross domestic savings and economic growth relationship in seventeen African countries using an annual data spanning from 1960 to 2000. The findings revealed an inverse relationship between gross domestic savings and real gross domestic product in the African countries. The findings also revealed that while gross

domestic savings may be sensitive to real GDP in the short run, it is insensitive to it in the long run.

Anoruo and Ahmed (2002) have explored the causal relationship between economic growth rate and growth rate of gross domestic savings for Ghana and six other African countries (Kenya, South Africa, Congo, Côte d'Ivoire, Zambia etc.) using time series annual data and VAR model of Granger causality test. The results suggest that there is a long-run relationship between economic growth rate and growth rate of gross domestic savings and that contrary to the conventional wisdom, economic growth rate granger causes growth rate of gross domestic savings for Ghana and most of the other countries under study. Only in Côte d'Ivoire is bi-directional causality found.

Bassam (2010) has examined the long – run relationship between real gross domestic product (GDP) and real gross domestic saving (GDS) for Morocco (1965-2007) and Tunisia (1961-2007). His results reveal that in Morocco, a long-run relationship exists between the variables, while no evidence of long-run relationship exists in Tunisia. HIs Granger causality test supports bidirectional causality between economic growth and gross domestic saving growth in Morocco. However, in the case of Tunisia, the results suggest that there is a unidirectional Granger causality between real GDP and real GDS and runs from gross domestic saving rate to economic growth.

Odhiambo (2003) looks at the direction of causality between gross domestic saving and economic growth in South Africa during the period 1950–2005. Using the cointegration-based

error–correction mechanism, the study finds a bi-directional causality between savings and economic growth to prevail in the short run and a distinct unidirectional causal flow from economic growth to savings to dominate in the long run.

Adebiyi (2000) examines the empirical evidence regarding gross domestic savings and economic growth relationship in Nigeria using a quarterly data spanning between 1971 and 1998. He investigates the causal links between saving and growth using Granger causality test via vector autoregressive model. In the final analysis the Granger causality tests showed that, in Nigeria, saving-GDP ratio granger causes per capita income.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In this chapter, data sample and data sources for the study are indicated and variables used in the study are explained. A model is then developed for the study. The model conforms to standard econometric technique required for any econometric research work of this nature. This chapter also develops an econometric estimation technique for the causality test as well as the procedure for the evaluation of results from the estimation.

3.2 Sample Data and Data Sources

Annual time series data on gross domestic savings and per capita real GDP used as a measure of economic growth in Ghana for the period 1961 to 2008 are used for this study. The data from 1961 to 2007 are from World Development Indicators (2009) of the World Bank. The data for 2008 are from Statistical Service of Ghana. All computations are performed using Eviews5 software.

3.3 Model Specification

The close relationship between the gross domestic savings rate of an economy and the economic growth rate has been well specified in a number of empirical investigations (Pagano, 1996; Gavin et al, 1997; Sinha and Sinha, 1998; Saltz, 1999). The linear model for this study is specified in logarithmic form. The purpose is to eliminate or to reduce considerably any heteroskedasticity in the residuals of the estimated model. In light of the existing literature, the

theoretical model used to examine the relationship between gross domestic savings and economic growth is stated as follows:

$$\Delta LY_t = f\{(\Delta LY_{t-i}), (\Delta LS_{t-i})\} \quad \text{.....(3.7)}$$

$$\Delta LS_t = f\{(\Delta LY_{t-i}), (\Delta LS_{t-i}),\} \quad \text{.....(3.8)}$$

where LY_t and LS_t are the natural logarithm of per capita real GDP, used as proxy for economic growth, and natural logarithm of gross domestic savings respectively, Δ is difference operator, ΔLS_{t-i} is lagged values of gross domestic savings and ΔLY_{t-i} is the lagged values of per capita real GDP.

3.4 0 Econometric Estimation Technique

3.4.1 Unit Root Test

To estimate the model, the first thing to determine is the order of integration of the variables LY_t, and LS_t. The Augmented Duckey-Fuller (ADF) test is used to test for unit root. The ADF test is preferred due to its simplicity and the fact that it has widely been used with satisfactory result. The presence of unit root indicates that the variables are not stationary. The Augmented Duckey-Fuller test is in two forms: one with only intercept and another with intercept and trend. The one that is chosen depends on the nature of curvature of the variable being tested for unit root. If the curvature of a time series variable exhibit trend, then, the Augmented Dickey-Fuller test is conducted with intercept and trend. On the other hand, if the curvature of a variable exhibits no trend, then, the ADF Test is performed with only intercept. The ADF test equation is stated as:

$$\Delta X_t = \varphi_0 + \beta_1 X_{t-1} + \delta t + \sum_{i=1}^{n} \theta_i \Delta X_{t-1} + \varepsilon_t \quad \text{.....(3.11)}$$

where Δ is the first difference operator, t is the time trend, ε is the stationary random error, φ_0 is a constant, and β_1 is a coefficient. The null hypothesis is that the series contains a unit root which implies that $\beta_1 = 0$. The null hypothesis that the series contains a unit root is accepted if the calculated value, in absolute terms, is less than 1%, 5% or 10% critical value. On the other hand, the null hypothesis is rejected if β_1 is negative and statistically significant. In this case the calculated value, in absolute terms, is more than 1%, 5% or 10% critical value.

Where the null hypothesis is accepted, it means the series contains a unit root and thus the series is non-stationary. Dynamic modelling using variables when the stochastic process is non-stationary can produce invalid estimates. Granger and Newbold (1974) called such estimates 'spurious regression' results: high R^2 values and high t-ratios yielding results with no economic meaning. In the presence of unit root in the series, the series are differenced to avoid spurious regression results. The equation for differencing is:

$$\Delta y_t = y_t - y_{t-1} = \varepsilon_t \quad \text{.....(4.1)}$$

where Δ is the difference operator and ε_t is the stochastic term. ADF test is conducted again on the differenced data. The null hypothesis is rejected if β_1 is negative and statistically significant else the series should be differenced over again until stationarity is achieved. The standard econometric practice is, however, that series should be differenced up to two. If stationarity is not achieved by differencing two times a variable, the series should be abandoned.

3.4.2 Cointegration Test

When stationarity is achieved, the long run relationship between the variables in the study must be determined. The Engel and Granger (1987) co-integration test procedure is used to determine whether or not a long-run relationship exists between the variables. The Engel and Granger cointegration is particularly appropriate since we are dealing with only two time series variables. The Engel and Granger co-integration test procedure requires time series in the system to be non-stationary in their levels. Moreover, it is imperative that all time series in the co-integrating equation have the same order of integration. The Engel-Granger co-integration test procedure is a two-step residual based co-integration procedure.

Taken Y_t as the dependent variable, the ***first step*** involves regressing Y_t on X_t on their levels and then generating the residuals. ***The second step*** is testing the residual using the Augmented Dicker-Fuller test procedure. If the residual is integrated of order zero *{I(0)}*, implying that the residual has no unit root, then the variables Y_t and X_t are co-integrated otherwise the variables are not co-integrated. The existence of co-integration between the two variables suggests the presence of causality between them in at least one direction. Its absence, however, does not mean there is no causality between the variables.

3.4.3 Granger Causality Test

If the variables in the series are not co-integrated, then the causal relationship between economic growth and gross domestic savings is examined with the help of a Granger causality procedure based on Vector Autoregressive (VAR) model (Adebiyi, 2000; Mohan, 2006). In this study, the VAR model is expressed in equations (3.9) and (3.10). A VAR model serves as a flexible

approximation to the reduced form of any wide variety of simultaneous structural models. Besides, it allows causality to emerge from the joint coefficients (F-statistic) of the lagged values of the explanatory variables even where the variables are not co-integrated. The VAR model is stated as follows:

$$\Delta LY_t = \Omega_o + \sum_{i=1}^{r} \Omega_{1i} \Delta LY_{t-i} + \sum_{j=1}^{r} \Omega_{2j} \Delta LS_{t-j} + \mu_t \quad \text{.....(3.9)}$$

$$\Delta LS_t = \Phi_o + \sum_{i=1}^{s} \Phi_{1i} \Delta LY_{t-i} + \sum_{j=1}^{s} \Phi_{2j} \Delta LS_{t-j} + \varepsilon_t \quad \text{.....(3.10)}$$

where $\mu_t and \varepsilon_t$ are the stochastic error terms, and r and s represent the operational lag lengths determined by applying the Akaike Information and Schwartz - Bayesian Criterion, Δ represents the difference operator, ΔLY_t is the growth rate of per capita real GDP (defined as the changes in the logarithm of per capita real GDP in period t). This is used as a measure of economic growth because it takes into consideration the total population of the country. ΔLS_t is the growth rate of gross domestic savings (defined as the changes in the logarithm of GDS in period t). Ω_{2j} and Φ_{2j} are the coefficients of growth rates of savings in equations (3.9) and (3.10) respectively. Ω_{1i} and Φ_{1i} are the coefficients of growth rates of per capita real GDP in equations (3.9) and (3.10) respectively.

