JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

CAUSAL RELATIONSHIP AMONG SAVINGS, INVESTMENT AND ECONOMIC GROWTH IN ETHIOPIA

BY

SHIMELIS KEBEDE

JUNE, 2013

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JIMMA

DECLARATION

I, undersigned hereby, declare that this thesis is prepared with my own effort that it has not been presented for a diploma or a degree requirement in this or any other University; and all sources of materials used for thesis work have been duly acknowledged. I agree to accept any responsibility for the scientific and ethical mischief pertaining to this research work as per terms and conditions of the Jimma University.

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List of Acronyms

ADF	Augmented Duckey Fuller
ARDL	Autoregressive Distributive Lag
FDI	Foreign Direct Investment
FEVD	Forecast Error Variance Decomposition
GDP	Gross Domestic Product
GDS	Gross Domestic Savings
GNP	Gross National Product
IMF	International Monetary Fund
IRFs	Impulse Response Functions
MoFED	Ministry of Finance and Economic Development
NBE	National Bank of Ethiopia
OECD	Organization for Economic Cooperation and Development
PASDED	Plan for Accelerated and Sustained Development to End Poverty
PP	Phillips-Perron
SSA	Sub-Saharan Africa
SUR	Seemingly Unrelated Regression
TYDL	Toda-Yamamoto and Dolado-Lutkepohl
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VARD	Vector Autoregressive in the first-differenced data
VARL	Vector Autoregressive in the level data

Abstract

The causal relationship among savings, investment and growth is mixed and controversial both theoretically and empirically. There is large empirical literature which examines the savings-growth nexus within a bivariate framework. There is also a considerable literature which looks at the relationship between economic growth and investment. However, little attention has been given to examining the causal relationship between economic growth, savings and investment within a multivariate framework. This paper examines the causal relationship among savings, investment and economic growth in Ethiopia using annual time series data from 1969/70-2010/11 in a multivariate framework. Results for ADF and PP unit root tests show that all variables under consideration are I(1). Result from the ARDL Bounds Testing indicates that there exists cointegration among gross domestic savings, gross domestic investment, gross domestic product, labor force and human capital when GDP is taken as dependent variable. Labor and investment have significant positive effect on economic growth of Ethiopia both in the short-run and in the long-run while GDS and human capital are statistically insignificant. Moreover, Toda-Yamamoto and Dolado-Lutkepohl as well as Innovative Accounting Techniques (i.e., IRFs and FEVD) approach to Granger causality analysis shows that there exists bidirectional causality between gross domestic investment and economic growth as well as between gross domestic savings and gross domestic investment. Granger causality running from investment to savings and from investment to growth is stronger as witnessed from impulse responses and variance decompositions. However, there is unidirectional Granger causality running from economic growth to gross domestic savings though it is weak. Therefore, the country is required to increase savings and investment, with due emphasis given to investment due to its dual effect, to attain high and sustained economic growth.

Keywords*: ARDL approach, Economic growth, Ethiopia, Granger causality, Savings, Investment, TYDL approach*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Economic growth is a major goal of both developing and developed countries. Economic growth refers to increases in a country's production or income per capita. Production is usually measured by gross national product (GNP) or gross national income (GNI), used interchangeably, an economy's total output of goods and services (Nafziger, 2006).

> "One of the most complex and empirically unsettled subjects in economics is the explanation of the process of economic growth. As the creation of wealth is of critical importance for the welfare of most people around the world the current disarray in growth economics is not only a topic of analytical interest but also of practical importance. One of the controversies in growth analysis is the relative role of capital accumulation and productivity growth in driving output" (Gutierrez and Solimano, 2007, p.1).

New evidence is showing that growth is a volatile phenomenon for most countries except probably high per capita income economies. Due to the irregularity and volatility of growth process, the same country may experience various shifts in growth regimes that can involve growth take-off and booms, stagnation and/or growth collapses over a period of several decades. The description of steady growth around a precise and stable trend is clearly not a good explanation of the actual growth experience for most economies in the world, certainly for developing countries. In this context investment and savings become important factors that we want to understand their determining factors and dynamics as they affect positively the rate of economic growth. A growth boom can be driven by different factors. To support and strengthen growth ahead of a boom phase, investment is a critical vehicle to create productive capacities and probably generate knowledge spillovers and new technologies. At the same time, ensuring a sufficient level of national savings is important as foreign savings can be volatile and lead to “sudden stops” that force costly macroeconomics regulation and finally growth crises (Gutierrez and Solimano, 2007).

Promoting economic growth through savings and investment has received considerable attention in many countries around the world (Verma, 2007) due to the fact that high investment and saving rates are crucial in view of their strong positive correlation with the GDP growth rates as suggested by endogenous growth theory (Agrawal , 2000).

The relationship between saving, investment and economic growth has puzzled economists ever since economics became a scientific discipline. In general, a fraction of income is saved and put into investment. An exogenous increase in the desire to save leads to an unchanged level of saving but at a lower level of income. If we define both saving and investment as the difference between gross domestic product and consumption, it may tend to be interpreted in terms of cause-and-effect relationship (Jangili, 2011).

The conventional perception through which investment, savings and economic growth are related is that savings contribute to higher investment and hence higher GDP growth in the short run (Mohan, 2006). However, there are different thoughts regarding linkages among these variables and how they affect one another.

The central idea of Lewis’s (1955) traditional theory was that increasing savings would accelerate growth, while the early Harrod-Domar models specified investment as the key to promoting economic growth. In contrast, the neoclassical Solow (1956) model argues that the increase in the savings rate boosts steady-state output by more than its direct impact on investment because the induced rise in income raises savings, leading to a further rise in investment (Jangili, 2011). This higher investment in turn accelerates economic growth by increasing aggregate demand in the economy. The relationship among economic growth, savings and investment works also in the other way round according to some recent studies which contradict with the conventional wisdom that savings stimulate economic growth (Ahmad and Anoruo, 2001). For instance, studies by Jappelli and Pagano (1994), Gavin et al.(1997),Sinha and Sinha (1998), and Carrol and Weil (1994, 2000) argue that it is economic growth that promotes savings and not vice versa.

In the Keynesian and post-Keynesian traditions investment plays a critical role both as a component of aggregate demand as well as a vehicle of creation of productive capacity on the supply side. In post Keynesian demand-driven models investment still plays a crucial role in determining medium run growth rates (Wondwesen, 2011).

Macroeconomic theory reveals that gross domestic savings rate boosts investment rate and this higher investment rate in turn influences economic growth. Ethiopia has faced a shortage of local saving to finance domestic investment like other developing economies. Ethiopian average gross domestic savings to GDP ratio has been lower than that of the SSA average in real terms (Dawit, 2005). The average GDS to GDP ratio in real terms for the Ethiopia had been 9.7% in the 1990s and 6.4% for the period 2000-08 which is lower than the corresponding average GDS to GDP ratio for SSA (Tasew, 2011).

1.2. Statement of the Problem

Savings and investment are key requirements for growth and development. Savings and investment have been considered as two critical macro-economic variables with micro-economic foundations for achieving price stability and promoting employment opportunities thereby contributing to sustainable economic growth. However, inadequate savings and investment are common problem in developing countries. Poor performance of the economy, high unemployment level, engagement of a large proportion of the population in the informal sector and low wages are factors responsible for low domestic savings in small developing states.

The interaction between saving and investment has turned out to be the issue of great interest and debate among macroeconomists. Ang (2009), states that knowing the correlation between domestic saving and investment provides some clue about the amount of domestic resources being translated into capital accumulation to spur long-term growth. The debate has traditionally revolved around two issues.

The first relates to whether domestic investment results in domestic savings, and the second relates to how domestic savings affects domestic investment. A growing body of literature has emerged, both at the theoretical and empirical level, attempting to answer these issues. Conventional thinking holds that savings is an essential element in promoting investment and therefore economic growth. According to this view, low levels of domestic savings in some developing countries condemn them to an uncomfortable choice between low investment and growth, or excessive reliance upon foreign capital which makes them vulnerable to financial crises.

The different models that support a correlation between saving and growth have quite different implications for causality. The central idea of Lewis's (1955) traditional theory was that increasing savings would accelerate growth, while the early Domar-Harrod models specified investment as the key to promoting economic growth. On the one hand, the central presumption of the Solow (1956) type growth models is that higher saving precedes and causes economic growth.

Endogenous growth models also highlight that, ceteris paribus, factors that stimulate saving promote growth. Higher saving finances investment, which is the main source not only of quantitative capital accumulation but also of improvement in total factor productivity if technological progress is embodied in new capital. On the other hand, Modigliani's classic life-cycle model implies that higher growth will increase the life-time wealth of younger savers relative to older dissavers, thereby increasing the aggregate saving rate. Similarly, models of consumption with habit formation predict that consumption responds slowly to unexpected income growth, so unanticipated growth can produce a higher saving rate at least in the short run. Moreover, the Carroll-Weil (1994) hypothesis also suggests that it is economic growth that contributes to savings, not the other way around.

Empirical findings are mixed and controversial across countries, data and methodologies. Some empirical studies support the classical growth theory[1], some studies agree with the Carroll-Weil hypothesis[2] and some do not support either of these[3].

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[1] See Jappelli and Pagano (1994)
[2] See Verma (2007), Sinha and Sinha (2008)
[3] See Sinha (1996)

Development and growth theories are replete with examples of how savings and investment play a critical role in promoting economic growth. However, most studies in Ethiopia look at the relationship between investment, savings and growth by commonly testing for bi-variate Cointegration and Granger causality separately between investment and growth, or between savings and growth. Therefore, this study will investigate the possibility of saving investment led growth and growth driven saving investment hypothesis by testing for Granger causality, under a multivariate framework, between gross domestic savings, gross domestic investment and growth in Ethiopia.

Generally, this study tries to answer the following key questions:

- ✓ What is the direction of causality among savings, investment and growth in Ethiopia?
- ✓ Does the long-run equilibrium exist among savings, investment and growth in Ethiopia? Specifically, what is the long-run effect of savings and investment on economic growth of Ethiopia?
- ✓ Do savings and investment affect economic growth of Ethiopia in the short-run?

1.3. Objectives of the Study

The major objective of this study is to analyze the causal relationship among savings, investment and economic growth in Ethiopia with the following specific objectives:

1. To investigate the existence and direction of causal relationships among savings, investment and economic growth in Ethiopia.
2. To determine whether a long run relationship exists among savings, investment and economic growth in Ethiopia; and to analyze whether savings and investment are the determinants of economic growth of Ethiopia in the short-run.

1.4. Scope of the Study

The study explores the causal chain between savings, investment and economic growth in Ethiopia. To achieve this objective, annual time series data covering the period from 1969/70-2010/11 was used based on the availability of the data.

1.5. Limitation of the Study

Even though the current study sheds some light on the causal relationship between savings, investment and economic growth, it suffers from some limitations. This limitation originates from the incompatibility of data reported by different institutions and even by different departments in the same institution.

1.6. Significance of the Study

Most empirical works on the area of relationship between savings, investment and economic growth are based on panel or cross-country regressions and may be criticized in view of the fact that they impose cross-sectional homogeneity on coefficients that in reality may vary across countries because of differences in institutional set up, domestic policy measures, political, social and economic structures. The overall result obtained from panel or cross-section regressions represents only an average relationship, which may or may not be appropriate to individual countries in the sample.

Actually, several time series studies have been conducted in the area. However, they treat causal relationship between savings, investment and economic growth bivariately by looking into the causal relationship either between savings and economic growth or between investment and economic growth. This paper uses time series data to examine the causal relationship between savings, investment and economic growth in Ethiopia in a multivariate framework. Thus, the immediate outcome of this study provides pertinent result and policy implication to the government and policy makers by bridging the abovementioned gap. Additionally, it contributes to the existing literature by extending the works of others and assists in filling the knowledge gaps in this area.

1.7. Organization of the Paper

The remaining part of the paper is arranged as follows. Chapter two discusses about theoretical and empirical literatures. In chapter three, the methodology and model specification used in this study are presented while performance of gross domestic savings, gross domestic investment and economic growth in Ethiopia under different regimes is discussed in chapter four. Chapter five is about discussion and interpretation of the results. Chapter six provides conclusions and policy implications drawn based on findings of the study.

CHAPTER TWO

LETERATURE REVIEW

The aim of this chapter is to review the related literature on the area of the causal relationship between savings, investment and economic growth. The chapter constitutes two main parts. The first part deals with theoretical literature and second part reviews the related empirical studies conducted so far on the area.

2.1. Theoretical Literature Review

This section presents a theoretical review of the causal relationship between gross domestic savings and economic growth, domestic investment and economic growth and finally, savings, investment and economic growth in various theories/models by introducing the concepts of savings, investment and economic growth first.

2.1.1. Concepts of Savings, Investment and Economic Growth

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). Saving is a mechanism by which economic agents make deliberate choice to allocate a portion of their current income for the purpose of making investment and increasing their future earning capacity.

In economics, savings may be classified into three: personal savings, business savings and government savings. Personal savings has been defined as personal disposable 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 dissave. 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 (Ogoe, 2009).

Investment spending is a central topic in macroeconomics for two reasons. First, fluctuations in investment account for much of the movement in GDP in the business cycle. Second, investment spending determines the rate at which the economy adds to its stock of capital, and thus helps determine the economy's long-run growth and productivity performance. In macroeconomics, investment spending refers to the flow of spending that adds to the physical stock of capital. The components of investment spending can be disaggregated into three categories. The first is business fixed investment, business spending on machinery, equipment, and structures such as factories. The second component is residential investment, consisting largely of investment in housing while the third is inventory investment, consisting of the additions to stock of inventories (Dornbusch et al., 2004).

"Economic growth refers to increases in a country's production or income per capita" (Nafziger, 2006: p.15). Production is usually measured by gross national product (GNP) or gross national income (GNI), used interchangeably, an economy's total output of goods and services.

Todaro (2003) defines economic growth as a long-term boost in capacity to supply increasing diverse economic goods to its population; and this growing capacity is based on advancing technology and the institutional and ideological adjustments that it demands. According to Todaro (2003), 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 (Todaro, 2003).

2.1.2. Savings and Economic Growth

The purpose of this section is to shed some light on the relationship between savings and economic growth under different theories. More specifically, it presents what the relationship between savings and economic growth looks like under theories such as financial repression theories, financial liberalizations theories and growth models (i.e. Harrod-Domar growth model, Solow growth model, and the new growth model). Finally, the connection between savings and economic growth is presented from 'the life-cycle theory of consumption and saving' perspective.

I. Financial Liberalization Theory and Financial Repression Theory

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

The concept of financial repression was initially suggested by MacKinnon (1973), who defined financial repression as government financial policies strictly regulating interest rates, setting high reserve requirement on bank deposits, and compulsory allocating resources. Such repressive policies, usually observed in developing countries, would hamper financial deepening and hinder efficiency of the financial system. MacKinnon (1973) and Shaw (1973) introduced a conventional representation of financial repression and its impact on saving and economic growth.

Financial repression theory is one of the theories on the causal relationship between gross domestic savings and economic growth. The proponents of financial repression argue that savings are not necessarily channeled into investment. Tobin (1965) argues that the development of a monetary sector could be harmful. 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.

Financial liberalisation covers domestic financial market deregulation and capital account liberalisation (i.e. establishing convertibility). Domestic financial market reform policies comprise nominal interest rate liberalisation, reduction or abolition of reserve requirements, the elimination of inflationary finance and other forms of taxing the financial system. Besides, financial liberalisation may comprise the revising of all policies that distort a financial intermediary’s fund allocations such as government's direct credit lines with commercial banks, discriminatory loan rates and the compulsory purchase of government liabilities (Ebrahim and Barbara, 1999).

Against the financial repression theorists standpoint, advocates of financial liberalisation (Levhari and Patinkin,1968; McKinnon,1973; Shaw,1973) have long argued for financial liberalisation on the basis that saving is complementary to investment in the development process, still with a money economy where saving can go either into the accumulation of money balances or the accumulation of physical capital.

Levhari and Patinkin (1968) argue money to be one of productive factors of production. The production function can be given as a function of labor, capital and real money balance so that production depends on working capital in the same way as it depends on fixed capital. If money were unproductive 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, lets 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 the development process. Because of the lumpiness of investment expenditure and the dependence 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 complementarities with capital accumulation will exist as long as the real interest rate does not exceed the real rate of return on investment. Shaw (1973), on the other hand, emphasizes the significance of financial liberalisation 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.

Though insightful, the work of McKinnon (1973), Shaw (1973) and others lacked analytical foundations. In traditional growth theory, financial intermediation could be related to the level of the capital stock per worker or to the level of productivity, but not to their respective growth rates. The latter were attributed to exogenous technical progress in which financial intermediation can be shown to have only level effects (Pagano, 1993).

However, Pagano (1993) contends that, under endogenous growth framework, financial development can be shown to have not only level effects, but also growth effects. To capture the potential effects of financial development on growth, Pagano (1993) consider the simplest endogenous growth model - the ‘AK’ model, where aggregate output(Y) is a linear function of the aggregate capital stock (K):

$$Y_t = AK_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(2.1)}$$

According to Pagano (1993), the impact of financial liberalization on the steady-state growth rate can be given as a product of the social marginal productivity of capital (A), the proportion of saving funneled to investment (ϕ) and gross saving rate (s) less capital depreciation rate (δ).

$$g = A\phi s - \delta \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(2.2)}$$ [4]

Where: the gross saving rate S/Y is denoted by s.

Equation (2.2) reveals succinctly how financial development can affect growth: it can raise ϕ, the proportion of saving funneled to investment by reducing leakage of resources during financial intermediation; it may increase A, the social marginal productivity of capital through collecting information to evaluate alternative investment projects and inducing individuals to invest in riskier but more productive technologies by providing risk sharing; and it can influence s, saving rate by providing better insurance against endowment shocks and better diversification of rate-of-return risk (Pagano, 1993).

King and Levine (1993) also argued that the predetermined components of financial development indicators significantly predict subsequent values of economic growth which is consistent with the view that financial services stimulate economic growth by increasing the rate of capital accumulation and by improving the efficiency with which economies use that capital.

In sum, the connotation of financial liberalisation theory is that growth is enhanced both since the increase in saving raises investment and the quality of investment improves.

II. The Role of the Savings Rate in Growth Models

This section presents a review of the role played by saving rates in different growth models. The first sub-section elaborates the relationship between savings and economic

[4] See Pagano (1993) for the detailed mathematical derivation of the model.

growth under the Harrod-Domar growth model followed by the Solow growth model. Lastly, the relationship between savings and economic growth is presented from the viewpoint of the new growth models.

A. The Harrod-Domar Growth Model

Harrod (1939) and Domar (1946) developed the first macroeconomic model to formally analyze the problem of growth. In so doing, particular attention is paid to make explicit the relationship between the consumption-saving by households and the investment decision by entrepreneurs, although these behaviors are not theoretically developed. In fact, the consumption-saving decision is defined, following the Keynesian approach, by an exogenously given propensity to consume, while the investment decision is defined by the accelerator principle. In their model, production is obtained only by means of physical capital and labour. Given the usual Keynesian assumption of fixed prices, firms choose the best technique at the given prices. Thus generically there is only one cost-minimizing technique, which implies that the capital/labour ratio and the capital/production ratio are uniquely determined (Salvadori, 2003).

According to Harrod and Domar's view, investment determines the level of income, Y_t, which determines in turn the net savings, i.e. the net supply of capital for full employment of capital steady state. The current stock of capital, which is optimal by the accelerator principle and the rate of growth of population, determines the net demand of capital for full employment of capital and labour steady state (Salvadori, 2003).

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, ceteris paribus (Ogoe, 2009).

B. The Solow Growth Model

The neoclassical growth model was developed by Solow (1956) and Swan (1956). It is built upon an aggregate, constant-returns-to-scale production function that combines labor and capital (with diminishing marginal returns) in the production of a composite good. Savings are assumed to be a fixed fraction of output, and technology improves at an exogenous rate (Agénor and Montiel, 2008).

The basic Solow (1956) growth model suggests that capital accumulation plays a pivotal role for the growth of an economy. According to this model the rise in the saving rate affects the stock of capital and the level of per capita, but does not affect the rate of economic growth. The model further shows that aggregate saving (investment) determines the growth of capital stock, which, in turn plays a key role in the growth of an economy.

Although the saving rate has no effect in the long run on the growth rate per capita, it affects (positively) the level of per capita income in the steady state. But changes in the saving rate affect the rate of growth in the short run (Agénor and Montiel, 2008). The implication of the Solow model is that an increase in the saving rate increases per capita output and per capita capital stock in steady- state. A higher savings rate will bring about 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 as for a given growth rate of labour, as increasing proportion of investment will be devoted to maintaining this higher capital-labour ratio. The saving rate thus determines 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.

Generally, the Solow growth model states that a change in the saving rate changes the economy's balanced growth path and hence per capita output in steady state, but it leaves the growth rate of output per worker on the balanced growth path unaffected. Only an exogenous technological change will bring about a further increase in output per worker in steady state.

C. The New Growth Theory

Since population growth and technological change are assumed exogenous in neoclassical growth model, the model does not explain the mechanisms that generate steady-state growth, and therefore does not allow an evaluation of the mechanisms through which government policies can potentially influence the growth process.

The new growth literature addresses these limitations of the neoclassical model by proposing a variety of channels through which steady-state growth arises endogenously. The new growth theory stresses the importance of innovation, human capital accumulation, the development of new technologies and financial intermediation as important determinants of economic growth (Agénor and Montiel, 2008).

One of the approaches followed in the new growth literature to relax the assumption of diminishing returns to capital imposed in the basic neoclassical growth model consists of viewing all production inputs as some form of reproducible capital, including not only physical capital (as emphasized in the basic neoclassical framework), but other types as well, especially human capital (Lucas, 1988) or the "state of knowledge" (Romer, 1986). A simple growth model along these lines is the so-called AK model proposed by Rebelo (1991) which states that output per worker (y) is a linear function of capital (both human and physical capital) per worker (k). The steady-state growth rate under the AK model states that the growth rate is positive (and constant over time) and that the level of income per capita rises without bound.

An important implication of the AK model is thus that, in contrast to the neoclassical model, an increase in the saving rate permanently raises the growth rate per capita. In addition—and again in contrast with the neoclassical growth model, which predicts that poor countries should grow faster than rich countries—the AK model implies that poor nations whose production process is characterized by the same degree of technological sophistication as other nations always grow at the same rate as rich countries, regardless of the initial level of income (Agénor and Montiel, 2008).

III. The Life-Cycle Theory of Consumption and Saving

In the early 1950s, Franco Modigliani and his student Richard Brumberg worked out a theory of spending based on the idea that people make intelligent choices about how much they want to spend at each age, limited only by the resources available over their lives. By building up and running down assets, working people can make provision for their retirement, and more generally, tailor their consumption patterns to their needs at different ages, independently of their incomes at each age. This simple theory leads to important and non-obvious predictions about the economy as a whole, that national saving depends on the rate of growth of national income, not its level, and that the level of wealth in the economy bears a simple relation to the length of the retirement span (Deaton, 2005).

The model developed by Jappelli and Pagano (1994) is in line with the Franco Modigliani's life-cycle theory of consumption. Jappelli and Pagano (1994) suggest that the direction of causal relationship runs form growth to savings. Jappelli and Pagano (1994) used a simple overlapping-generations model where individuals live for three periods in order to illustrate the relationship between savings and growth. Individuals are assumed to earn labor income only in the second period of their life. This provides an incentive for intergenerational borrowing.[5]

In steady state capital and output grow at the common rate, thus $(K_{t+1} - K_t)/K_t = (Y_{t+1} - Y_t)/Y_t$.[6] The steady-state net saving rate, $(K_{t+1} - K_t)/Y_t$, is equal to the growth rate, $\dot{K}_{t+1} =$ $(K_{t+1} - K_t)/K_t = (Y_{t+1} - Y_t)/Y_t$ multiplied by the (constant) capital-output ratio:

$$\frac{S_t}{Y_t} = \dot{K}_{t+1} \frac{K_t}{Y_t} = \left[\frac{Y_{t+1} - Y_t}{Y_t} \right] \frac{K_0}{Y_0} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2.22)}$$

[5] When young, individuals borrow to finance current consumption. When middle- aged, they repay the loan taken out in the first period and save for retirement. When old, they consume the savings accumulated in the second period of their life.

[6] See Pagano (1994) for the detailed mathematical derivation.

Equation (2.22) indicates that a rise in steady-state growth increases saving.[7]

According to Jappelli and Pagano (1994), the steady-state growth rate is independent of the accessibility of credit to households. However, the saving rate in an economy with liquidity constraint is higher than in an economy with perfect markets; and if in the former case borrowing constraints are relaxed, saving falls. Besides, the effect of growth on saving is stronger in the presence of liquidity constraints.

Growth has contrasting effects on saving. On the one hand, it increases the current income of the middle aged and hence their savings. On the other hand, it increases the future income of the young, thus enabling them to borrow more. This second effect is weakened by the presence of liquidity constraints and vanishes completely if the young have no access to credit markets. Growth has an extra positive effect on saving. The interest rate responds positively to an increase in growth, which reduces the discounted lifetime income of the young, and so their desired borrowing (Jappelli and Pagano, 1994).

2.1.3. Investment and Economic Growth

I. Capital Fundamentalism

Few economic ideas are as intuitive as the notion that increasing investment is the best way to raise future output, either for an individual or for a nation. In the 1950's and 1960's, this idea formed the basis for the dominant theory of economic development, sometimes termed "capital fundamentalism". Under this view, differences in national stocks of capital were the primary determinants of differences in levels of national product. Correspondingly, capital fundamentalists viewed rapid capital accumulation as central to increasing the rate of economic growth. Capital fundamentalism provided a coherent foundation for giving advice on development problems: national and international policies designed to increase a

[7] The reason is that saving grows at $\frac{\partial(S_t/Y_t)}{\partial(K_{t+1}/K_t)} = (1+\rho)^{1/(1-\alpha)}\frac{K_0}{Y_0}$ which is positive, where ρ denotes the productivity growth rate. See Pagano (1994) for detail.

nation's physical capital stock were the best way to foster economic development (Levine and King, 1994).

Capital fundamentalism embodies the belief that the rate of physical capital accumulation is the crucial determinant of economic growth. The Harrod (1939)-Domar (1946) growth model formed the original theoretical basis for capital fundamentalism. In the Harrod-Domar framework the economy grows at rate equal to a net investment rate as a ratio of capital-output ratio. More recently, capital fundamentalism has become the front line of economic research and policy prescriptions. Romer (1986, 1987), for instance, develops an endogenous growth model in which there are large externalities to capital. Romer's analysis implies an assumption that it is exogenous changes in the rate of capital accumulation in combination with a very large elasticity of output with respect to capital accumulation that drives economic growth. Likewise, the study by Mankiw, Romer, and Weil (1992) proposes a very important role for capital in explaining differences in cross-country differences in output per person.

Growth and development theory have long regarded the accumulation of physical capital as the engine of growth. In fact, the notion that raising the investment rate is a key to increasing long-run growth has been at the heart of growth thinking since the times of David Ricardo. Nevertheless, the key role of investment in the growth process was challenged in the 1960s and 1970s by neoclassical growth theorists (Schmidt-Hebbel et al., 1994)

Neoclassical theory of investment is one of the theories that discuss the relationship between domestic investment and economic growth. In the neoclassical model, capital accumulation affects growth only during the transition to the steady state; by contrast, long-run growth is determined only by population growth and the rate of technical change, which was assumed exogenous. This view attracted considerable criticism from a number of authors (e.g., Kaldor 1957, Robinson 1962) on the grounds that the separation between investment and innovation (or technical change) was artificial, as most technical innovation tends to be embodied in new machinery and equipment. Growth-accounting exercises based on the neoclassical model (Solow 1956) appeared to confirm that cross-country differences in investment ratios could explain only a limited portion of the differences in per capita growth performance over long periods, suggesting a crucial role for technological change as a major source of long-run growth.