In equations (3.9) and (3.10) the lagged values per capita real GDP and gross domestic savings respectively are included in the explanatory variables to eliminate the business cycle effect between per capita real GDP and growth rate of gross domestic savings. According to standard economic theory, during recessions, it is expected that savings will decrease or the growth rate of savings (ΔLS_t) be less than the growth rate of per capita real GDP because consumers dis-save during the hard times to maintain a fairly even consumption pattern. Similarly, savings is

expected to increase or ΔLS_t to exceed ΔLY_t during economic boom as people save more in anticipation of the next downturn in the economy. Thus, one expects a positive correlation between gross domestic savings and per capita real GDP simply because of the business cycle effects.

However, Granger (1969) or Engle-Granger (1987) causality test is expected to eliminate this problem of business cycle effects. Included among the explanatory variables for ΔLY_t are lagged values of ΔLY_t. Thus, if ΔLY_t rises at the same time as ΔLS_t, due to the business cycle, this effect will be captured by the coefficient of the lagged values of ΔLY_t rather than by the coefficient of the lagged values of ΔLS_t. Similarly, the lagged values of ΔLS_t will capture the business cycle effect when ΔLS_t is used as the dependent variable. Thus, one expects that Ω_{1_i}, $\Phi_{2_j} > 0$; where i = 1, 2 … and j = 1, 2…..

Again, Harrod (1939), Domer (1946) and Solow (1956) indicate increase in savings translate into high investment, which in turn stimulates economic growth. The apparent effect of higher savings is to increase the availability of funds for investment. The more capital goods a nation has at its disposal, the more goods and services it can produce. In Romer (1986) growth model in which technology is endogenised, an increase in the saving rate not only increases per capita output in steady state but also increases the growth *rate* of per capita output. These theories indicate that there is a positive correlation between economic growth and savings; hence in equation (3.9) $\Omega_{2_j} > 0$ where j=1, 2 ….

The lifecycle theory of saving and consumption developed by Japelli and Pagano, (1994) predicts that changes in an economy's rate of economic growth will affect its aggregate saving. According to Aylit (2003), that per capita output has a positive effect on private saving is consistent with the life-cycle hypothesis of saving and consumption. Thus, it is expected that in equation (3.10) $\Phi_{1_i} > 0$ where i=1, 2…...

In the VAR model, the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP if the sum of the Ω_{2j}'s in equation (3.9) is statistically significant and the sum of Φ_{1i}'s in equation (3.10) is not. The causality is from the growth rate of per capita real GDP to growth rate of gross domestic savings if the sum of the Ω_{2j}'s in (3.9) is not significant but the sum of Φ_{1i}'s in (3.10) is. There is bidirectional causality if both the Ω_{2j}'s and the Φ_{1i}'s are statistically significant.

On the other hand, Vector Error Correction Model (VECM) is used where the series are co-integrated. This procedure is particularly attractive over the standard VAR because it permits temporary causality to emerge from:

(1) The sum of the lagged coefficients of the explanatory differenced variables, and

(2) The coefficient of the error-correction term.

In other words, the VECM allows causality to emerge even if the coefficients of the lagged differences of the explanatory variable are not jointly significant (Granger, 1983; Engle and Granger, 1987; Miller and Russek, 1990; Miller, 1991; Dawit, 2005). In this study, the error-correction model is expressed as follows:

$$\Delta LY_t = \Omega_o + \sum_{i=1}^{r} \Omega_{1_i} \Delta LY_{t-i} + \sum_{j=1}^{r} \Omega_{2_j} \Delta LS_{t-j} + \Omega_3 Z_{t-1} + \mu_t \quad \text{.....(3.12)}$$

$$\Delta LS_t = \Phi_o + \sum_{i=1}^{s} \Phi_{1_i} \Delta LY_{t-i} + \sum_{j=1}^{s} \Phi_{2_j} \Delta LS_{t-j} + \Phi_3 Z_{t-1} + \varepsilon_t \quad \text{.....(3.13)}$$

where $\mu_t and \varepsilon_t$ are the stochastic error terms, and r and s represent the operational lag lengths determined by applying the Akaike Information and Schwartz- Bayesian Criterion, Δ represents the difference operator, ΔLY_t is the growth rate of real per capita GDP (defined as the changes in the logarithm of real GDP per capita in period t). ΔLS_t is the growth rate of savings (defined as the changes in the logarithm of GDS in period t) and Z_{t-1} is the error correction term with one lag. The growth rate of savings causes real per capita GDP growth if the sum of the Ω_{2j}'s or Ω_3 in equation (3.12) is statistically significant, but neither the sum of the Φ_{1i}'s nor the b_3 in equation (3.13) is statistically significant. The causality is from the growth rate of real per capita GDP to growth rate of savings if the sum of the Ω_{2j}'s or Ω_3 in (3.12) is not significant but the sum of Φ_{1i}'s or Φ_3 in equations (3.13) is. There is bidirectional causality if both the sum of the Ω_{2j}'s or Ω_3 and either the sum of the Φ_{1i}'s or Φ_3 are statistically significant. According to Engle and Granger (1987), Z_{t-1} is statistically significant if the sign is negative and between zero and two.

To be double sure of the results of either the VECM or the VAR model, the Pairwise Granger Causality test is performed to affirm or refute the results of any one of the two models already mentioned. The null hypothesis is that there is no causal relationship between the growth rate of gross domestic savings and the growth rate of per capita real GDP. The alternative hypothesis is that there is a causal relationship between growth rate of gross domestic savings and the growth rate of per capita real GDP.

3.5.0 Diagnostic Tests

Diagnostic tests are performed to assess the performance of the VAR model or VECM used in running the regression. These tests include autocorrelation test, normality test and stability test.

3.5.1 Autocorrelation Test

The model assumes that successive values of the random variable u are temporally independent and that the value which u assumes in any one period is independent from the value it assumed in any previous period. This implies that the covariance of u_i and u_j equals zero. If this assumption is not satisfied, then the value of u in any particular period is correlated with its own preceding value (or values). This is known as autocorrelation or serial correlation of the random variable u. Where the random term is autocorrelated, the parameter estimates are still statistically unbiased but the variances of the parameter estimates are likely to be larger or the variance of the random term may be seriously underestimated or the predictions based on the parameter estimates will be inefficient in the sense that the variance is large. The null hypothesis of no serial correlation at lag order "h" is tested against alternative hypothesis of serial correlation is the VAR model. If the result is insignificant, the null hypothesis is accepted; if the result is significant, the null hypothesis is rejected implying the presence of serial correlation.

3.5.2 Normality Tests

The model assumes that the random variable u has a normal distribution. Symbolically: $u \sim N(0, \delta^2_U)$, which reads: u is normally distributed around zero mean and constant variance $\delta^2_{U.}$ This means that small values of u's have a higher probability to be observed than large values. This assumption is necessary for conducting statistical tests of significance of the parameter estimates

and for constructing confidence intervals. If the assumption of normality is violated, the estimates of parameters are still unbiased but the statistical reliability by the classical tests of significance (t-statistic and F-statistic) of the parameter estimates cannot be assessed because these tests are based on the assumption of normal distribution of the u's. The null hypothesis is that the u's have normal distribution against the alternative hypothesis that the the u's are not normally distributed.

3.5.3 Stability Test

Stability test is conducted to assess the stability of the coefficients of the model. Two tests are conducted: root of characteristic polynomial of the VAR model in table form and in graph. The null hypothesis is that the test results satisfy the stability condition against the alternative hypothesis that the test results do not satisfy the stability condition.

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Introduction

In this chapter, the results obtained from the various tests and model are presented and analyzed. The analysis covers the results obtained from the stationarity tests, the co-integration test, the causality test from the VAR model or the Vector Error Correction Model and its confirmation or refutation by the Pairwise Granger Causality test as well as diagnostic tests. The study employs annual time series data covering the period 1961 to 2008. All the variables are measured in natural logarithms.

4.2.0 Results of Econometric Estimations

4.2.1 Results of Unit Root Tests

In other to find the causal relationship between gross domestic savings and economic growth, the first thing to determine is the order of integration of the variables to determine whether they are stationary or non-stationary, that is, whether they follow a stochastic trend or follow a random walk. The variables are first presented in their logarithmic forms in graphs to determine the appropriate statistically method to use. For instance, the diagrams determine whether to choose only the intercept or the intercept with trend. The diagrams are presented in figure 4.1 and figure 4.2.