The arithmetic of the Solow model, however, does not square well with the strong correlation between investment ratios and growth performance observed in practice (see Romer, .1987). Recent research addressing this issue has brought capital accumulation back to center stage of the growth process, suggesting an enhanced - albeit more indirect - role for investment as a key growth determinant. One line of research focuses on the complementarities between investment in physical and human capital: new and technologically advanced machines and equipment need to be operated by workers with adequate skills and education. Likewise, the identification and design of profitable and innovative investment projects requires also the existence of an entrepreneurial class with innovative skills and awareness of business opportunities. Along these lines, Mankiw, Romer and Well (1992) extend the Solow model to include human capital and, under the assumption that its accumulation is guided by that of physical capital, find that investment performance can account directly and indirectly (i.e., through the parallel accumulation of human capital) for the bulk of the variation in growth performance across countries.

A second line of research that has featured prominently in the "new" growth literature (e.g., Romer 1986, 1987, among many others) emphasizes the close links between the accumulation of physical capital and technological change. If productivity growth is endogenous rather than exogenous, and related to the accumulation of physical (or human) capital, then an increase in the rate of investment again raises the rate of growth in the steady state.

According to Barro (1996), a higher saving rate increases the level of domestic investment and it ultimately leads to a steady state level of output per worker, which enhances economic growth rate. A rapidly growing economy through domestic investment would be expected to boost expectations and hence further investment opportunities (Duncan et al. 1999).

In conclusion, Kowalski'00 (2000) argues that domestic investment is a fruitful indicator for economic growth. Thus, domestic investments can serve as a means of faster and sustainable channel for modern economic growth, particularly through capital formation, productivity, infrastructural development, export, etc., thereby making the domestic investors to automatically seek out the most favorable investment opportunities (Alfa and Garba, 2012).

II. The Accelerator Theory of Investment

Among the earliest empirical investment models was the acceleration principle, or accelerator. In modern textbooks, the accelerator model survives as a theory of inventory investment. The accelerator is a simple model that comprises the sort of response from current output to investment that Keynes saw occurring through the effect of current output on investors' anticipations. The accelerator model starts with an assumption that firms' desired capital-output ratio is more or less constant. This implies that the desired capital stock for any period t is proportional to the level of output in time t[8]. Therefore, the simplest accelerator model predicts that investment is proportional to the change in output in the coming period (Hausman et al., 2005).

As the capital-output ratio in most economies is larger than one (often three or more in advanced economies), moderate expected changes in output are capable of triggering relatively large changes in investment in the accelerator model. This is one of the reasons that this theory gained great popularity after the Great Depression as a model of investment (Parker, 2010).

In sum, the accelerator principle of investment states that it is growth that causes investment as opposed to the capital fundamentalism.

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[8] Investment, I, at time t is given as $I_t = \sigma \Delta Y_t$ where σ is the desired capital-output ratio and ΔY_t represents change in output.

2.1.4. Saving-Investment Relationship

Understanding the relationship between savings and investment is essential for at least two reasons: first, as just argued it may hold the key to the positive correlation between saving and growth. Second, if capital accumulation is indeed the centerpiece of the growth engine, the interaction between saving and investment is crucial for assessing the validity of the traditional recipe that raising saving is the surest way to increase growth -which involves the implicit- assumption that each country's extra saving is necessarily translated into higher domestic investment (Schmidt-Hebbel et al., 1994).

Nevertheless, in the closed economy national saving and domestic investment must be identically equal at least in an ex-post sense, so that if saving effectively increases investment must rise as well. But matters are more complicated in the open economy, as capital flows introduce a distinction between national saving and domestic investment (Adedeji and Thornton, 2006). National saving need not be used to invest domestically; it can also be devoted to finance investment abroad. Ideally, in a world of unrestricted capital mobility, each country's saving would flow to the most productive use in the world; thus, an increase in national saving would be primarily reflected in an improvement in the current account balance, rather than in higher domestic investment and growth. And this mechanism seems all the more relevant in view of the substantial decline in barriers to international capital flows, especially, among industrial countries (Schneider, 1999).

2.1.5. Economic Growth, Savings and Investment: Causality Issues

The traditional wisdom of development theory since at least World War II has been that the long-run rate of economic growth is largely dependent on the saving rate: saving determines the financeable rate of capital accumulation, which in turn is the basic determinant of long-run growth. Recent theoretical and empirical research has shed new light on, and also uncovered some puzzles, concerning this mechanism.

In the Keynesian and post-Keynesian traditions investment plays a vital role both as a component of aggregate demand as well as a vehicle of creation of productive capacity on the supply side. In post Keynesian demand-driven models of investment still plays a crucial role in determining medium run growth rates. Most of these models presume unemployment and idle productive capacities. An alternative but assuming full employment of labor is provided by Nicholas Kaldor who postulated growth models with changes in functional income distribution as a mechanism of macroeconomic adjustment acting through national savings in which capitalists have a greater marginal propensity to save than workers (Gutierrez and Solimano, 2007).

In the 1950s neoclassical economics gave rise to a celebrated long run, supply-driven, growth models such as Solow (1956). In this model, the rate of technical change, the savings ratio and the rate of population growth are the three parameters that determine the rate of growth of the economy in steady –state. In this model, the investment ratio plays a role only in the transition between steady –states but not in the configuration of long run growth equilibrium of the economy. In the Solow model, as said before, there is no independent investment function (a concept central to the Keynes of the General Theory). Full wage-price flexibility solves any ex-ante divergence between intended savings and desired investment avoiding the sort of macroeconomic fluctuations that were the concern of Keynes and Austrian economists alike. In the endogenous growth theory developed since the mid 1980s a new role was renovated for investment to have an effect on long run growth by making the rate of technical change and productivity growth related either to the accumulation of physical capital or the accumulation of human capital.

The issue of causality between savings, investment and growth has plagued growth economics since the start. The controversy can be cast in terms of two leading theoretical perspectives: the "Marx–Schumpeter-Keynes view" versus the "Mill- Marshall-Solow view "(Solimano, 1997). The first view posits that investment (Keynes, and to some extent, Marx) and innovation (Schumpeter, Marx) are the two variables that drive output growth. In this context, savings adjusts passively to meet the level of investment required to hold macroeconomic equilibrium and deliver a certain growth rate of output. In this view growth leads savings. On the contrary, in the Mill-Marshall-Solow approach that channel of causality is overturned as it assumed that all savings is automatically invested and translated into output growth under wage–price flexibility and full employment. As a result, in the Mill-Marshall-Solow approach savings leads economic growth. The two schools deliver alternative lines of causality between savings, investment, innovation and growth which are still relevant in an open economy with capital mobility (Gutierrez and Solimano, 2007).

Even though, savings and investment have been regarded as two key macro-economic variables with micro-economic foundations for attaining price stability and promoting employment opportunities thus contributing to sustainable economic growth (Das et al., 2010), the relationship between savings and investment has become a debatable issue in macroeconomics since the seminal study by Feldstein and Horioka (1980). The question of "causation" is the central issue of the debate; and whether it is "saving that causes investment" or "investment that causes saving". As stated by Palley (1996) the issue of saving - investment causation is the key question for fiscal policy.

The view that saving causes investment is widely celebrated with classical macroeconomics, while Keynesian macroeconomics is against this view (they argues that investment causes saving). However, deeper inspection reveals that both theoretical perspectives are capable of producing bi-directional causality, and this limits the usefulness of theory for resolving this crucial matter. Empirical findings are mixed; some findings lend a support to classical view while others favor that of Keynesians'. For example, Palley (1996) showed that it is investment which causes saving which is in line with Keynesians' view. Contrary, Venkata and Syrival.V (2005), and Jain and Sami (2011) argue that savings causes investment with no feedback effect. Besides, some empirical findings argue that there is no causality between savings and investment form either direction.[9] Bi-directional causality between savings and investment has also been revealed by some empirical works.[10]

[9] See Abu (2004), for the detailed information
[10] See Das, Mishra and Mishra (2010)

2.2. Empirical Literature Review

The relationship between economic growth and other macroeconomic variables such as savings and investment is crucial for formulating the macroeconomic policies. Thus, the role of savings and investment in spurring growth has received more attention in growth theories as well as in many of the empirical studies. The following sections present some of the empirical literatures reviewed on the area of causal relationship between savings, investment and economic growth.

2.2.1. Savings and Economic Growth

The conventional perception is that savings contribute to higher investment and therefore higher real GDP growth in the short run. Thus, higher saving rates cause higher economic growth. However, theories and empirical works have revealed 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 link between savings and economic growth is studied using contemporaneous correlation and dynamic models. This section tries to present some of the studies that attempted to show a relationship between savings rate and economic growth. Many recent studies focused on the dynamic relationship of savings and economic growth using the concept of Granger causality. Mohan (2006) studied the causality between gross domestic savings and economic growth in countries with different income levels using annual data from 1960-2001. Johansen method to Cointegration was used to study the long-run relationship of the variables under consideration and Granger causality in VECM framework was used. Evidence from Granger causality test reveals that the direction of causality in these economies is different based on their income class.[11] Based on the

[11] The study classified countries as low−income, low−middle income, upper−middle income, and high−income countries based on their income level.

empirical results, Mohan (2006) concluded that drawing a firm conclusion is difficult in deciding the direction of causality in low income countries as results are mixed. In all of the low-middle income countries, economic growth rate Granger causes growth rate of savings. Moreover, economic growth rate leads growth rate of savings in all of the high-income countries, except in Singapore.

Carrol and Weil (1994) used cross-country and household data to examine the relationship between income growth and savings. At the macro level, their finding shows that growth Granger causes saving, but saving does not Granger cause growth. Using household data, they found that households with predictably higher income growth save more than households with predictably low growth. Therefore, their findings support the hypothesis that growth Granger causes savings.

Sinha (1996) examined the relationship between growth rates of gross domestic savings and economic growth for India using annual time series data for the period 1950-1993. The study distinguishes between gross domestic saving and gross domestic private saving. Applying the Johansen and Juselius (1990) method for Cointegration test, the study revealed that growth rates of gross domestic savings, growth rates of gross domestic private savings and economic growth have long-run relationship. Granger causality tests between the growth rates of gross domestic saving/the growth of private domestic saving and the growth of GDP point out that the causality does not run in any direction.

Masih and Peters (2009) analysed the causal relationship between savings and economic growth in Mexico using annual data spanning the sample 1960 to 1996. The study used the Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) (TYDL) approach to Granger causality. Moreover, test results from TYDL are augmented by estimating generalized impulse response and generalized variance decompositions. The evidence from TYDL Granger causality clearly shows long-run bidirectional causal relationship between public savings and GDP. Their findings also reveal that public savings leads private savings. However, the long-run causality running from private savings to GDP is missing.

Moreover, evidence from generalized impulse response and generalized variance decompositions corroborate results obtained from TYDL Granger causality.

Abu (2010) studied the nexus between savings and economic growth in Nigeria during the period 1970-2007. Granger causality and Cointegration techniques were used to investigate the relationship between savings and economic growth. The Johansen co-integration test indicates that the variables are co-integrated, and that a long-run equilibrium exists between them. Additionally, the granger causality test reveals that causality runs from economic growth to savings.

The study by Katircioglu and Naraliyeva (2006) has empirically investigated the long-run relationship and direction of causality between economic growth (real GDP growth), domestic savings (DS) and foreign direct investment (FDI) in Kazakhstan using quarterly time series data covering the 1993:Q1-2002:Q4 period. To this end, the authors applied Johansen and Juselius (1990) Cointegration and VAR framework for the Granger causality approaches to test for long-run relationship and direction of causality respectively. Co-integration results imply a long-run equilibrium relationship between each pair of the above variables except between domestic savings and FDI. Granger causality test results imply unidirectional causations running from both domestic savings and FDI to real GDP growth.

Khan and Shahbaz (2010) re-investigated the association between savings and economic growth in Pakistan for the period ranging from 1971-2007. They applied new techniques in testing for Cointegration and causality between savings and economic growth. Autoregressive Distributive Lag (ARDL) Bounds Testing and Johansen Cointegration methods were applied to study for long run association while Innovative Accounting Techniques (impulse response functions and variance decomposition), and Toda and Yamamoto (1995) for causal relationship has been employed. Results disclose that there exists a long run association between economic growth and domestic savings. Causality results through innovative accounting technique stress that there is unidirectional causality running from economic growth to domestic savings while causality from opposite side is very weak. Moreover, Results by Toda and Yamamoto's technique also prove that economic growth precedes domestic savings in Pakistan.

The study by Tang (2008) examined the savings behavior in Malaysia through the Cointegration and causality analyses by using annual data from 1970 to 2004. The study employed the bounds testing for Cointegration procedure to examine the potential long run equilibrium relationship within the autoregressive distributed lag (ADRL) framework. Toda and Yamamoto (1995) causality test was used to determine the direction of causality between a set of variables. The results of bounds test confirmed a long run equilibrium link between savings and its determining factors.[12] The study found that the major causes of savings in Malaysia are real income and dependency ratio. Results from causality analysis shows that savings Granger caused economic growth in Malaysia. Similarly, Tang (2010) investigated the saving- led growth hypothesis for Malaysian economy using quarterly data from 1970:Q1 to 2008:Q4. The long run TYDL version of Granger causality – Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) technique was applied for causality test. Empirical findings are in favor of the savings-led growth hypothesis which is long run phenomenon and stable over time in this case. Tang (2010) concluded that the Malaysian dataset verifies the endogenous growth theory.

Misztal (2011) analyzed the cause and effect relationship between economic growth and savings in advanced economies and in emerging and developing countries using annual time series data covering the period 1980-2009. Co-integration model and Granger causality tests were used to analyze the data. The empirical results supported that the growth of gross domestic savings positively causes the growth of Gross domestic product in advanced economies, as well as in emerging and developing economies with no feedback effect.

Agrawal and Sahoo (2009) examined the causal relationship between total domestic savings rate and economic growth in Bangladesh using annual time series data (1975-

[12] The study has used real income, dependency ratio and real interest rates as determinants of saving during their analysis.

2004). The study has also examined the main determinants of the total domestic savings rate and the private savings rate for Bangladesh using the Autoregressive distributed lag (ARDL) approach to Cointegration. The ARDL estimation proved that there exists a stable and long-run equilibrium relationship between total savings rate, economic growth and other control variables[13] included in the model. They used Granger causality analysis and Forecast Error Variance Decomposition (FEVD) analysis in the VAR framework for causality test. The results of both approaches (i.e. Granger causality and FEVD) assert bi-directional causal relationship between total domestic savings rate and economic growth in Bangladesh.

By using quarterly data for the period of 1973:1 to 2003:4 from Pakistan, Sajid and Sarfraz (2008) investigated causal relationship between savings and output. Employing Cointegration and the vector error correction techniques to investigate causal relationship between savings and economic growth, the authors found bidirectional or mutual long run relationship between savings and output level. Specifically, there is unidirectional long run causality from public savings to output (GNP and GDP), and from private savings to gross national product (GNP). The overall long run results of the study support the capital fundamentalist's standpoint that savings lead the level of output in case of Pakistan. However, Sinha (1998-1999) finds somewhat different results. Using annual data for 1960-1995 from Pakistan and applying an augmented Granger causality tests in an error-correction framework, he finds that growth rate of GDP Granger causes the growth rates of both private saving and total saving. Moreover, the empirical result shows that there is feedback from growth rate of total saving while that of private saving is missing.

AbuAl-Foul (2010) empirically investigated the long-run relationship between real GDP and real gross domestic savings (real GDS) in Morocco and Tunisia. Using annual data from 1965 to 2007 for Morocco and from 1961 to 2007 for Tunisia and applying an Autoregressive Distributed Lag (ARDL) Bounds Test approach to Cointegration, the

[13] Agrawal and Sahoo (2009) used dependency rate, banking density, interest rate and foreign savings as control variables.

author found that there is a long-run relationship, over the sample periods, between saving and real GDP growth in the case of Morocco whilst in the case of Tunisia, such relationship is absent. Test results of Granger causality between saving and real GDP support bidirectional Granger causality in the case of Morocco. Nonetheless, in the case of Tunisia, the results of Granger causality between saving and GDP show that causality runs from saving to economic growth but not the other way around.

Ogoe (2009) have investigated the direction of causality between gross domestic savings and economic growth of Ghana using annual time series data from 1961-2008. To this end, Vector Autoregressive (VAR) model and pair wise Granger causality test were employed. Results from Granger causality tests showed that there is bidirectional causality between growth rates of gross domestic savings and economic growth of Ghana.

The empirical work of Ahmad and Anoruo (2001) has tried to determine the causal relationship between economic growth and growth rate of domestic savings for seven African countries (i.e. Congo, Coˆte d'Ivoire, Ghana, Kenya, South Africa, and Zambia) using annual time series data spanning 1960–1997. Their analysis employed cointegration in the context of the Johansen and Juselius (1990) framework and the vector error-correction model (VECM) in due course. Moreover, a Granger-causality test was undertaken to determine the direction of causality between economic growth and growth rate of domestic savings. The results of the cointegration tests suggest that there is a long-run relationship between economic growth and growth rate of savings. The results from the Granger-causality tests indicate that contradictory to the conventional wisdom, economic growth causes growth rate of domestic savings for most of the countries in question.

Sinha and Sinha (2007) examined the causal relationship between economic growth and different components of savings (i.e. household saving, corporate saving and government saving) in Mexico using annual time series data covering 1950-2001. Results from Granger causality test shows that economic growth Granger causes household saving, corporate saving and government saving with no feedback.

2.2.2. Investment and Economic Growth

The causal relationship between investment and economic growth is not settled as direction of causality running in several directions. Several empirical works have been done to determine the causal relationship between these two variables though they come up with mixed results. Some of the results are in line with the capital fundamentalists' point of view; others support the accelerator principle of investment while some results support neither of these theories. Thus, this section discusses some of the empirical works conducted so far on the area.

Tang et al (2008) investigated the causal relation between foreign direct investment (FDI), domestic investment and economic growth in China for the period 1988:1-2003:4 using a multivariate VAR system with error correction model (ECM) and the innovation accounting (variance decomposition and impulse response function analysis) techniques. Their result reveals that there is a bi-directional causality between domestic investment and economic growth in China during the sample period.

Alfa and Garba (2012) looked into both short-run and long-run relationship between domestic investment and economic growth in Nigeria using annual time series data set from 1981-2010. From cointegration results, they found a positive long-run relationship between domestic investment and economic growth while short-run Granger causality indicates significant bidirectional causality between the variables.

Casero and Varoudakis (2004) studied the relationship between growth, private investment and the cost of doing business in Tunisia and found that Tunisia's growth was driven more by public and less by private investment as compared to other high-growth countries in which the key precondition for accelerated growth and faster job creation is greater private investment under more competitive environment.

Sinha (1999) empirically investigated the relationship between export stability, investment and economic growth in nine Asian countries[14] using time series data.[15] The results are not the same across countries casting doubts about the validity of the numerous cross-section studies. They found a negative association between export instability and economic growth in case of Japan, Malaysia, Philippines and Sri Lanka. For (South) Korea, Myanmar, Pakistan and Thailand, their findings show a positive association between the two variables while it is mixed in case of India. Economic growth is found to be positively associated with domestic investment in most cases.

Blomstrom, Lipsey and Zejan (1993) examined the shares of fixed capital formation in GDP and rates of economic growth for more than 100 countries over consecutive five-year periods between 1965 and 1985 in order to find out the direction of causality between them. To this end, they applied simple regressions and multiple regressions including several standard determinants of growth in addition to simple causality test. The results suggest that increases in growth precede rises in rates of capital formation than that increases in capital formation precede increases in growth. High rates of fixed capital formation accompany rapid per capita income; however, they found no evidence that fixed capital formation is the only or major source of spurring economic growth.

Steve (2011) analyzed the relationship between capital formation and economic growth in Nigeria using annual time series data covering the years 1979-2009. Harrod –Domar growth model was applied to Nigerian growth model and tested whether it can work in Nigeria. The study employed ordinary least square multiple regression analytical method to look at the relationship between capital formation and economic growth. Moreover, Parsimonious error correction mechanism was used to determine the long-run relationship among the variables analyzed.

The long run Parsimonious Error Correction Results shows that there is long-run relationship among the variables examined. According to the results, public investment ratio has positive coefficients at current periods and negative coefficients at past periods

[14] India, Japan, (South) Korea, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka and Thailand
[15] India (1950-94), Japan (1955-96), (South) Korea (1953-97), Malaysia (1955-97), Myanmar (1950-97)

which are both statistically significant. In the reported results, public investment is significant at the 1% level. This result suggests a "crowding in" effect of public investment over gross domestic output in Nigeria indicating that public investment is complimentary to output growth in Nigeria.

Aisha Ismail et al (2010) investigated the relationship between exports, inflation, investment and economic growth for Pakistan using annual time series data spanning 1980-2009. They applied Johansen and Juselius (1990) cointegration method to decide a long-run relationship between the variables and the test results suggested that the long-run equilibrium exist between the variables under examination. In the long-run, if there is one percent increase in the total investment, economic growth increases by almost 0.179 percent. Additionally, the study employed Error Correction Model (ECM) to analyze the short-run impacts of the variables on economic growth. Results from ECM revealed that exports and investment both have a significant positive impact on economic growth while inflation negatively affects economic growth in the short-run.

2.2.3. Savings, Investment and Economic Growth

A lot of empirical researches have been done on savings, investment and economic growth (in a multivariate framework) in recent years. The motivation for these empirical studies is the growing divergence in saving and investment rates between the developing countries, the growing concern over the falling savings rates in the major OECD countries, and the increasing emphasis of the vital role of investment in the more recent economic growth literature (Verma and Wilson, 2005). This section, therefore, tries to present some of these empirical studies.

Ramesh (2011) examined the direction of the relationship between saving, investment and economic growth in India at both aggregate level and sectoral level for the period 1950/51 to 2007/08 by using Granger causality test through VAR/VECM framework. Besides, cointegration test based on Johansen-Juselius (1990) method was used in order to test the long-run relationship among the variables. The cointegration test result suggests that there exist co-integration relationship among all series with GDP except private corporate saving. study found that the direction of causality runs from saving and investment to economic growth collectively as well as individually and there is no causality from economic growth to saving and (or) investment. However, there exists reciprocal causality from saving and investment of the private sector to economic growth. This reciprocal causality comes from the household sector where saving and investment led growth and growth driven saving and investment were observed. Empirical evidence also reveals that private corporate sector saving does not Granger cause economic growth.

The study conducted by Verma and Wilson (2005) on savings, investment, foreign inflows and economic growth of the Indian economy using the annual time series data from 1950 ─2001 shows little evidence that sectoral per worker savings and investment affect GDP in the long run while per worker GDP has significant but small effects on per worker household savings and investment in the short run. The feedbacks to GDP are absent in the long run and only small and not precise in the short run. Whilst savings certainly influence investment, there are only weak links from investment to output. Generally, their findings do not support the Solow and endogenous growth policy prescriptions that it is desirable to increase household savings and investment so as to encourage economic growth in India.

Verma (2007) empirically examined the relationship between savings, investment and economic growth in India using annual time series data for the period 1950/51 to 2003/04. The study applied the Autoregressive Distributed Lag (ARDL) Bounds Testing technique to test for Cointegration. The ARDL Cointegration result revealed that GDP, GDS and GDI have long-run relationship except when GDP is the dependent variable. The author also estimated the long-run and short-run elasticities of the correlation between GDS, GDI and GDP growth which exposes three conclusions. Firstly, the econometric evidence corroborates the Carroll-Weil hypothesis that savings do not cause growth, but growth causes savings. Secondly, the results obviously support the view that savings drive investment both in the short-run and in long-run. Lastly, there is no evidence that investment is the driver of economic growth in India during the sample period.

Attanasio et al (2000) analysed the short-run and long-run relationship among savings, investment and growth rate for 123 countries over the period 1961– 94. By applying techniques such as OLS, Granger causality and impulse response functions, the study found the following results which are vigorous across data sets and estimation methods: i) lags of saving rates are positively related to investment rates; ii) investment rates Granger cause growth rates with a negative sign; iii) growth rates Granger-cause investment with a positive sign.

Budha (2012) examines the relationship between the gross domestic savings, investment and growth for Nepal using annual time series data for the period of 1974/75 to 2009/10. The study employed the Autoregressive Distributed Lag (ARDL) approach to test for cointegration and error correction based Granger causality analysis for exploring the causality between the variables of interest. Empirical results show that cointegration exists between gross domestic savings, investment and gross domestic product when each of them is taken as dependent variable. Granger causality analysis shows that there is short-run and long-run bidirectional causality between investment and gross domestic product as well as between gross domestic savings and investment. Nevertheless, no short-run causality is found between gross domestic savings and gross domestic product.

To come to the point, it is evident from the above theoretical and empirical literature review that the direction of causality between savings, investment and economic growth is mixed. Most of these empirical studies are cross section and cross country studies and fail to use long period data. The problem with such studies is the homogeneity assumption throughout the countries, which is unlikely because of differences in social, economic and institutional conditions. This necessitates country specific studies to shed more light on the causality issue of savings and investment and the related policy issues.

Moreover, most of the existing country specific empirical studies, including those conducted for the Ethiopian case; look into the relationship between savings, investment and economic growth by normally testing for bi-variate cointegration and Granger causality separately between investment and growth, or between savings and growth which can result in specification bias. Stern (2011) claimed that multivariate Granger tests are advantageous over bi-variate Granger tests in that they can help avoid spurious correlations and can aid in testing the general validity of the causation test which can be done through adding additional variables that may be responsible for causing y or whose effects might obscure the effect of x on y. There may also be indirect channels of causation from x to y, which VAR modeling could find out as suggested by Stern (2011). Therefore, this paper tries to fill these gaps by examining the causal relationship between savings, investment and economic growth in Ethiopia through a multivariate Granger causality framework.

CHAPTER THREE

METHODOLOGY

The main purpose of this chapter is to discuss some methodological issues used to achieve objectives set by this study. This chapter is composed of three main sections. The first section deals with the sources and types of data on variables used in the model. The second section of this chapter presents specification of an appropriate model used to analyze the causal relationship among savings, investment and economic growth of Ethiopia. Moreover, a succinct description of variables of interest used in the model is stated. Finally, estimation methods such as unit root tests, cointegration test, Granger causality test and related issues are discussed in the last section of this chapter.

3.1. Sources and Types of Data

In order to test the causal relationship among gross domestic savings, gross domestic investment and economic growth in Ethiopia this paper used annual time series data ranging from 1969/70-2010/11 is used based on availability of data. The data which help us accomplish this objective were obtained from different sources. The major data sources for the problem under study were publications of National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED), Statistical data base of Ethiopian Economic Association (EEA) and African Development Indicator (ADI). Moreover, WB CD-ROM was used.