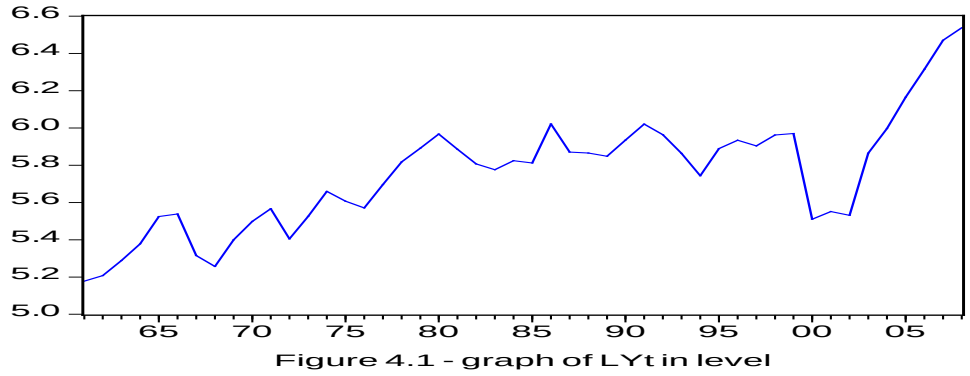


Figure 4.1 - graph of LYt in level

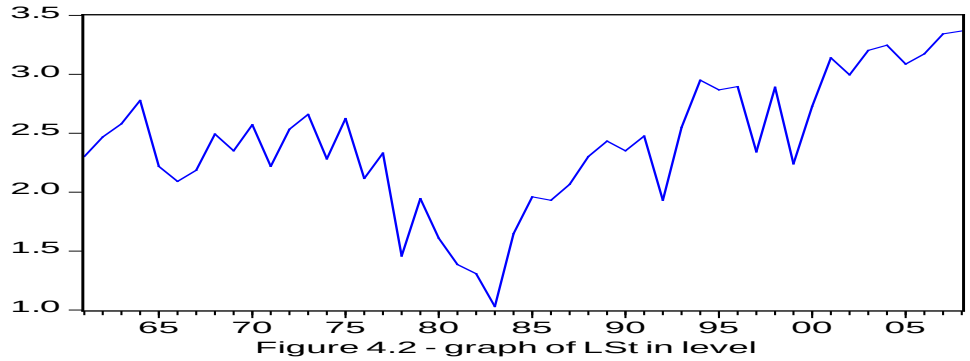


Figure 4.2 - graph of LSt in level

A careful examination of figures 4.1 and 4.2 in reveals that the variables are non-stationary. It is very clear that the graph of LY_t in level exhibits trend whilst that of LS_t exhibits a falling part for the first part of the graph and a rising trend for the second part of the grapn. The Augmented Dickey-Fuller test (ADF, 1971, 1981) statistic is used to affirm or refute the results in figures 4.1 and 4.2. The ADF test takes two forms: intercept without trend and intercept with trend. The lag dimension of the ADF test regressions are determined by the Akaike Information Criterion (Akaike, 1973) and Schwarz Information Criterion (SIC). The graphs of fig. 4.1 and 4.2 exhibit non-stationarity. The ADF tests confirm the nature of the graphs that they are non-stationary in their levels. Table 4.2a displays the results of the unit root test in levels.

Table 4.2A Unit Root Test in Levels

Augmented Dickey-Fuller Test Statistic *Ho: series has unit root; H1: series has no unit root* *Log-Levels*			
Variable	**Constant**	**Constant with Trend**	**Order of Integration**
LS_t	-0.105315	-1.204641	*I(1)*
LY_t	-0.446726	-0.725281	*I(1)*

The ADF test involves testing the null hypothesis of non-stationarity of the variables against the alternative hypothesis of stationarity. Due to the curvature of fig. 4.1 and 4.2, it is more appropriate to apply the ADF test of ***constant with trend*** in testing LY_t since the graphical representation of LY_t exhibits trend and in the case of LS_t apply ADF test of ***constant*** only. From table 4.2a, at the log-levels, the null hypothesis of non-stationarity (constant and constant with trend) cannot be rejected. This implies that the variables are not stationary at their log-levels and that they are integrated of order one, that is, *I(1)* as shown in column four of table 4.2a. The results of the Augmented Duckey-Fuller test in table 4.2a affirms that the variables are non-stationary in their levels.

The graphs of the variables in first difference are shown in figures 4.3 and 4.4 as follows:

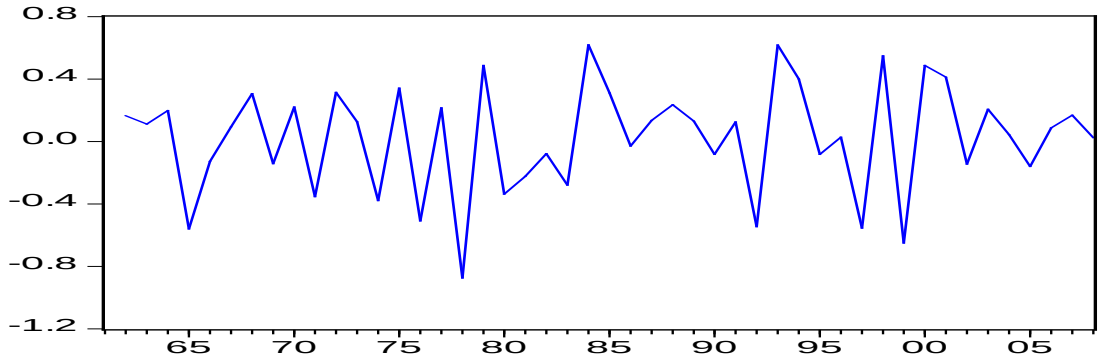


Figure 4.3 - graph of LSt in first difference

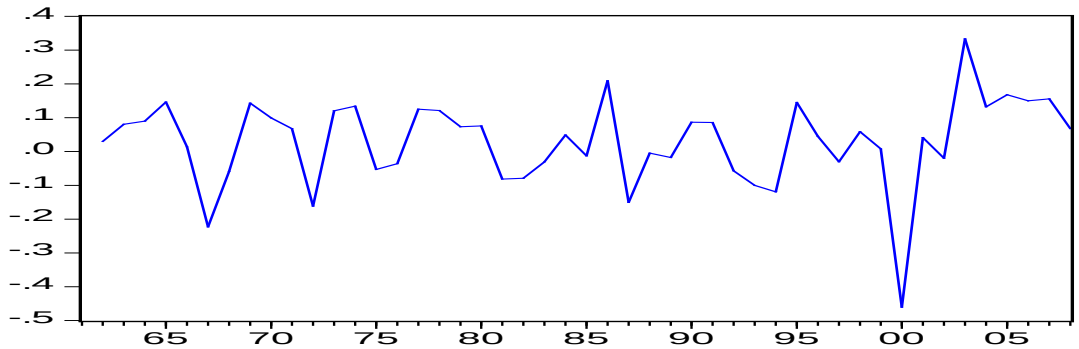


Figure 4.4 - graph of LYt in first difference

A careful examination of fig. 4.3 and 4.4 reveals that the series are stationary in first difference. The ADF test is again used to confirm or refute the results of the graphs. The results are presented in table 4.2b.

` Table 4.2B Unit Root Test in First Difference

Augmented Dickey-Fuller Test Statistic *Ho: series has unit root; H1: series has no unit root* *Log-First Difference*			
Variable	**Constant**	**Constant with Trend**	**Order of Integration**
Δ LS_t	-10.45711***	-10.73098***	*I(0)*
Δ LY_t	-5.284851***	-5.388642***	*I(0)*
Note: *** indicate statistical significance at 1% level and Δ implies first difference operator.			

The result of ADF test in table 4.2a indicates that the variables are non-stationary; however, they become stationary after the first difference. This is shown in column four of table 4.2b where the variables are integrated of order zero, that is, *I(0).* The results affirm the results in the graphs that the series are stationary after their first difference. Thus, the results from all the tests suggest that

the variables are integrated of order one, that is, *I(1)* in their log-levels but become integrated of order zero, that is, *I(0)* in their first difference indicating the presence of unit root in the data.

4.2.2 Result of Co-integration Test

Having achieved stationarity, accordingly, as Engle and Granger (1987) indicate, there should be a co-integration test. The existence of co-integration between the variables is an indication that there is a long run relationship between the variables. The co-integration test is performed using Engel and Granger two-step residual based test. The results are presented in table 4.3.

Table 4.3 - Results of Engel-Granger Cointgration Test – Variables in Levels

Step 1:

Dependent Variable: GDS
Estimation Method: Ordinary Least Squares
Sample: 1961 2008
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INCOME	-0.008090	0.004594	-1.761045	0.0849
CONSTANT	10.87403	1.592182	6.829643	0.0000

R-squared	0.063161	Mean dependent var	8.204167
Adjusted R-squared	0.042795	S.D. dependent var	3.444327
Log likelihood	-125.4009	F-statistic	3.101280
Durbin-Watson stat	0.983469	Prob(F-statistic)	0.084877

Step 2:

	ADF	**PP**	**KPSS**	**DF-GLS[+]**
Test statistics	***-1.8862***	***-3.3835***	***0.1662[*]***	***-2.1869***
Critical values: 1% level	-4.1706	-4.1658	0.2160	-3.7700
Critical values: 5% level	-3.5107	-3.5085	0.1460	-3.1900

[+] Elliot-Rothenberg-Stock DF-GLS test statistics
[*] indicates significant at 5%

It can generally be concluded that at 5% level of significance, gross domestic savings and per capita real GDP are not co-integrated when the variables are in levels. This result is consistent

for the entire test statistics used except in the case of KPSS where it is found that the gross domestic savings (GDS) and per capita real GDP (PCY) are co-integrated at 5% level of significance. Therefore, when Granger causality is run on these two variables (GDS and PCY) in their levels, the results may be unreliable and misleading. In table 4.3b the Engel–Granger cointegration test result in presented with the variables in their first differences. The result of the cointegration means that there is no long run relationship between gross domestic savings and economic growth. In view of the absence of cointegration between the variables, we estimate the granger causality using VAR model. However, we have to first estimate the VAR lag order selection criterion to enable us to know the extent of the lag length that we should use in estimating the VAR model.