3.2. Model Specification

The question of causality between the savings, investment and growth has taken attention in growth economics since the beginning. The debate can be expressed in terms of two most important theoretical perspectives: the "Marx-Schumpeter-Keynes view" and "Mill-Marshall-Solow view" as mentioned in chapter two. In order to explain the possible association between the savings, investment and growth based on Ethiopian data, this study has postulated the following specification based on Budha (2012) and Verma (2007) with some modifications. Budha (2012) and Verma (2007) suggest that gross domestic product is positively related with the gross domestic savings and gross domestic investment, all other things being equal. Thus, GDP is an increasing function of gross domestic savings and gross domestic investment which can be given as below:

$$\ln GDP = f(\ln GDS, \ln GDI) \qquad (3.1)$$

Where: GDP, GDS, and GDI are gross domestic product; gross domestic savings as a percentage of GDP and gross domestic investment as a percentage of GDP respectively. Gross domestic investment is proxied by gross capital formation as a percentage of GDP. Here, gross domestic savings and gross domestic investment rather than their net are taken for the analysis. The reason, according to Feldstein and Horioka (1980), is that the accounting definitions of depreciation are very imperfect, especially when there is significant inflation; errors of measurement in the depreciation estimates would cause a bias in the estimated coefficients.

Human capital plays a special role in a number of models of endogenous economic growth (Barro, 1991). In Romer (1990), human capital is the key input to the research sector, which generates the new products or ideas that underlie technological progress thereby leads to faster growth. According to Lucas (1988), human capital is an important source of long -term growth because of its positive. Policies that enhance public and private investment in human capital, therefore, promote long-run economic growth. In this setting, increases in the quantity of human capital per person tend to lead to higher rates of investment in human and physical capital, and hence, to higher per capita growth. Moreover, Solow (1956) growth model suggests that labor plays a crucial role determining economic growth. Based on these arguments, therefore, Equation (3.1) is augmented by including these two variables in the equation. Accordingly, Equation (3.1) becomes:

$$\ln GDP = f(\ln GDS, \ln GDI, \ln LF, \ln HC) \qquad (3.2)$$

Where LF is labor force measured by share of population aged 15-64 and HC represents human capital proxied by total capital expenditure on health and education (Adelakun, 2011; Asghar and Aswan, 2012) while ln stands for natural logarithmic transformation. The variables are transformed to their natural logarithm form to remove or to reduce considerably any heteroskedasticity in the residuals of the estimated model.

Given the existence of potential two-way relationships among the considered variables, the estimation of a VAR model to test causality hypotheses is more reliable than that of a single equation model. VAR systems treat all variables as endogenous avoiding thus infecting the model with false identifying restrictions (Sims, 1980). So, to undertake our empirical analysis, we specify the following vector autoregressive model comprised of gross domestic savings, gross domestic product, gross domestic investment, labor force and human capital. The lag augmented VAR representation of Equation (3.2) is given as below:

$$\ln GDP_t = \beta_{10} + \sum_{i=1}^{p}\theta_{1i} \ln GDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\Omega_{1i} \ln GDP_{t-i} + \sum_{i=1}^{p}\delta_{1i} \ln GDS_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\varphi_{1i} \ln GDS_{t-i} + \sum_{i=1}^{p}\gamma_{1i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\psi_{1i} \ln GDI_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\eta_{1i} \ln LF_{t-i} + \sum_{i=1}^{p}\vartheta_{1i} \ln HC_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\omega_{1i} \ln HC_{t-i} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

$$\ln GDS_t = \beta_{20} + \sum_{i=1}^{p}\theta_{2i} \ln GDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\Omega_{2i} \ln GDP_{t-i} + \sum_{i=1}^{p}\delta_{2i} \ln GDS_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\varphi_{2i} \ln GDS_{t-i} + \sum_{i=1}^{p}\gamma_{2i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\Psi_{2i} \ln GDI_{t-i} + \sum_{i=1}^{p}\phi_{2i} \ln LF_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\eta_{2i} \ln LF_{t-i} + \sum_{i=1}^{p}\vartheta_{2i} \ln HC_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\omega_{2i} \ln HC_{t-i} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots (3.4)$$

$$\ln GDI_t = \beta_{30} + \sum_{i=1}^{p}\theta_{3i}\ln GDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\Omega_{3i}\ln GDP_{t-i} + \sum_{i=1}^{p}\delta_{3i}\ln GDS_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\varphi_{3i}\ln GDS_{t-i} + \sum_{i=1}^{p}\gamma_{3i}\ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\psi_{3i}\ln GDI_{t-i}$$

$$+ \sum_{i=p+1}^{p+d_{\max}}\eta_{3i}\ln LF_{t-i} + \sum_{i=1}^{p}\vartheta_{3i}\ln HC_{t-i} + \sum_{i=p+1}^{p+d_{\max}}\omega_{3i}\ln HC_{t-i} + \varepsilon_{3t} \text{......................}(3.5)$$

Where $\theta_i s$, $\Omega_i s$, $\delta_i s$, $\varphi_i s$, $\gamma_i s$, $\psi_i s$, $\eta_i s$, $\vartheta_i s$ and $\omega_i s$ are parameters of the model; d_{max} is the maximum order of integration suspected to occur in the system; ε_{1t}, ε_{2t} and ε_{3t} are the residuals of the model; ln represents natural logarithm. Equations (3.3), (3.4) and (3.5) will be estimated to determine the direction of causality between the variables under consideration.

From (3.3), Granger causality from $\ln GDS_t$ to $\ln GDP_t$ implies $\delta_{11} = \delta_{12} = \ldots \delta_{1p} \neq 0$; Granger causality from $\ln GDI_t$ to $\ln GDP_t$ implies $\gamma_{21} = \gamma_{22} = \ldots \gamma_{2p} \neq 0$. From (3.4), Granger causality runs from $\ln GDP_t$ to $\ln S_t$ if $\theta_{21} = \theta_{22} = \ldots \theta_{2p} \neq 0$ and from $\ln GDI_t$ to $\ln GDS_t$ if $\gamma_{21} = \gamma_{22} = \ldots = \gamma_{2p} \neq 0$. Similarly, from (3.5), Granger causality from $\ln GDP_t$ to $\ln GDI_t$ shows that $\theta_{31} = \theta_{32} = \ldots. = \theta_{3p} \neq 0$ and Granger causality from $\ln GDS_t$ to $\ln GDI_t$ implies $\delta_{31} = \delta_{32} = \ldots = \delta_{3p} \neq 0$.

3.3. Method of Data Analysis and Estimation Techniques

Quantitative analysis was used to examine the collected data. Specifically, the study carried out the analysis of the time series property of the data through unit root test, test of cointegration (ARDL approach) to evaluate the long run relationship among variables under consideration. Moreover, the ARDL version of error correction modeling was applied in order to examine the short-run dynamics of growth equation. Finally, the TYDL approach to Granger non-causality along with impulse response function and variance decomposition was used to determine the existence and direction of causality between savings, investment and economic growth. All estimations were carried out using econometric software packages.[16]

3.3.1. Unit Root Test

Much of `classical' econometric theory has been predicated on the supposition that the observed data come from a stationary process, meaning a process whose means and variances are constant over time (Hendry and Juselius, 1999). However, most macroeconomic variables are non-stationary at level. Regression of non-stationary time series data results in invalid estimates, thus makes economic forecasts badly wrong. The first step in building dynamic econometric models, therefore, entails a thorough investigation of the characteristics of the individual time series variables involved. Such an analysis is essential as the properties of the individual series have to be taken into account in modeling the data generation process of a system of potentially related variables (Lutkepohl and Kratzig, 2004).

When discussing stationary and non-stationary time series, the need to test for the presence of unit roots in order to avoid the problem of spurious regression was stressed. If a variable is found to have a unit root, then it is non-stationary, and unless it combines with other non-stationary series to form a stationary co-integration relationship, then regressions involving these series can falsely imply the existence of a meaningful economic relationship (Harris and Sollis, 2003). Unit root test should be conducted in order to determine whether individual variables are stationary or not. To this end, the augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) tests were applied.

In conducting the Duckey Fuller (DF) test, it is assumed that the error term is uncorrelated which lead to loss of significant power if the assumption is implausible. But in case where the error terms are correlated, Dickey and Fuller have developed a test, known as the

[16] Eveiws 6 and Microfit 4 were used for an econometric analysis.

augmented Dickey–Fuller (ADF) test. The Augmented Dickey-Fuller test comes in the following general form:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \varepsilon_t \text{...(3.6)}$$

where β_1 is a drift, t is a trend, p is the lag length and ε_t ~ iid (0, δ^2). We have the following hypothesis:

H_0: δ =0 (i.e. the series is non-stationary); Ha: δ <0 (i.e. the series is stationary)

If the computed value, in absolute term, of the t statistic is greater than the ADF critical values, we reject the null hypothesis implying that the time series is stationary.

The Augmented Dickey Fuller test corrects for higher order serial correlation through lagged difference terms. On other hand, Phillips and Perron (1988) test estimating a non-augmented version of original dickey fuller equation and modifying the t-ratio so that serial correlation does not affect the asymptotic distribution of the test statistics (Sami, 2011). The test regression for the PP test, as stated in Kumar (2010), is:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + \varepsilon_t \text{.. (3.7)}$$

Where ε_t is I(0) and may be heteroskedastic and D_t contains deterministic components (constant or constant plus time trend). The PP test adjusts for any serial correlation and heteroskedasticity in the disturbance terms ε_t of the test regression directly modifying the test statistics.

3.3.2. Cointegration Test: ARDL Bounds Testing Approach

Harris and Sollis (2003) states that if a series must be differenced d times before it becomes stationary, then it contains d unit roots and is said to be integrated of order d, denoted I(d). Given two time series y and x that are both I(d), as a general rule, any linear combination of the two series will also be I(d) (e.g., the error terms obtained from regressing y_t, on x_t, are I(d). If, on the other hand, there exists a vector β such that the disturbance term from the regression ($u_t = y_t - \beta x_t$) is of a lower order of integration I(d-b), where b>0, then Engle and Granger(1987) define y_t, and x_t, as cointegrated of order (d, b).[17]

There are various techniques for conducting the cointegration analysis among time-series variables. The well-known methods are: the residual-based approach proposed by Engle and Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Julius (1990) and Johansen (1992).

This paper adopts the so-called autoregressive distributed lag (ARDL) bounds test which was introduced originally by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001) appears to be applied in recent empirical investigations. This method has certain econometric advantages as compared to other cointegration procedures. First, it is applicable irrespective of the degree of integration of the variables (i.e. whether the underlying variables are Purely I(0), I(1) or mixture of both) and thus avoids the pre-testing of the order of integration of the variables. Second, the long-run and short-run parameters of the model are estimated simultaneously since it takes into account the error correction term in its lagged period. Third, the ARDL approach is more robust and performs better for small sample sizes.

The ARDL approach requires estimating the conditional error correction version of the ARDL model for variables under estimation. The augmented ARDL ($p, q_1, q_2, ..., q_k$) is specified by the following equation (Pesaran and Pesaran, 1997; Pesaran et al., 2001);

$$\alpha(L,p)y_t = a_0 + \sum_{i=1}^{k} \beta_i (L,q_i) x_{it} + \lambda' w_t + \varepsilon_t, \forall_t = 1,...,n \text{ .... } (3.8)$$

y_t is the dependent variable, α_0 is the constant term, L is the lag operator, w_t is $sx1$ vector of deterministic variables such as intercept term, time trends, or exogenous variables with

[17] Even if Engle and Granger's (1987) original definition of cointegration relates to variables that are integrated of the same order, Enders (2004) argues that it is possible to find equilibrium relationships among groups of variables that are integrated of different orders. See also Asteriou and Hall (2007) and Lutkepohl (2004).

fixed lags. The x_{it}, in Equation (3.8) is the i^{th} independent variable where i = l, 2, . . . , k. The long-run equation with respect to the constant term can be written as follows[18]:

$$y_t = \alpha_0 + \sum_{i=1}^{k} \beta_i x_i + \delta' w_t + v_t \text{ ....(3.9)}$$

The ARDL approach involves two steps for estimating the long-run relationship (Pesaran et al., 2001). The first step is to test the existence of long-run relationship among all variables in the equations under estimation. The second step is to estimate the long-run coefficients of the same equation.

A more general form of ECM with unrestricted intercept and unrestricted trends (Pesaran et al., 2001, p. 296) is given by:

$$\Delta y_t = c_0 + c_1 t + \pi_{yy} y_{t-1} + \pi_{yx.x} x_{t-1} + \sum_{i=1}^{p-1} \psi_i' \Delta z_{t-1} + w' \Delta x_t + u_t \text{ ………… (3.10)}$$

Where $c_0 \neq 0$ and $c_1 \neq 0$

Consequently, we define the constituent null hypotheses $H_0^{\pi_{yy}} : \pi_{yy} = 0$, $H_1^{\pi_{yx.x}} : \pi_{yx.x} = 0'$, and alternative hypotheses $H_1^{\pi_{yy}} : \pi_{yy} \neq 0$, $H_1^{\pi_{yx.x}} : \pi_{yx.x} \neq 0'$. Hence, the joint null hypothesis of interest is given by:

$$H_0 = H_0^{\pi_{yy}} \cap H_0^{\pi_{yx.x}} \text{ ………………….. (3.11)} \quad \text{[i.e. there is no cointegration]}$$

and the alternative hypothesis is correspondingly stated as:

$$H_1 = H_1^{\pi_{yy}} \cup H_1^{\pi_{yx.x}} \text{ ....(3.12)} \quad \text{[i.e., there is cointegration]}$$

Two sets of asymptotic critical values are provided by Pesaran et al (2001).[19] The first set assumes that all variables are I(0) while the second set assumes that all variables are I(1). If the computed F-statistics is greater than the upper bound critical value, then we reject the null hypothesis of no cointegration and conclude that there exists long-run

[18] See Pesaran et al. (2001) for the detailed mathematical derivations.

[19] The asymptotic distributions of the F-statistics are non-standard under the null hypothesis of no cointegration relationship between the examined variables, irrespective of whether the variables are purely I(0) or I(1) or mutually cointegrated.

equilibrium among the variables of interest. If the computed F-statistics is less than the lower bound critical value, then we cannot reject the null of no cointegration. If the computed F-statistics falls within the lower and upper bound critical values, then the result is inconclusive (Faras and Ghali, 2009).

3.3.3. The Error Correction Models (ECM)

It is pointed out that estimating a dynamic equation in the levels of the variables is problematic and differencing the variables is not a solution, since this then removes any information about the long run. The more suitable approach is to convert the dynamic model into an error correction model (ECM), and it is shown that this contains information on both the short-run and long-run properties of the model, with disequilibrium as a process of adjustment to the long-run model (Harris and Sollis, 2003).

The error correction (EC) representation of the ARDL ($\hat{p}, \hat{q}_1, \hat{q}_2, ...\hat{q}_k$) model can be obtained by writing Equation (3.8) in terms of the lagged levels and the first differences of $y_t, x_{1t}, x_{2t}, ..., x_{kt}$ and w_t, where $\hat{p}$ and $\hat{q}_i$, i=1, 2,…,k are the estimated values of p and q_i, i = 1,2,…,k, is given by:

$$\Delta y_t = \Delta a_0 + \sum_{i=1}^{k} \beta_{i0} \Delta x_{it} + \lambda' \Delta w_t - \sum_{j=1}^{\hat{p}-1} \alpha_j^* \Delta y_{t-1}$$

$$- \sum_{i=1}^{k} \sum_{j=1}^{\hat{q}_{i-1}} \beta^*{}_{ij} \Delta x_{i,t-j} - \alpha(1, \hat{p}) ECM_{t-1} + \varepsilon_t \text{..........................(3.13)}$$

where Δ is the first difference operator; λ', α_j^* and $\beta^*{}_{ij}$ are the coefficients relating to the short-run dynamics of the model's convergence to equilibrium while $\alpha(1, \hat{p})$ measures the speed of adjustment. ECM represents the error-correction model and it is defined as follows:

$$ECM_{t-1} = y_t - \hat{\alpha} - \sum_{i=1}^{k} \hat{\beta}_i x_{it} - \lambda' w_t \text{..} \quad (3.14)$$ where

x_t are k-dimensional forcing variables which are not cointegrated among themselves.

The existence of an error-correction term among a number of cointegrated variables implies that changes in the dependent variable are a function of both the level of disequilibrium in the cointegration relationship (represented by the ECM) and the changes in other explanatory variables. This tells us that any deviation from the long-run equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long-run equilibrium (Faras and Ghali, 2009).

3.3.4. Granger Causality Test: The TYDL Approach

x is (simply) Granger causal to y if and only if future values of y can be predicted better, i.e. with a lesser forecast error variance, using current and past values of x. Granger causality with more than two variables can be extended to a general case as well (Kirchgässner and Wolters, 2007).

Given the definition of Granger non -causality (GNC) hypothesis, there have been three approaches to implement the Granger causality test depending on time-series properties of variables; a VAR model in the level data (VARL), a VAR model in the first-differenced data (VARD), and a vector error correction model (VECM) can be used to test for the existence and direction of causality between variables based on evidence for cointegration among the variables.

However, Phillips and Toda (1993, 1994) argue that VAR estimation often involves nuisance parameters and then no satisfactory basis for mounting a statistical test of causality test applies as the F-test statistic does not have a standard distribution when variables are integrated. The VECM approach which involves pre-testing through unit root and Cointegration tests suffers from size distortions and can often lead to mistaken conclusions about causality.[20]

As a result, this study adopts the TYDL approach of Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996). This approach has many advantages over other methods of testing Granger non-causality. TYDL approach is applicable irrespective of integration and cointegration properties of model. The TYDL method is better control the type I error probability than other methods based on the VARL, VARD, and VECM. The simulation results by Yamada and Toda (1998) indicate that among three causality procedures, TYDL is the most stable approach when compared to VAR and VECM. The basic idea is to artificially augment the correct VAR order, k, with d_{max} extra lags, where d_{max} is the maximum likely order of integration of the series in the system as follows:

$$Z_t = \sum_{i=1}^{k} \Phi_i Z_{t-i} + \sum_{j=1}^{d_{\max}} \Phi_{k+j} Z_{t-k-j} + \varepsilon_t, \quad H_0 : R_M vec(\Phi_1,...,\Phi_k) \text{ .... } (3.15)$$

where k is the true lag length, d_{max} is the maximal order of integration among variables in the system, $vec(\cdot)$ represents to stack the row of a matrix in a column vector, M_R is the appropriate selection vector corresponding to a specific GNC hypothesis and Z_t is vector of endogenous variables in the VAR system. Then, Granger causality is tasted using the modified Wald (MWald) test which is theoretically very simple, as it involves estimation of a VAR model augmented in a straightforward way.

3.3.5. Impulse Response Function (IRF) and Variance Decomposition

Since the cointegration analysis focuses on the long-run properties of the macroeconomic model, it is important to combine it with some additional information on how the long-run relations respond to shocks (Pesaran and Pesaran, 2009). Impulse response functions

[20] Such possibilities are demonstrated by a number of simulation studies (e.g., Yamada and Toda, 1998; Clarke and Mirza, 2006).

(IRFs) and variance decomposition (VDC) serve as tools for evaluating the dynamic interactions and strength of causal relation among variables in the system (Dausa, 2007).

Granger-causality may not tell us the complete story about the interactions between the variables of a system. In applied work, it is often of interest to know the response of one variable to an impulse in another variable in a system that involves a number of further variables as well. Thus, one would like to investigate the impulse response relationship between two variables in a higher dimensional system (Lutkepohl, 2005).

A shock to the i^{th} variable not only directly affects the i^{th} variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables (Eviews 6 User's Guide, 2007).

Following Sims' (1980) influential paper, dynamic investigation of vector autoregressive (VAR) models is usually carried out using the 'orthogonalized' impulse responses, where the underlying shocks to the VAR model are orthogonalized using the Cholesky decomposition before impulse responses, or forecast error variance decompositions are computed (Pesaran and Shin, 1998). However, the Cholesky decomposition is criticized by Pesaran and Shin (1998) since it is not invariant to the ordering of the variables in the VAR implying that changing the order of the equation may dramatically change the impulses. To overcome this problem, Pesaran and Shin (1998) proposed an alternative approach called generalised impulse response[21] which is invariant to the ordering of the variables in the VAR.

Determining the existence of Granger causality is restricted to essentially within sample tests, which are useful in distinguishing the plausible Granger exogeneity or endogeneity of the dependent variable in the sample period, but are unable to infer the degree of exogeneity of the variables beyond the sample period. To examine this issue, the decomposition of variance which measures the percentage of a variable's forecast error variance that occurs as the result of a shock from a variable in the system should be

[21] The approach is also used in the construction of order-invariant forecast error variance decompositions.

considered (Narayan and Symth, 2004). As the orthogonalized forecast error variance decompositions are not invariant to the ordering of the variables in the VAR, the generalized forecast error variance decomposition which is invariant to the ordering of the variables in the VAR (Pesaran and Pesaran, 2009) is used in this study.

CHAPTER FOUR

PERFORMANCES OF ECONOMIC GROWTH, SAVINGS AND INVESTMENT IN ETHIOPIA

The functioning of an economy is highly explained by the reliability of the macroeconomic policy environment, the political framework, the various institutional setup of a country, and indeed the design of the macroeconomic policy is a reflection of the political process. Economic performance in Ethiopia is highly associated with the political structure (Alemayehu, 2001)

Ethiopia has witnessed broadly three policy regimes: the Imperial era (Prior to 1973/74), the Socialist (Derg) regime (1974/75 – 1990/91) and the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) regime (1991/92 on wards). The first regime adopted non-interventionalist approach, whose general policy stance was to pursue market-oriented policies. The second followed rigid inward looking strategy and the third initiated economic reforms to tackle the long -term structural problems of under development (Ramakrishna and Rao, 2012). Clearly the EPRDF period is characterized by liberalization of the economy in a distinctive Structural Adjustment Programme (SAPs) approach which is partly responsible for better growth performance as compared to the previous two regimes.

The main objective of this part is, therefore, briefly discussing the performance of the Ethiopian economy measured by real GDP growth rates and its sectoral contribution, savings and investment performance and the correspondence resource gap under these three different regimes.

4.1. Overview of the Ethiopian Economy

Ethiopia is one of the countries in Sub-Saharan Africa where sustained and meaningful economic growth has eluded the macro economic statistics for a long time. The country suffered tremendous social upheavals, war, and natural calamities over the last five decades (Alemayehu et al., 2002).

Being mainly dependent on agriculture, the performance the Ethiopian economy has particularly been vulnerable to unpredictability of weather. In addition to this, the performance of the Ethiopian economy also depends on the external environment which is important bearing on the functioning of both the agricultural, and more importantly, the country's main source of foreign exchange that comes from few products like coffee, skins, hides and others. Apart from this, frequent drought and famine accompanied by poor policies and civil war have made it possible to bring about structural transformation of the economy (Hailemariam, 2010).

The Ethiopian economy has been growing at an average annual rate of 3.8 percent whereas the population has been growing at annual rate of 2.6 percent with the corresponding real per capita GDP growth rate of 1.4 percent per annum for the period 1960-2011. [See Table 4.1]

As a predominantly agriculture based economy (where agriculture employs more than 85 percent of the population and contributing nearly half to GDP), the economic performance in Ethiopia is largely determined by what happens in the agricultural sector. The performance can be seen along three distinctive periods.

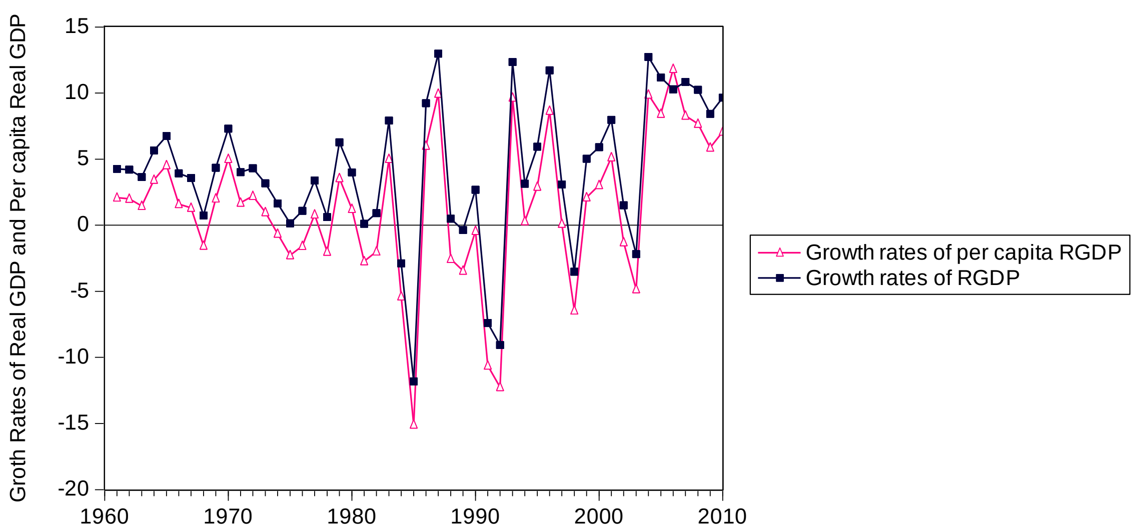
Table 4.1: Average Growth Rates of Real GDP and its Sectoral components

Item/period	1960/61-1973/74	1974/75-1990/91	1991/92-2010/11	1960/61-2010/11 (Average)
Growth rate in real GDP	3.7	2.0	7.0	4.2
Growth rate in Population	2.2	2.9	2.6	2.6
Growth rate in PCGDP	2.1	-0.68	2.8	1.4

Source: Abeba (2002) and own computation from MoFED (2010/11) data

During the 'Imperial regime' (before 1974) growth was satisfactory (Easterly, 2001) even though there was downward trend. See Figure 4.1 below. The Ethiopian economy had been growing at a rate of 4.2 percent per annum with an average population growth of 2.2 percent and real per capita GDP growth of 2.1 percent during the Imperial era. During this regime, growth never recorded a negative values and it was fluctuating within a small band as compared to the remaining two regimes. GDP was growing at 5.66%, 6.75% and 7.31% during 1963/64, 1964/65 and 1969/70 respectively while the lowest growth rate recorded during the Imperial regimes is 0.75% which was attained during 1967/68. Similarly, per capita real GDP had been growing at 3.44%, 4.53%, 5% and -0.65% (the lowest per capita RGDP growth rate during the regime) during 1963/64, 1964/65, 1969/70 and 1967/68 correspondingly.

Figure 4.1: Trends of Growth Rates of Real GDP and Per Capita Real GDP



Source: Own Computation from World Bank (2010/11) Data

During the Derg regime (1973/74-1990/91) the country's growth rate decelerated to a mere 2 percent- a growth rate far below the estimated population growth of 2.9%- which resulted in an average annual rate of -0.68 percent in real per capita GDP. Several factors can be mentioned for this meager performance. This can easily be witnessed by disaggregating this period in rather short time intervals. During the period 1974-1978 the growth rate was less than 1%. Among other things the civil war, the instability induced by the emerging new policy (following the 1974 revolution) as well as the war with Somalia responsible for this growth performance. Due to relatively stable and good weather conditions, the economy revived and growth rate increased to about more than 4% (around 2% in per capita terms) in 1979/80. In 1984/85 growth declined to -5.3% due to severe drought. [See Figure 4.1] This rate rose to 7.9% in 1986/87, and decline back to 1% in 1988/89.