4.2.3 Result of VAR Lag Order Selection Criteria

The result of the Vector Autoregressive Lag Order Selection Criteria is presented in table 4.4. This result shows the number of lags that should be used in the VAR model. The lag order selection is essentially determined by Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC).

Table 4.4 Result of VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LY_t LS_t
Exogenous variables: C

Sample: 1961 2008
Included observations: 44

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-407.2817	NA	411669.3	18.60371	18.68481	18.63379
1	-344.2477	117.4725	28141.99	15.92035	16.16365	16.01058
2	-334.4466	17.37459*	21652.62*	15.65666*	16.06216*	15.80704*
3	-332.1997	3.778939	23530.35	15.73635	16.30405	15.94688
4	-331.2339	1.536385	27179.60	15.87427	16.60417	16.14495

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4.4 indicates that the appropriate lag length criteria are 2. This is based on the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Final Prediction Error (FPE) and Hannan-Quinn Information Criterion (HQ). Accordingly, the VAR model uses two lag lengths.

4.2.4 Result of the VAR Models

The co-integration test shows that the variables are not co-integrated. Consequently, the causality test is conducted using the VAR model. The results of the co-integrated test conform to VAR model. The VAR model allows causality to emerge even when the variables are not co-integrated (Saltz, 1999). The results of the model are presented in tables 4.5a and 4.5b.

Table 4.5A Results of VAR Model – Growth Equation

Vector Autoregressive Estimates Sample (adjusted): 1963 2008 Included observations: 46 after adjustment Dependent variable: ΔLY_t			
Regressor	Coefficient	Standard Error	t-statistic
Constant	0.395769	0.41053	0.96405
ΔLY_{t-1}	1.049368	0.15459	6.78804***
ΔLY_{t-2}	-0.142484	0.15816	-0.90089
ΔLS_{t-1}	0.126556	0.05463	2.31674**
ΔLS_{t-2}	-0.058371	0.05936	-0.98337
R-squared		0.831585	
Adj. R-squared		0.815154	
Sum sq. resides.		0.622879	
S.E. equation		0.123257	
Log likelihood		33.67583	
F-statistic		5.061157***	
Akaike AIC		-1.246775	
Schwarz SC		-1.048010	
Mean dependent		5.776948	
SD dependent		0.286685	

Table 4.5B Results of VAR Model – Savings Equation

Vector Autoregressive Estimates Sample (adjusted): 1963 - 2008 Included observations: 46 after adjustment Dependent variable: ΔLS_t			
Regressor	Coefficient	Standard Error	t-statistic
Constant	-0.562946	1.02383	-0.54985
ΔLY_{t-1}	0.914245	0.38554	2.37135**
ΔLY_{t-2}	1.026023	0.39444	2.60124 **
ΔLS_{t-1}	0.505141	0.13623	3.70787***
ΔLS_{t-2}	0.486419	0.14804	3.28583***
R-squared		0.725592	
Adj. R-squared		0.698820	
Sum sq. resides.		3.874098	
S.E. equation		0.307393	
Log likelihood		-8.361613	
F-statistic		7.10312***	
Akaike AIC		0.580940	
Schwarz SC		0.779705	
Mean dependent		2.410912	
SD dependent		0.560119	

Tables 4.5a and 4.5b present the results of the VAR model used for the Granger Causality test. The model has two equations: one with ΔLY_t as the dependent variable whose results are presented in table 4.5a and the one with ΔLS_t as the dependent variable whose results are presented in table 4.5b.

In table 4.5a, the constant of ΔLY_t has the correct positive sign because the intercept of the aggregate demand curve should start from the positive value of the y-axis. The dependent variable has two lags used as independent variables. The first lag has the expected positive sign and is statistically significant, meaning that the current growth rate of per capita real GDP is strongly positively influenced by its immediate past growth rate. The second lag, however, has a negative sign and it is statistically insignificant. This does not conform to theory and the implication is that the current growth rate of per capita real GDP is not affected by its value two years ago. Again, the table shows that the current growth rate of per capita real GDP is positively and significantly affected by the immediate past value of growth rate of gross domestic savings. This is because the first lag of savings has the expected positive sign and its value is statistically significant. On the other hand, the second lag of growth rate of savings has the unexpected negative sign and statistically insignificant. This means the second lag of growth rate of savings does not impact on the value of growth rate of per capita real GDP. The value of the F-statistic of 5.061157 implies that the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP. The R-squared value of 0.831583 implies that more than 83% of the value of the dependent variable has been explained by the independent variables.

Table 4.5b has the growth rate of savings (ΔLS_t) as the dependent variable. Here too, the intercept of ΔLS_t has the correct negative sign because the intercept of the savings function is negative on the y-axis. The coefficient of the first lag of the growth rate of per capita real GDP has the expected positive sign and statistically significant. This implies that the growth rate of per capita income of the immediate past year positively influences the growth of savings in the current period. The second lag of the growth rate of per capita real GDP too has the correct

positive sign and statistically significant. Thus, the growth rate of per capita income positively affects the growth rate of gross domestic savings.

The lags of savings have the expected signs. Both have positive signs and statistically significant. However, the first lag is more significant than the second lag. This implies that the growth rate of savings is more influenced by its immediate past value than its remote past values. The value of the F-statistic of 7.10312 is an indication that the growth rate of per capita real GDP granger causes the growth rate of gross domestic savings. The R-squared value of 0.725592 indicates that more than 72% of the dependent variable is explained by the independent variables.

However, in the growth equation in table 4.5a, it is realised that the second lag of per capita real GDP (ΔLY_{t-2}) and the second lag of gross domestic savings (ΔLS_{t-2}) are insignificant. Consequently, they are taken out and the equation estimated again via VAR. The result is presented in table 4.5c.

Table 4.5C

Vector Autoregression Estimates
Sample (adjusted): 1963 2008
Included observations: 46 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	ΔLS_t	ΔLY_t
ΔLS_{t-1}	0.498022	0.290207
	(0.12810)	(0.03579)
	3.88790***	2.00546**
ΔLY_{t-1}	1.194858	0.144055
	(0.52312)	(0.14615)
	2.28411**	1.98568*
C	-0.031437	0.024758
	(0.06852)	(0.01914)
	[-0.45878]	[1.29330]
R-squared	0.700582	0.656404
Adj. R-squared	0.668051	0.624377
Sum sq. resids	8.858703	0.691437
S.E. equation	0.453890	0.126807
F-statistic	9.239859***	4.293827***
Log likelihood	-27.38463	31.27418
Akaike AIC	1.321071	-1.229312
Schwarz SC	1.440330	-1.110053
Mean dependent	-0.002879	0.028913
S.D. dependent	0.530531	0.130402

Determinant resid covariance (do adj.)	0.003299
Determinant resid covariance	0.002883
Log likelihood	3.984928
Akaike information criterion	0.087612
Schwarz criterion	0.326130

If we consider the savings equation (ΔLS_t) in table 45c, the constant has the expected negative sign. The first lag of savings (ΔLS_{t-1}**)** has the expected positive sign and is statistically significant. This means that the current growth rate of savings is positively and strongly

influenced by its immediate past values. Again, the first lag of per capita real GDP (ΔLY_{t-1}) has the expected positive sign and is statistically significant. The implication is that, as it is expected, the immediate past income positively and significantly influence our savings habit in the country. The F-statistic (9.239859) is statistically significant. The implication is that the growth rate of per capita real GDP or the growth of per capita income granger causes the growth rate of gross domestic savings.

The growth equation (ΔLY_t) in table 4.5c has the expected constant positive coefficient. The first lag of savings (ΔLS_{t-1}**)** has the expected positive sign and is statistically significant. This means that the current growth rate of per capita income is influenced positively and strongly by the growth rate of immediate past value of growth rate. This supports economic theory of those who advocates that savings through investment leads to economic growth of the country. The fist lag of per capita income has the expected positive sign and is statistically significant. The implication is that growth rate of per capita GDP is positively and strongly influenced by its immediate past value. The F-statistic (4.293827) is statistically significant. This implies that the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP. The result is in line with the result first obtained in the first two equations in table 4.5a and 4.5b that there is bidirectional causality between gross domestic savings and economic growth in Ghana.

To determine how robust the results obtained are, the lag length was extended to three and the model estimated. The result of the three lag length is presented in table 4.5d.

Table 4.5D
Vector Autoregression Estimates
Sample (adjusted): 1965 2008
Included observations: 44 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	ΔLS_t	ΔLY_t
ΔLS_{t-1}	0.584792	0.121471
	(0.16593)	(0.04479)
	3.52423***	2.71201***
ΔLS_{t-2}	0.288939	0.061006
	(0.18364)	(0.05529)
	1.57343	1.10339
ΔLS_{t-3}	0.066949	0.056800
	(0.17072)	(0.04608)
	0.39215	1.23268
ΔLY_{t-1}	1.607966	0.362893
	(0.58818)	(0.15875)
	2.73380***	2.28594**
ΔLY_{t-2}	1.340501	0.314170
	(0.61113)	(0.16494)
	1.19348	1.00823
ΔLY_{t-3}	0.166963	-0.114280
	(0.62590)	(0.16893)
	0.26676	-0.67649
C	-0.027412	0.028499
	(0.07558)	(0.02040)
	[-0.36266]	[1.39698]
R-squared	0.334651	0.193855
Adj. R-squared	0.226757	0.063129
Sum sq. resids	8.394487	0.611510
S.E. equation	0.476317	0.128559
F-statistic	4.101656**	3.748291**
Log likelihood	-25.98778	31.63901
Akaike AIC	1.499444	-1.119955
Schwarz SC	1.783293	-0.836106
Mean dependent	-0.007183	0.026359
S.D. dependent	0.541674	0.132819

Determinant resid covariance (dof adj.)	0.003701
Determinant resid covariance	0.002617
Log likelihood	5.941330
Akaike information criterion	0.366303
Schwarz criterion	0.934000

In table 4.5d, three lag lengths are used. In the savings equation (ΔLS_t), the constant has the expected negative sign. The first lag of savings (ΔLS_{t-1}) has the expected positive sign and is statistically significant. This means that the growth rate of savings is positively and strongly influenced by its own past values. The second lag (ΔLS_{t-2}) and third lag ($\Delta LS_{t-}3$) of savings have the expected positive signs but are not statistically significant. The implication is that the impact of past values of savings on the current value reduces as we move into the distant past. The first lag of per capita real GDP (ΔLY_{t-1}) on savings has the expected positive sign and is statistically significant. This means the current growth rate of gross domestic savings is positively and strongly influenced by the immediate growth rate of per capita real GDP. However, though the second lag (ΔLY_{t-2}) and the third lag (ΔLY_{t-3}) of per capita real GDP have the expected signs on savings, they are not statistically significant. The F-statistic of 4.101656 is however statistically significant. This means that the growth rate of per capita real GDP granger causes the growth rate of gross domestic savings.

In the growth equation (ΔLY_t), the constant has the expected positive sign. The first lag of savings (ΔLS_{t-1}) on growth has the expected positive sign and is statistically significant. The second lag of savings (ΔLS_{t-2}) and the third lag of savings (ΔLS_{t-3}) on growth have the expected positive signs but they are statistically insignificant. We may thus conclude that the immediate past values of savings have stronger impact on growth than remote past values. The first lag of

per capita real GDP has the expected sign and is statistically significant. The second lag (ΔLS_{t-2}) has the correct positive sign but is not statistically significant. The third lag (ΔLS_{t-3}) has the wrong negative sign and is statistically insignificant. The F-statistic of 3.748291 is statistically significant. This means that the growth rate of gross domestic savings granger causes the growth rate of per capita GDP in Ghana. There is, again, bidirectional causality between savings and economic growth in Ghana.

4.6 Result of Pairwise Granger Causality Test

The results of the VAR model suggest bi-directional causality. In other words, the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP and vice-versa. The Pairwise Granger Causality Test is performed to affirm or refute the results of the VAR model. Table 4.6 illustrates the results of the Pairwise GC test.

Table 4.6 Result of Pairwise Granger Causality Test

Pairwise Granger Causality Test

Sample: 1961 2008

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
ΔLS_t does not Granger Cause ΔLY_t	46	3.83212	0.04679
ΔLY_t does not Granger Cause ΔLS_t		7.49118	0.00898

The null hypotheses are in two forms: growth rate of gross domestic savings does not granger cause the growth rate of per capita real GDP and the growth rate of per capita real GDP does not

granger cause the growth rate of gross domestic savings against the alternative hypotheses that the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP and the growth rate of per capita real GDP granger causes the growth rate of gross domestic savings. From the results, the null hypothesis that the growth rate of gross domestic savings does not granger cause the growth rate of real per capita GDP is rejected at 5% significance level. Thus, the alternative hypothesis holds that the growth rate of gross domestic savings granger causes the growth rate of per capita real GDP. Again, the null hypothesis that the growth rate of per capita real GDP does not granger cause the growth rate of gross domestic savings is rejected at 1% level of significance. Hence, the alternative hypothesis holds that the growth rate of per capita real GDP granger causes the growth rate of gross domestic savings.

The results indicate bi-directional causality between gross domestic savings and economic growth. The results of this study confirm the studies done by Lean and Song (2009), Mohan (2006), Saltz (1999) and Mavrotas and Kelly (2002).

The findings of this study fail to accept the null hypothesis that there is no causal relationship between growth rate of gross domestic savings and growth rate of per capita real GDP. The findings, however, fail to reject the alternative hypothesis that there is a causal relationship between growth rate of gross domestic savings and the growth rate of per capita real GDP. Again, the findings of this study contrast the findings of Anoruo and Ahmed (2002) who found the direction of causality running from the growth rate of per capita real GDP to the growth rate of gross domestic savings. The findings of this study finds a bi-directional causality between growth rate of per capita real GDP and the growth rate of gross domestic savings.

4.7.0 Results of Diagnostic Tests

The results obtained from the various diagnostic tests are presented below. The results include autocorrelation test, normality test and stability test.

4.7.1 Result of Autocorrelation Test

The result of the test is presented in table 4.6a in appendix 3 in page 78. Breush-Godfrey Lagrange Multiplier (LM) test is used to perform VAR Residual Serial Correlation Test. Autocorrelation may arise due to omitted explanatory variables, mis-specification of the mathematical form of the model, interpolation in the statistical observations or mis-specification of the true random term. The table shows that at lag order 12, the results are not significant so the null hypothesis of no serial correlation in the model is accepted. This implies that the random variable “u” is not correlated with its previous values; hence there is no serial correlation in the model.

Table 4.7A – Result of Residual Serial Correlation Test

VAR Residual Serial Correlation LM Test

H_0: no serial correlation at lag order h

Sample: 1961 2008

Included observations: 45

Lags	LM-Stat	Prob
1	2.249747	0.6899
2	1.815996	0.7696
3	1.688799	0.7928
4	2.397340	0.6631
5	3.164802	0.5306
6	2.887378	0.5768
7	0.460865	0.9772
8	3.806294	0.4329
9	1.085952	0.8965
10	4.666744	0.3232
11	2.116539	0.7143
12	1.265906	0.8671

Probs from chi-square with 4 df.

4.7.2 Results of Normality Test

The result of the normality test is presented in table 4.7b in appendix 4 in page 79. The results of the VAR normality tests presented in table 4.7b reveal that the chi-squared results of Skewness and Kurtosis are statistically insignificant, so is the result of Jarque-Bera statistic. Thus, the null hypothesis of normal distribution of the residuals is not rejected. These results are confirmed by

residual graphs of fig. 4.5 and 4.6 in appendix 5 in page 80. These graphs show that the residuals are normally distributed.

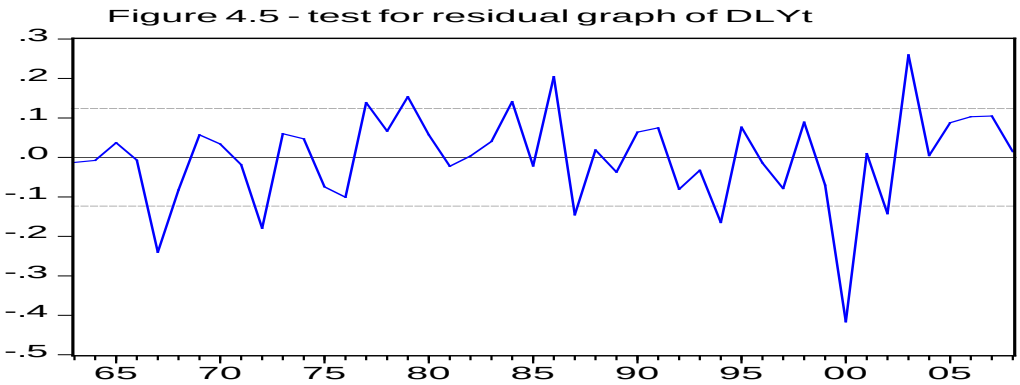
Table 4.7B – Result of Residual Normality Test
VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H_0: residuals are multivariate normal
Sample: 1961- 2008
Included observations: 46