In spite of the disappointing growth records and poor economic performance in the Derg regime and early periods of EPRDF, the country started to make improvement in the performance of the economy (Tassew, 2011). Economic growth during the post-Derg period (1991/92-2010/11) is quite impressive where real total and per capita GDP on average grew at 7 percent and 2.8 percent per annum, respectively with average population growth of 2.6 percent. The track of progress in economic growth is strong especially after the year 2003/04. During these periods the Ethiopian economy recorded a healthy successive economic growth. For instance, the Ethiopian economy grew by 11.7%, 12.6% 11.6% and 10.41% during 2003/04, 2004/05, 2005/06 and 2009/10, respectively. As can be seen from Figure 4.1 above, economic growth during the post-Derg regime is quite satisfactory as compared to the past two regimes though it is extremely erratic due to different factors. For instance, growth decelerated during 1991/92 due to regime shift, 1999/2000 (resulted from the outbreak of war with Eritrea) and 1993/94, 1997/98, 2000/2001 and 2002/03 due to severe drought (and hence shortage of rain-fall). On the other hand, a good growth record of 1995/96 and 2001/02 is attributed to good harvest as a result of favorable weather condition.

4.2. Structure of the Ethiopian Economy

Agriculture is the mainstay of the Ethiopian economy which prescribes both GDP growth and employment. As a result, the performance of the sector determines the economic welfare of the population. This dominance has remained inherent mainly for the reason that the other sectors have not developed quickly and the overwhelming majority of the population lives in the rural areas. The following table demonstrates the average share, the contribution to growth in GDP and growth rates of agriculture, industry and service sectors to GDP in the three regimes. Moreover, the average contribution to growth in GDP and the average growth rates of each sector is presented in the table.

Table 4.2 shows that agriculture, as compared to other sectors, contributed a lion's share in the real GDP of Ethiopia during the entire period under review (1960/61 – 2010/11) amounting to 53.1 percent, while the shares of industrial and service sectors are 13.4 and 33.5 percents correspondingly. Therefore agriculture has been the backbone of Ethiopian economy for the last five decades with average growth rate of 2.31 percent. Even though agriculture is contributing a great share to GDP (i.e. 53.1 percent), it accounted only 25.8 percent of the growth of GDP. This is witnessed by the low relative contribution factor, which is 0.49. The industrial and service sectors have been growing at average rates of 5.48 percent and 6.07 percent respectively during the period under review (1960/61-2010/11). The industrial sector accounted for 19.4 percent of the growth of GDP while that of service sector is 54.5 percent. This happens due to the fact that the relative contribution factor of these two sectors (i.e. industry and service) is greater than unity.

During the Imperial regime, on average, the agriculture sector contributed 60.8 percent of GDP which accounted for 31.2 percent of the growth of GDP. The sector had been growing at an average growth rate of 2.1 percent. The industrial and service sectors contributed 13.3 and 25.9 percent of GDP respectively. In this period, the share of the industrial sector grew steadily from 7 percent in 19960/61 to 28.7 percent in 1974/75. The steady growth in the percentage share of the industrial and service sectors can be viewed as the right track to economic growth and development.

Table 4.2: Average Sectoral Contribution to GDP and to Growth in GDP

Item/period		1960/61-1973/74	1974/75-1990/91	1991/92-2010/11	1960/61-2010/11 (Average)
Sectoral Contribution to GDP					
Agriculture		60.8	52.4	46.1	53.1
Industry		13.3	13.0	15.0	13.4
Distributive Service		13.1	14.8	19.0	16.0
Other Service		12.8	19.8	20.1	17.5
Sectoral Contribution to growth in GDP[22]					
Agriculture	Percentage	31.2	14.9	31.3	25.8
	Cont. factor	0.51	0.29	0.67	0.49
	Growth rate	2.10	0.06	4.77	2.31
Industry	Percentage	22.7	18.1	17.5	19.4
	Cont. factor	1.71	1.43	1.10	1.41
	Growth rate	7.04	3.60	5.80	5.48
Distributive service	Percentage	24.9	20.5	25.4	23.6
	Cont. factor	1.9	1.35	1.24	1.50
Other service	Percentage	21.2	47.0	25.8	31.3
	Cont. factor	1.66	2.37	1.26	1.76
	Growth rate[23]	7.47	3.41	7.65	6.07

Source: Own computation from MoFED (2010/11) data

[22] A sector, which accounts for a major part of GDP, may not necessarily contribute to growth of GDP significantly. The very simple method to determine the contribution of a sector to growth in GDP in relation to its contribution to GDP is to look at the ratio of the percentage contribution of a sector to its share in GDP. It is simply calculated as the ratio of growth rate in the value-added of a sector to growth rate in GDP.

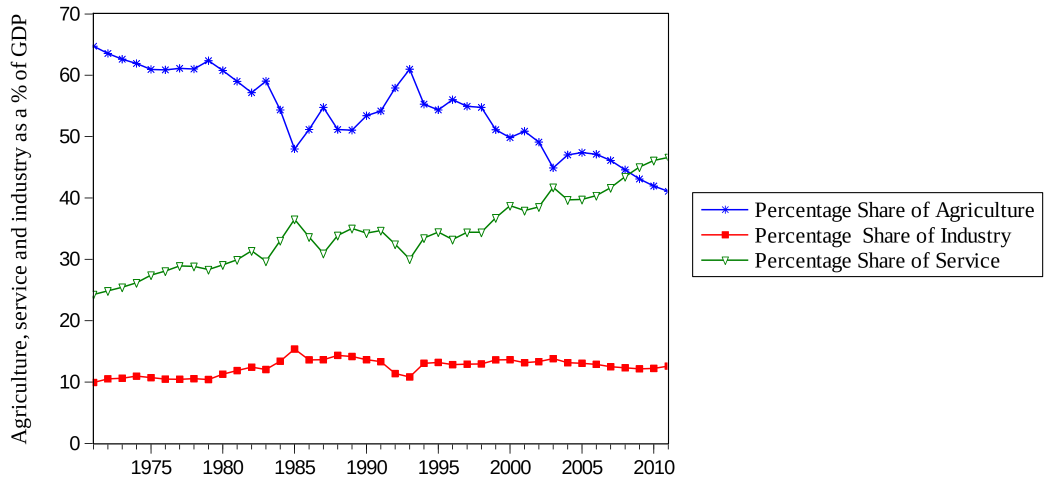
[23] It represents the average growth rates of total service sector (i.e. distributive sector and other service sector altogether).

The average contribution of agriculture declined to 52.4 percent of GDP in the Derg-regime (1974/75 – 1990/91). The industrial and service sectors were 13.0 and 34.6 percent per annum respectively. The share of the agricultural sector declined which was accompanied by an increase in the share of service sector. The share of industrial sector exhibited little change from the figure of Imperial regime.

Table 4.2 above also shows that agriculture is still the most dominant sector (during the current regime) which accounts for 46.1 percent of GDP. Though agricultural production has increased considerably, due to favorable weather conditions and enhanced support by government (e.g., improved supply of fertilizer) agricultural productivity remains low. The expansion in agriculture production has been driven by increases in the area of land cultivated, rather than major improvements in productivity. Given current technological conditions and the structure of production, pushing the production frontier further is difficult due to the already existing pressures on the land (African Development Bank, 2010). On the other hand, the contribution of industrial sector, on average, is 13.4 percent while that of service sector is 39.1 percent.

Figure 4.2 below shows trends of share of the three sectors in GDP. The share of the services sector in GDP has been rising, while that of agriculture has been declining steadily (See Figure 4.2). The agricultural sector's share of GDP declined steadily and attained 47.9 percent during 1984/85. This low share might be due to the severe drought of 1984/85. Then afterwards, the contribution of agricultural sector had been increasing until 1992/93 and reached 60.9 percent which was resulted from timely and adequate rainfall. After 1992/93, the share of agriculture declined back and finally has been exceeded by the share of service sector since 2008/09. According to African Development Bank (AfDB, 2010), factors such as rapid expansion in financial intermediation, public administration and retail business activities have put growth in services on this impressive track. Figure 4.2 below summarizes the above and the forthcoming points.

Figure 4.2: Trends of Percentage Distribution of GDP by Major Industrial Classification



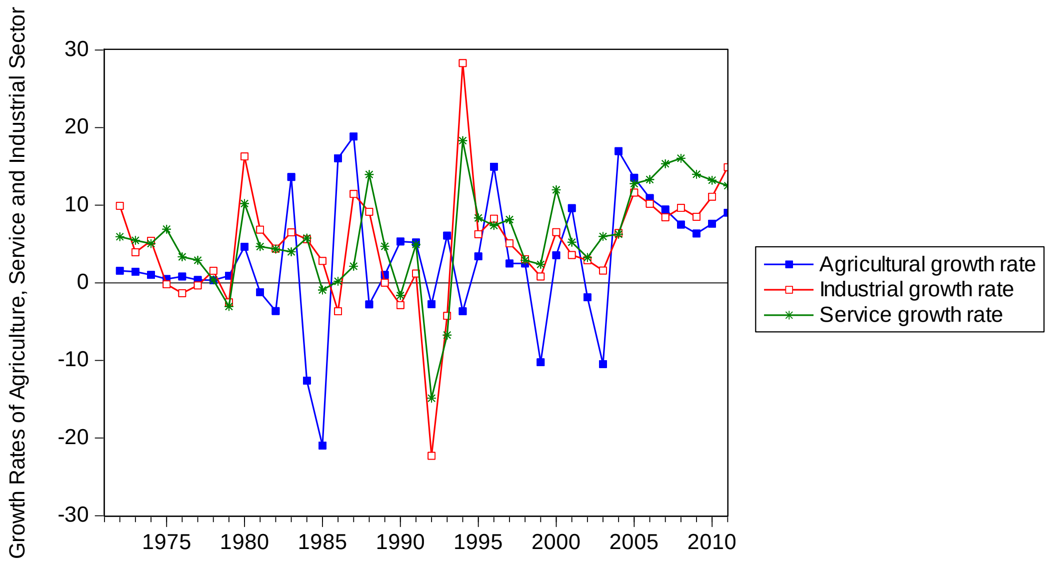
Source: Own Compution from MoFED (2010/11) Data

On the other hand, the share of industry in GDP has remained relatively static, amounting to between 13 and 14 percent if abnormal years (1991/92 and 1998/99) are not considered. The manufacturing sub-sector contributed less than 4 percent of GDP growth in 2008/2009. The low share of the manufacturing sector, a crucial sector in transforming an economy, is a concern for the Ethiopian Government (AfDB, 2010).

Structural change in the economy plays a central role in explaining sustainable macroeconomic performance (Alemayehu, 2001). Generally, with the exception of the service sector it is logical to reason out, from Figure 4.2 above, that the Ethiopian economy does not show major change in the structure of the economy during the post-Derg period.

Economic growth does depend not only on sectoral contribution to GDP but also on growth performance of these sectors. Figure 4.3 below presents the trends of growth rates of the three sectors (i.e. agriculture, service and industry). The GDP growth rate closely follows the growth rate of value-added in agriculture due to the fact that the share of agriculture in GDP is dominant and growth rate of agriculture shows a great variation as compared to the reaming two sectors as shown in Figure 4.3 below. The dependency of Ethiopian agriculture on vagaries of nature as well as man-made factors such as war makes growth performance of agriculture very erratic as compared to growth performances of the other two remaining sectors.

Figure 4.3: Trends of Growth Rates of Agricultural, Service and Industrial Sector



Source: Own Computation from MoFED (2010/11) Data

The poorest growth performance in agriculture was recorded during 1984/85 with the growth rate of -20.96 percent which was resulted from the worst drought in that year. Similarly, the poor growth performance during 1993/94 (-3.7%) and 2002/03 (-10.48%) were attributed to severe drought while that of 1998/99 (-10.24%) was recorded due to Ethio-Eritrea war. On the other hand, the high growth rates of agriculture during 1986/87, 1995/96, 2001/02, 2003/04, 2004/05, 2006/07 were owing to good harvest, which in turn are results of good and timely rainfall. In addition to good weather condition, some efforts and support for farmers in the form of extension packages and an increase in cultivated land seem to have contributed to this performance of 2001/02, 2003/04, 2004/05 and 2006/07.

As can be seen from Figure 4.3 above, the growth rates of both service and industrial sector followed a declining trend in the 1970s and increased in 1979/80. This trend declined back and showed a downward trend until 1985/86. Both service and industrial sector achieved the lowest growth rates during 1991/92 which is attributed to the regime shift. After 1991/92, the growth performance of both sectors recovered following reforms of the early 1990s.

4.3. Performance of Savings and Investment

Investment and its sources of financing are critical factors in achieving positive and sustainable macroeconomic performance. Neoclassical growth theories claim that capital formation activity is a key to economic growth. According to this theory developing countries' growth is constrained by a serious lack of capital. The situation in Ethiopia is not distinct from the other developing countries and the figure of both investment and saving remained low relative to GDP (Tassew, 2011).

Gross domestic saving as a ratio of GDP has been very low in Ethiopia from a historical perspective and relative to similar economies (SSA) because of the subsistence nature of the economy where output is barely enough for consumption (Ethiopian Economics Association, 2006). For example, the average gross domestic saving to GDP for the last five decades (1960/61-2010/11) has been 9.4 percent which is by far lower than investment (15.2%) resulting in negative resource gap that amounts to -5.8 percent.

During the Imperial period GDS on average constituted about 14.1 percent of GDP while gross fixed investment contributed on average about 15.9 percent of GDP with the corresponding resource gap of -1.8 percent of GDP implying that GDS more or less covered domestic investment. However, rate of domestic saving failed to revive from its depression after the early 1970s and the average GDS and investment as a percent of GDP declined to 6.7 percent and 12.2 percent, respectively, during the Derg era. According to Ayalew (2010), poor performance in saving and investment during the Derg regime was presumably due to poorly structured and ill managed economic environment. In this particular period, ownership of means of production was mainly restricted to the government and the role of the private sector in the economy was deliberately reduced. Even the public owned large enterprises, which could have expanded the rate of physical capital formation, were less productive and contributed low level.