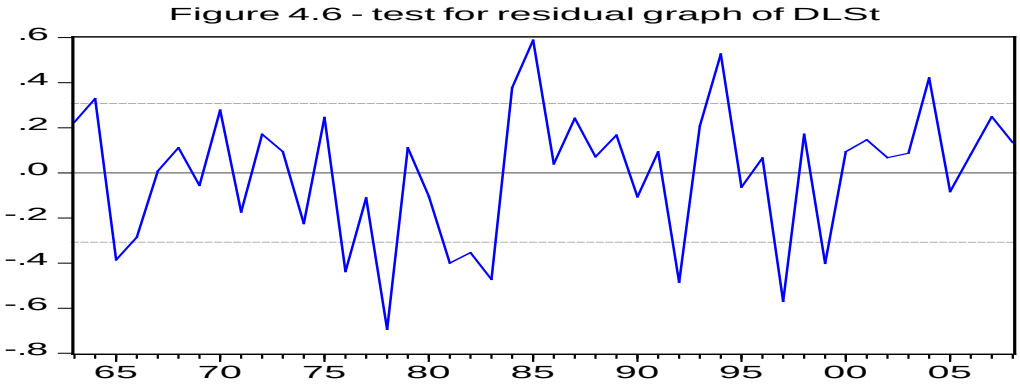
Component	Skewness	Chi-sq	df	Prob.
1	-0.351316	0.946242	1	0.3307
2	-0.730696	4.093366	1	0.0631
Joint		5.039608	2	0.1805

Component	Kurtosis	Chi-sq	df	Prob.
1	2.106917	1.528730	1	0.2163
2	4.160344	2.580597	1	0.1082
Joint		4.109327	2	0.1281

Component	Jarque-Bera	df	Prob.
1	2.474971	2	0.2901
2	6.673963	2	0.0555
Joint	9.148935	4	0.1075

Tests for Residual Graphs of DLY_t and DLS_t





4.7.3 Result of Stability Test

The result of the root of characteristic polynomial of the VAR is presented in table 4.7c and it indicates that the VAR model satisfies the stability condition. This implies that the parameters of the model are stable over the whole of the sample period. This result is confirmed by the graph result of Inverse Roots of Autoregressive (AR) Characteristic Polynomial of figure 4.7. Table 4.7c shows that "no root lies outside the unit circle." Thus, the stability tests reveal that the parameter estimates of the model are stable at least over the sample period.

Table 4.7C – Result of Stability Test

Roots of Characteristic Polynomial

Endogenous variables: ΔLY_t ΔLS_t

Exogenous variables: C

Lag specification: 1 2

Root	Modulus
-0.617844	0.617844
0.232028 - 0.331795i	0.404877
0.232028 + 0.331795i	0.404877
-0.210345	0.210345

No root lies outside the unit circle.

VAR satisfies the stability condition.

Result of Inverse Roots of AR Characteristic Polynomial

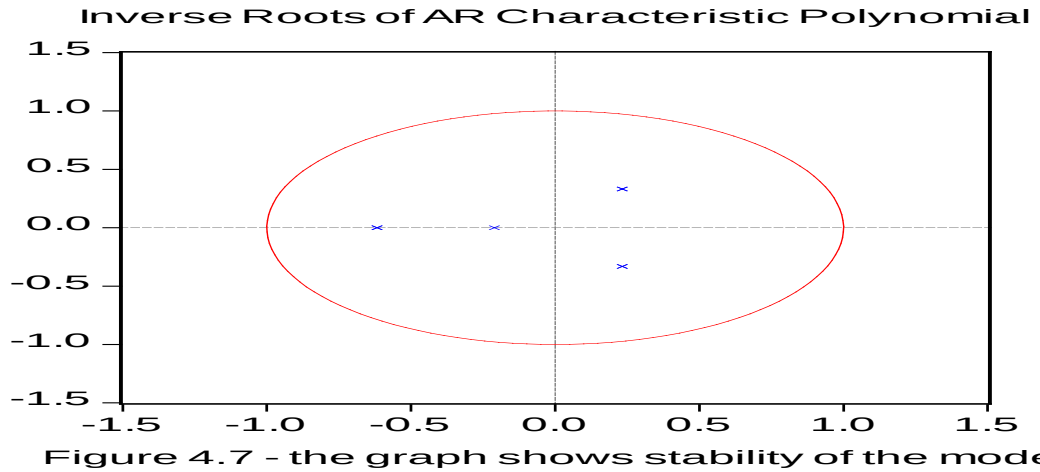


Figure 4.7 - the graph shows stability of the model

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter looks at the summary of the findings of the study, the conclusion and recommendations.

5.2 Summary of Findings

The study finds that there is no long run relationship between gross domestic savings and economic growth in Ghana. The study, however, finds a positive bi-directional relationship between growth rate of gross domestic product and growth rate of per capita real GDP. The findings confirm the works of Mavrotas and Kelly (2002), Kumar et al (2008), and Dawit (2005) whose study on the causal relationship between economic growth and gross domestic savings using Granger causality test found a bidirectional relationship between them.

On one hand, the direction of causality runs from savings to economic growth. This result supports the economic growth theorists like Lewis (1954, 1955), Solo-Swan (1956), Harrod-Domar (1956), Romer (1986); the financial liberalization theorists such as Levhari and Patinkin (1968), Mckinnon (1973), Shaw (1973) as well as the empirical works by Saltz (1999), Bacha (1990), DeGregorio (1992) and Mohan (2006). All these writers believe that savings is a pre-requisite for investment and thus the direction of association between gross domestic savings and economic growth must necessarily run from savings to economic growth.

On the other hand, this study also finds that the direction of association between economic growth and gross domestic savings running from economic growth to savings. This result supports Life Cycle Theory of Consumption and Savings of Japelli and Pagano (1994), Absolute Income Hypothesis of Keynes (1936); the financial repression theorists such as Tobin (1965) and empirical works of Carrol and Weil (1993), Sinha (1999) and Anoruo and Ahmed (2002).

5.3 Conclusion

The objectives of this study are to investigate whether there is a long run relationship between economic growth and the gross domestic savings of the country, whether there is a causal relationship between them and if so, where the angle of causality between them runs for the Ghanaian economy over the period 1961-2008. This study is done by the use of Vector Autoregressive (VAR) model and the Pairwise GC test within the sample period. The null hypothesis of no causality between gross domestic savings and economic growth is tested using modern time series analysis of unit root test, co-integration test, the VAR model and the pairwise GC test to a set of annual time series data covering the period. A graphical representation of savings and growth shows a strong positive relationship between the two variables.

In the short run, the traditional view of macroeconomic theory is that higher savings rates lead to higher investment and higher economic growth. The empirical results of this study, however, do not provide evidence supporting this conventional view. In other words, the findings of this study do not lend support to the hypothesis that only faster growth rate of gross domestic savings causes higher growth rates of per capita real GDP. Neither do they support the Keynesian view

that only income induces savings from one angle of causation. The study, however, finds bi-directional causality between economic growth and gross domestic savings.

5.4.0 Recommendations

The following are recommended based on the findings of the study.

5.4.1 Monetary Policy to Boost Savings and Growth

In the results, it is found that, on one hand, gross domestic savings causes economic growth and vice-versa. This implies that if measures were put in place to boost domestic savings, investment would increase and hence growth would be accelerated. On the other hand, increasing growth would also increase gross domestic savings. One way of boosting domestic savings and to increase growth is to increase the deposit rate and reduce lending rate of the commercial banks through monetary policy at the disposal of the Central bank. At the moment, there is a huge disparity between lending rate and deposit rate. Whilst the inter-bank lending rate is around 25% per annum charged by commercial banks for their lending to investors and traders, deposit rate on savings is very negligibly about 2%. Currently, the inflation rate (even at single digit) is higher than deposit rate on savings. This implies that households and firms who have surplus funds to deposit at banks are reluctant to do so because the real value of the savings would fall. Whilst the high lending rates put investors and potential investors off from borrowing funds to invest to encourage growth in the country, the low deposit rates on saving discourages people from depositing their surplus funds at the banks. These practices do not boost savings and growth in the economy. It is very strongly recommended that the Central Bank, either through moral suasion, bank rate or special directives, influence the commercial banks to reduce their

lending rate whilst at the same time increasing their deposit rate at least above the rate of inflation of about 9%.

An increase in the deposit rate above the rate of inflation, other things being equal, will be mutually beneficial to the depositors, on one hand, and the commercial banks themselves, on the other. An increase in the deposit rate, in one breath, will encourage individual households and businesses with idle surplus funds to deposit them at the banks. This is because they know that they will earn a positive real interest rate on the funds deposited at the banks. Thus, they will prefer to deposit their idle surplus funds with commercial banks than keeping the idle funds and lose the interest rate they would earn. On the other hand, the idle surplus funds deposited by individual households and businesses will mean that the banks have funds to lend to investors and potentials investors to invest. This means that the bank, charging a reasonable interest on loans lent to investors and traders, would make profits on the loans and overdrafts they offer to investors. Thus, it is not a good business practice for the banks to pay interest on deposit less than the rate of inflation.

Again, it makes a good economic sense to reduce lending rate. The interest on loans (cost if capital) is just part of the total production costs that businesses incur in producing a good or providing service. According to investment theory, there is a negative relationship between interest rate and the level of investment. A higher interest rate (as we experience in the country) means low investment levels. Other things being equal, this has negative effect on the growth of the economy. This is because a high interest rate increases production cost and there is a negative relationship between production cost and output. Thus, a high interest rate on loans and overdraft

prevents investors and potential investors from borrowing funds to invest to increase the growth rate of the economy especially where business expectations are not much. However, at lower lending rate, it becomes attractive for firms to borrow and invest. A moderate lending rate plus high business expectations would attract businesses and investors to borrow from the banks, employ factors of production including labour, to invest or expand their existing size of their businesses to increase output and growth. Thus, for the monetarist, savings and growth could be boosted through monetary policy at the disposal of the Central Bank.

5.4.2 Fiscal Policy to Boost Savings and Growth

The monetary policy is often used not in isolation but in tandem with the fiscal policy at the hands of the central government. For instance, an increase in money supply to reduce interest rate and boost investment and growth could be counteracted by a contractional fiscal policy. Fiscal policy basically follows the economic theory of Keynes (1936), that insufficient demand causes unemployment and excessive demand leads to inflation. It aims to stimulate demand and output in periods of business decline by increasing government purchases and cutting taxes, thereby releasing more disposable income into the spending stream, and to correct overexpansion by reversing the process. Government uses fiscal policy to influence the level of aggregate demand in the economy, in an effort to achieve economic objectives of price stability, full employment, and economic growth.

In using fiscal policy to complement monetary policy to increase growth and savings, it is recommended that the government embarks on an expansionary fiscal policy by increasing government spending, reduce taxes or both. Keynesian economics suggests that increasing

government spending and decreasing tax rates are the best ways to stimulate aggregate demand. Since our aim is to boost savings and growth, increasing government spending and decreasing taxes would mean that aggregate demand would increase to boost output in the economy. This is because an expansionary fiscal policy enhances the business expectations of investors who produce in anticipation of increased demand for goods and services. In economic theory, the resulting deficits would be paid for by an expanded economy during the boom that would follow.

An expansionary fiscal policy through decrease in direct taxes would increase disposal incomes of Ghanaians. An increase in incomes would increase both savings and consumption in the economy. An increase in consumption enhances business expectations to produce more goods and services whilst increased savings means there would be enough surplus funds for investors to borrow especially were the lending rate is moderately low. This boosts investment prospects and increases the national output leading to growth of the economy.

An interesting but worrying feature of fiscal policy applied most times in Ghana tends to be pro-cyclical (Thorton, 2008). That is, fiscal policy is expansionary during booms and downturns are associated with fiscal contractions (Ilzetzki and Vegh, 2008). There are several reasons why Ghana tends to adopt procyclical policies despite the presumed benefits of countercyclical policies. Lack of policy space due to conditions attached to lending by international financial institutions limits the set of policy choices available to the country in response to shocks. In addition, financing for low-income countries is generally procyclical. In good times Ghana is able to borrow and in bad times the country has very limited access to finance. This constrains the ability of the country to run counter-cyclical fiscal policies. This fiscal policy measure does not encourage the growth of the country and must therefore not be allowed to happen.

Ghana has to exploit the potential of fiscal policy as a countercyclical mechanism for cushioning the effects of shocks on macroeconomic variables. Empirical studies {Ocrean (2009), Amin (1998)} say that some government expenditures have positive effects on growth; others have negative effects whilst others have no effects at all. Thus, in an effort to use fiscal policy as a tool to increase growth, it becomes critically important to know which component should be adjusted and why. Knowing the relative contribution of each component to economic growth is crucial for decision making. The need for this type of knowledge in decision making assumes great importance, as one of the government's recent priorities is to encourage and promote strong private sector-led growth. The belief, among other things, is that such growth would be able to generate fiscal surpluses and sustain interest payments on debt, as well as lessening the debt burden, promote employment and further support necessary public expenditures. So it is important to evaluate how the different components of public expenditures affect economic performance, since a different composition of budgetary expenditure may affect the economy differently.

5.4.3 Legislation to Boost Savings and Growth

Legislation could also play a key role in savings mobilization for investment, growth and development as is done in other African countries. One area that could be looked at is the Act that established the Ghana Post. In recent years, financial-sector reforms in many African countries have expanded the range of products offered by postal services. The Ghana Post in Ghana, for instance, introduced services such as Expedited Mail Services (EMS), Internal Money Transfer (IMT) as well as sending letters internally and externally. It is recommended that government amend the Act establishing Ghana Post to enable it mobilize small amounts of

savings and provide basic financial services in rural and urban areas by introducing banking service to its range of products. This is important because there are post offices in areas where banks are not available. This is done in some African countries like Kenya and Benin. The Ghana Post might request a minimum of GH¢1.00 to open an account without much documentation and a minimum balance of same amount. Customers might be given a saving Pass Book in which deposits and withdrawals are recorded and the balance in the account visibly shown. The amended Act should enable Ghana Post to offer loans and credit facilities to its customers, low-income earners and micro-enterprises. It is believed that if this product is started, the number of postal savings accounts can exceed that of all deposit accounts with mainstream banks as it is happening in other African countries. Ghana Post will then have a more vital role to play in the economic and social development especially in rural Ghana where the majority of the economically active population does not have access to mainstream banks. This is especially important due to the fact that in the study it is found that on one hand growth rate of gross domestic savings causes growth rate of per capita real GDP. Thus, to accelerate economic growth, savings must be mobilized in all respects.

5.4.4 Other Way(s) to Boost Savings and Growth

There are other ways that savings could be mobilised and growth accelerated in the country. One area is the mobile phone banking. Mobile phone banking can be introduced in areas that do not have access to financial services or every part of the country. This has been used in South Africa, the Democratic Republic of Congo, Zambia and Kenya to take banking services to remote areas where conventional banks have been physically absent or have found those places

too expensive to operate. In this situation, a commercial and or a rural bank may liaise with a mobile phone service operator such as Vodaphone, Kasapa, Airtel (formerly Zain), tiGO or MTN so that subscribers can open accounts, check their balances, pay their bills or transfer money for a small fee. FinMark Trust, a research group seeking to make financial services more accessible, reports that 47 per cent of those who do not have bank accounts in Ghana nevertheless own mobile phones. Hence, if this service is adopted, many more Ghanaians will have access to financial services even at their doorstep. This will enable idle resources to be mobilized which could be channelled to investment activities to boost growth.

Bibliography

Adebiyi, M. A. (2006). "Can High Real Interest Rate Promote Economic Growth without Fuelling Inflation in Nigeria", Journal of Economics and Social Studies, Maiden edition, pp. 86-100

Adebiyi, M.A. (2000). "Saving-Growth Relationship in Nigeria: an Empirical Investigation. Department of Economics, University of Lagos, Nigeria.

Akaike, H. (1973). "Information Theory and an Extension of the Maximum Likelihood Principle," in B.N. Petrov and F. Craki (eds.), 2nd International Symposium on International Theory, Academia Kiado, Budapest.

Anoruo, E. and Y. Ahmad, (2000). "Causal Relationship between Domestic Savings and Economic Growth: Evidence from Seven African Countries," Working Paper, African Development Bank, PP. 238-249.

Aylit, T. (2003). "The Relationship between Savings and Growth in South Africa: An Empirical Study." University of Witwatersrand

Bacha, E.I. (1990). "A Three-Gap Model of Foreign Transfers and the GDP Growth Rate in Developing Countries," Journal of Development Economics, Vol. 32 PP. 279-96.

Baharumshah et al., (2003). "Savings Dynamic in Asian Countries," Journal of Asian Economics, 13: 827-845.

Barro, R.J (1990). "Government Spending in a Simple Model of Endogenous Growth"; Journal of Political Economy, 98(5), 103-125.

Caroll, C.D., and Weil, D.N.(1994). "Saving and Growth: A Reinterpretation," Carnegie-Rochester Conference Series on Public Policy, 40:133-92.

Dawit, S. (2005). "Causal Relationship between Economic Growth and Gross Domestic Savings: Case of Ethiopia," Department of Economics, Addis Ababa University.

Dawit, S. (2003). "Real Effective Exchange Rate Misalignment, Volatility and Their Impact on Macroeconomic Performances of Ethiopia: An Empirical Investigation," Department of Economics, Addis Ababa University.

DeGregorio, J. (1992)."Economic Growth in Latin America," Journal of Development Economics, vol. 39, PP. 59-84.

Dickey, D.A. and W.A. Fuller (1981). "Likelihood Ratio Statistics for Autoregressive Time Series," Econometrica, Vol. 49, PP. 1057-72.

Dickey, D.A. and W.A. Fuller (1979). “Distribution of Estimates of Autoregressive Time Series with Unit Root.” Journal of the American Statistical Association, PP. 427-431.

Domer, E.D. (1946). “Capital Expansion, Rate of Growth, and Employment,” Econometrica, Vol. 14, PP. 137-47.

Engle, R. F. and C.W.J. Granger (1987). “Cointegration and Error Correction: Representaion, Estimation and Testing.” Econometrica 55: 251-276.

Fischer, S. (2003). "Globalization and Its Challenges." American Economic Review, PP.13-24.

Friedman, M. (1975). “Government Revenue from Inflation.” Journal of Political Economy. PP. 44-56.

Gavin, M.R.H. and E. Talvi (1997). “Savings Behaviour in Latin America: Overview and Policy Issues,” Journal of Econometrics, PP. 65-74.

Gilllis, M.; Perkins, H.D.; Roemer, M.; & Snodgrass, R.D. (1987). Economics of Development, 2nd Edition (W.W. Norten & Company 500 Fifth Avenue, N.Y. 10110).

Granger, C.W.J.(1983). “Co-Investigated Variables and Error-Correction Models,“ Working Paper, 83-13. University of California, San Diego.

Granger, C.W.J. (1969). “Investigating Causal Relations by Econometric Models and Cross-Spectral Methods,” Econometrica, Vol. 37, 424-38.

Granger, C.W.J. and P. Newbold, (1974). “Spurious Regression in Econometrics,” Journal of Econometrics, PP. 111-120.

Harrod, R. (1939). “An Essay in Dynamic Theory, “Economic Journal, Vol. 49, PP. 14-33.

Jappelli, T. and M. Pagano (1994).”The Determinants of Saving: Lessons from Italy,” Paper presented at the Inter-America Development Bank Conference on Determinants of Domestic Savings in Latin America, Bogota, Colombia.

Johansen, S. (1991). “Statistical Analysis of Cointegration Vectors.” Journal of Dynamics and Control12: 232-254.

Johansen, S. and K. Juselius (1990).”Maximum Likelihood Estimation and Inference on Co-integration with Applications to the Demand for Money”, Oxford Bulletin of Economics and Statistics, Vol. 52, Vol. PP. 169-210.

Kaldor, N., (1956). “Alternative Theories of Distribution,” Review of Economic Studies, 23(2): 83-100.

Keynes, J. M. (1936). “The General Theory of Employment Interest and Money” Macmillan

Cambridge university press, for royal economic society.

Lean, H.H. and Song, Yingzhe (2009). "The Domestic Savings and Economic Growth Relationship in China." Journal of Chinese Economic and Foreign Trade Studies, Vol 2, Issue 1, pp 5-17.

Levhari, D & Patinkin, D. (1968). "The Role of Money in a Simple Growth Model"; American Economic Review, 58(4), 713-53

Lucas, R. (1988)."On the Mechanics of Economic and Development" , Journal of Monetary Economics, Vol. 22, pp. 3- 42.

Lewis, W.A. (1955). "The Theory of Economic Growth." Homewood, III: Irwin.

Lucas, R.E. (1988). "Econometrics Policy Evaluation: A Critique," In the Philips Curve and Labour Markets, Conference in Public Policy, Amsterdam, North Holland.

Maddison, A. (1992). "A Long Run Perspective on Saving," Scandinavian Journal of Economics, Vol. 94, PP.181-96.

Mavrotas, G. and Kelly, R. (2002). "Old Wine in New Bottles: Testing Causality between Savings and Growth," The Manchester School, Vol.69: 97-105.

McKinnon, R. I. (1973). "Money and Capital in Economic Development," Washington, DC: The Brookings Institution.

Meadows, D.L., Meadows, D.L. and Randers, J. (1973). "The Limits to Growth" Washington, DC: Potomac Associates

Mensah, S. (2004). "Ghana's Economic Puzzle: What is to be done?" SEM International Association Limited.

Miller, M. (1991). "Money Dynamics: An Application of Co-integration and Error-Correction Modeling," Journal of Money, Credit, and Banking, Vol. 23, PP. 139-54.

Miller, S. and F.S. Russek (1990), "Co-integration and Error-Correction Models, The Temporal Causality between Government Taxes and Spending," Southern Economic journal, PP. 221-29.

Modigliani, F. (1975). "The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests." American Economics Review, PP. 55-84.

Mohan, R.,(2006). "Causal Relationship between Economic Growth and Gross Domestic Savings in Countries with different income levels". Economic Bulletin, Vol 5, No. 3 pp 1-12.

Pagano, A.M. (1993). “Financial Markets and Growth: An Overview”, European Economic Review, Vol. 37, pp. 613- 22.
Quah, D.T. (1993). “Galton’s Fallacy and Convergence Hypothesis.” Scandinavian Journal of Economics, PP. 427-443.

Robinson, G. and M. Eatwell (1973). “Optimal Technical Change in an Aggregate Model of Economic Growth”, International Economic Review, Vol. 6, pp. 18- 31.

Romer, P. (1989). “Capital Accumulation and the Theory of Long Run Growth, in Modern Business Cycle Theory, (Ed.) R. Rana (Harvard University

Saltz, I.S. (1999). “An Examination of the Causal Relationship between Savings and Economic Growth in the Third World.” Journal of Economics and Finance, Vol 23, PP. 90-98.

Samuelson, P., and Modigiani, P., (1966). “The Passinetti Paradox in Neo-classical and More.” Journal of Economics, Vol. 70, PP. 104-115.

Shaw, E. (1973). “Financial Deepening in Economic Development.” (Oxford: Oxford University Press).

Sinha, D. (1999). “Savings and Economic Growth in Sri-Lanka,” Indian Journal of Applied Economics, Vol 8, PP. 164-174.

Sinha, D. and T. Sinha (1998). “Cart Before the Horse? The Saving-Growth Nexus in Mexico.” Economics Lectures, Vol 6, PP. 43-47.

Solow, R.M. (1956). “A Contribution to the Theory of Economic Growth,” Quarterly Journal of Economics, Vol. 70, PP. 65-94.

Solow, R.M. and T.W. Swan (1956). "Economic Growth and Capital Accumulation', Economic Record, 32, pp. 334–61.

Stern, N. (1991). “The Determinants of Growth,” Economic Journal, Vol. 101, PP. 122-133.

Tobin, J. (1965). “Money and Economic Growth”; Econometrica, 34, pp. 69-72.

Todaro, P.M. (2003). “Economics of Developing World,” 3rd Edition, (Longman House, Burnt Mill, Harlow, Essex CM20, 2JE, England).

Xavier Sala-i-Martin. (2007). “Global Inequality Fades as the Global Economy Grows,” Index of Economic Freedom.

UNEP’s Global Environment Outlook: environment for development (GEO-4 2007) report.

APPENDIX

Appendix 1 – The Data Set

THE DATA SET

Year	GDS	Per Capita real GDP	Residual Series
1961	9.8	177.3	0.360368107
1962	12.9	182.7	3.504055449
1963	12.5	198	3.227836252
1964	15.5	216.6	6.378314875
1965	8.3	250.7	-0.545807650
1966	7.9	254.2	-0.917491780
1967	7.8	203.4	-1.428476406
1968	10.6	191.8	1.277676711
1969	11.2	221.3	2.116339043
1970	12.8	244.4	3.903223784
1971	9.6	261.5	0.841567035
1972	12.6	222.5	3.526047341
1973	14.1	251	5.256619425
1974	9.6	287.1	1.048677397
1975	13.7	272.3	5.028941719
1976	8.5	262.7	-0.248724667
1977	10	297.8	1.535243057
1978	4	336.2	-4.154091399
1979	6.6	361.8	-1.346981036
1980	4.9	390.3	-2.816408953
1981	4	359.8	-3.963161533
1982	3.7	332.5	-4.484025319
1983	3.3	322.4	-4.965736829
1984	4.2	338.5	-3.935483827
1985	6.6	334.2	-1.570271896
1986	5.8	412	-1.740850559
1987	3.9	354.4	-4.106848876
1988	5.4	352.7	-2.620602298
1989	5.6	346.5	-2.470761839
1990	5.5	377.8	-2.317537060
1991	7.3	411.7	-0.243277634
1992	1.3	388.9	-6.427735301
1993	6	351.8	-2.027883522
1994	12.5	312.2	4.151742636
1995	11.6	361	3.646546765
1996	13.2	377.6	5.380844891
1997	4.2	366.4	-3.709765893
1998	10.3	388.5	2.569028600

1999	3.5	391.6	-4.205891630
2000	5.6	247.1	-3.274932544
2001	7	257.5	-1.790793960
2002	7.4	252.5	-1.431245202
2003	7.9	352.4	-0.123029373
2004	8.2	402.2	0.579865005
2005	7.3	475.7	0.274498273
2006	7.8	552.6	1.396638386
2007	10.5	645.6	4.849031501
2008	11.3	690.8	6.014710735