Table 4.3: Average Percentage Share of Gross Domestic Saving and GCF to GDP

Macroeconomic indicators	**Period**			
	1960/1–1973/4	1974/5–1990/1	1991/2–2010/11	1960/1–2010/11 (Average)
Gross Capital Formation (% of GDP)	15.9	12.2	17.6	15.2
Gross Domestic Saving (% of GDP)	14.1	6.7	7.28	9.4
Resource gap (% of GDP)	-1.8	-5.5	-10.3	-5.8

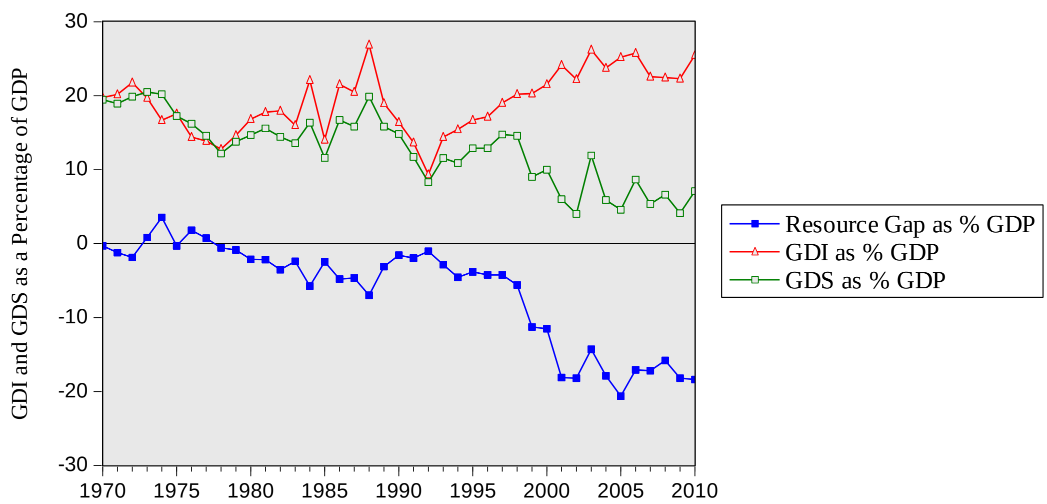
Source: Own Computation Based on MoFED (2010/11) Data

In contrast to the Derg regime, the share of gross domestic investment was higher (17.6 percent) while that of gross domestic saving increased averagely to 7.28 percent during the current regime. This was mainly due to better economic environment which encourages private sector participation in the economy by reducing the role of the government. Figure 4.4 summarizes trends of savings-investment relationship and the corresponding resource gap during 1970/71-2010/11.

One important fact that can emerge from Figure 4.4 below is that, since the 1970s there was a downward trend of gross domestic investment and gross domestic saving implying the extreme deteriorating condition of the economy during the last days of the Derg. This downward trend in gross domestic investment has risen in the post-Derg period though the level of investment is very small, even by African standard (see Alemayehu, 2002 and Tassew, 2010). This upward trend of gross capital formation during the post-Derg period is promoted by a favorable investment climate and acceleration of privatization as well as improved land lease management, and a series of investments in physical infrastructure and human development that contributed to higher growth in private investment (Plan for

Accelerated and Sustained Development to End Poverty, 2007). In fact, private investment took over the public's share since 1995/96 (Alemayehu 2002).

Figure 4.4: Trends of GDI, GDS and Resource Gap as a Proportion of GDP



Source: Own Computation and Plotting from MoFED (2010/11) Data

Physical capital formation plays a crucial role in bringing sustainable economic growth. However, in LDCs like Ethiopia, the low rate of investment (resulted from financing constraint) has greatly hindered the country's economic growth. Investment is financed from different sources of which gross domestic saving (GDS) is the dominant one. The gap between the two, if it exists, can be obtained from external sources through external debt, aid and foreign direct investment (FDI).

As can be seen from Figure 4.4 above, the trend of GDS as a percentage of GDP has not been satisfactory. GDS as a percentage of GDP shows a downward trend while the trend of gross domestic investment as a percentage of GDP follows upward pattern. When disaggregated to regime basis, the trend of gross domestic saving as a percentage of GDP of Ethiopia confirms that the achievement during the Imperial regime (1960/61 –1973/74) was noteworthy with a narrow resource gap implying little dependence on external capital flows to finance domestic investment.

Since 1974/75, saving as a ratio of GDP showed a tremendous fluctuation though remained significantly lower than the figure recorded in the Imperial era [See Table 4.2]. The performance of GDS has deteriorated to 6.7 percent, as a percent of GDP on average, during the Derg regime. External aggression by the then Somalia expansionist regime from the late 1970s up to the early 1980s accompanied by government's inappropriate economic policies and natural disasters such as severe drought had severely affected the country's overall economic activities resulting in poor performance of gross domestic savings.

Continued civil war in the early days of the current government and the war with Eritrea in the late 1990s was the main cause for the poor performance of Ethiopia's GDS. During the post-Derg regime, gross domestic savings as a percentage of GDP follows the declining trend. However, gross domestic investment as a percentage of GDP is still increasing resulted in a further huge resource gap.

Generally, savings have been steadily declining from the 1970s to early 1980s and began to recover from mid 1980s, although its absolute level was far below the rate in the 1960s. It again started declining in 1990/91 (the second period of a change in government) and late 1990s (mainly owing to the war with Eritrea) has been rising since 1999/00. Public saving has shown quite a remarkable recovery in the post-Derg period. Alemayehu et al (2002) argued that this good performance in public savings has emerged from the government's fiscal policy which seems to have been quite good. The implication is that the reliance the Ethiopian economy on foreign capital flows to finance domestic investment has been increasing from time to time.

CHAPTER FIVE

ESTIMATION AND DISCUSSION OF RESULTS

This chapter discusses the estimation and interpretation of results grounded on the methods of estimation discussed in chapter three. Accordingly, the first task is to conduct test of unit root for each variable in the model. Next, test for cointegration followed by estimation of error correction model (or dynamic short run) is undertaken. Toda-Yamamoto and Dolado-Lutkepohl (TYDL) based Granger causality is conducted in order to determine the existence and direction of causality among the variables included in the model. Finally, the dynamic interactions and strength of causal relation among variables in the system is explored through the impulse response functions (IRF) and the forecast error variance decomposition (FEVD) mechanisms.

5.1. Unit Root Testing

Though the ARDL approach to cointegration and the TYDL approach to causality do not require pre-testing of the variables included in the model, testing for unit root is still worthwhile for two main reasons. On the one hand, testing for unit root is necessary to avoid the risk of I(2) variables. If I(2) variables are included in our model the computed F-statistics provided by Pesaran et al. (2001) become invalid since they are established on the presumption that the variables are I(0) or I(1). On the other hand, testing for the unit root helps us know the maximal order of integration, d_{max}, entering the augmented VAR model. These two cases necessitate the need to test for stationarity of the series before detailed analysis of the variables is undertaken.

We applied two types of formal tests in order to look at the order of integration of the series under consideration. These tests are the Augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP) test. The ADF and PP tests allow for three alternatives when carrying out of the tests; without intercept and trend, with only intercept and with both intercept and trend.

The null hypothesis for the test (in both ADF and PP) claims that the data series under examination has unit root while the alternative hypothesis claims that the series is stationary. The result for the ADF and PP unit root test for the variables at the level and at the first difference is presented in Table 5.1 and Table 5.2 below

Table 5.1: Result for the Augmented Dickey-Fuller (ADF) Unit Root Test

Specification	**Variables at Level**			**Variables at First Difference**		
	Variables	Test statistic	Lag Length	Variables	Test Statistic	Lag Length
With C & T	lnGDI	-0.280	4	DlnGDI	-6.563**	1
With C		2.798	4		-2.983*	1
No C & T		4.444	1		-1.122	2
With C & T	lnRGDP	3.206	7	DlnRGDP	-6.563**	1
With C		3.971	5		-2.085	2
No C & T		1.875	3		-1.122	2
With C & T	lnGDS	-3.109	0	DlnGDS	-3.652*	9
With C		0.452	1		-8.854**	0
No C & T		1.958	1		-8.369**	0
With C & T	lnLF	-0.859	1	DlnLF	-9.289**	0
With C		0.577	1		-9.131**	0
No C & T		1.675	1		-8.779**	0
With C & T	lnHC	0.872	0	DlnHC	-5.505**	0
With C		3.042	0		-2.754	1
No C & T		10.367	0		-1.013	1

Note: Lag lengths used in ADF test (as determined by AIC) are to remove serial correlation in the residuals. and ** show the rejection of the unit root at 5% and 1% level of significance respectively. C is constant while T is trend term. D represents the first difference.*

Table 5.2: Result for the Phillips-Perron (PP) Unit Root Test

Specification	**Variables at Level**			**Variables at First Difference**		
	Variables	Test Statistic	Band-widths	Variables	Test Statistic	Band-widths
With C & T	lnGDI	-0.264	8	DlnGDI	-9.480**	8
With C		7.407	13		-6.734 **	1
No C & T		5.146	4		-5.033**	3
With C & T	lnRGDP	1.755	7	DlnRGDP	-5.935**	5
With C		5.642	12		-3.717**	3
No C & T		3.944	3		-3.717**	3
With C & T	lnGDS	-3.020	2	DlnGDS	-9.818 **	4
With C		0.458	2		-9.075 **	2
No C & T		2.192	4		-8.392**	2
With C & T	lnLF	-2.445	2	DlnLF	-10.232**	8
With C		-0.989	0		-9.703**	4
No C & T		1.943	6		-8.863**	1
With C & T	lnHC	0.820	3	DlnHC	-5.528**	2
With C		2.817	2		-4.710**	2
No C & T		10.367	0		-1.756	1

Note: bandwidths used in PP are Newey-West Bandwidths (as determined by Bartlett Kernel). and ** show the rejection of the unit root at 5% and 1% respectively. C is constant term while T is trend term. D represents the first difference.*

As can be seen from Table 5.1 and Table 5.2 above, results from both ADF and PP test witnessed that GDI in natural log at level is non-stationary under all options (i.e. with constant and trend, with constant only and without both) since we cannot reject the null hypothesis of unit root at 1% and 5% level of significance. On the other hand, when the first difference of natural log of GDI is considered it becomes stationary under ADF test at 5% level of significance (when only constant is included) and at 1% level of significance (when both constant and trend are considered). Coming to the PP test, the result reveals that the first difference of lnGDI is stationary at 1% level of significance under all specifications. However, lnGDI at level is not stationary.

Both ADF and PP tests show that none of the variables is stationary at level. However, taking the first difference of the variables makes them stationary under both tests at 1% and 5% level of significance since the null hypothesis of unit root is rejected at the specified level of significance.

In addition to the formal tests visual inspection of the time series plots of the variables at level and first difference against time also help us evaluate the nature of the variables. The plot of variables at their level witnessed that all variables show a clear trend implying that they are not stationary at level. However, this trend disappears and all variables become stationary when the first difference of the variables is plotted against time.[24]

In general, the ADF and the PP tests from Table 5.1 and Table 5.2 above provide identical results for all variables. According to these tests, all variables are integrated of order one, I (1). Thus, the determination of cointegrating relationships using the ARDL technique doesn't face a problem from the existence of I(2) or beyond variables in our model.

5.2. Co-integration Test and Estimation of Long-Run Relationship

A two step procedure is used in estimating the long-run relationship: an initial examination of the existence of a long-run relationship among the variables in Equation 3.2 is followed by an estimation of the short-run and long-run parameters. This estimation is only possible if the long-run relationship is established in the first step.

To examine a long-run relationship among lnRGDP, lnGDI, lnGDS, lnLF and lnHC, we estimate unrestricted error correction (UECM) regressions by taking each of the variables in turn as a dependent variable without having any prior information about the direction of the long-run relationship among the variables. For example,

[24] See Appendix I: A and B.

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=1}^{p}\beta_i \, \Delta \ln RGDP_{t-i} + \sum_{i=0}^{q_1}\eta_i \Delta \ln GDS_{t-i} + \sum_{i=0}^{q_2}\gamma_i \, \Delta \ln GDI_{t-i} + \sum_{i=0}^{q_3}\theta_i \Delta \ln LF_{t-i}$$

$$+ \sum_{i=0}^{q_4}\pi_i \Delta \ln HC_{t-i} + \delta_1 \ln GDP_{t-1} + \delta_2 \ln GDS_{t-1} + \delta_3 \ln GDI_{t-1} + \delta_4 \ln LF_{t-i}$$

$$+ \delta_5 \ln HC + \varepsilon_{1t} \ldots\ldots\ldots\ldots \quad (5.1)$$

The parameters δ_i where i= 1, 2, 3, 4, 5 are the corresponding long-run multipliers, while the parameters β_i , $\eta_i, \gamma_i, \theta_i, \pi_i$ are the short-run dynamic coefficients of the underlying ARDL model.

From Equation 5.1 above, we first test the null hypothesis of no cointegration, $H_{0:}$ $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ against the alternative using the F-test with upper and lower critical values that are calculated automatically and reported after the ARDL regression estimates.[25] To this end, the order of the lag distribution function should be selected using one of the standard information criteria such as Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC). Pesaran and Shin (1995) argue that the Schwartz-Bayesian Criteria (SBC) is preferable to other model specification criteria because it often has more parsimonious specifications. Therefore a more parsimonious model is selected using the SBC criteria with the maximum lag order of two.[26]

Table 5.3 below shows that lnRGDP, lnGDS, lnGDI, lnLF and lnHC are co-integrated when lnRGDP is taken as dependent variable since F-statistic, also written as F_{lnRGDP} (lnRGDP| lnGDS, lnGDI, lnLF, lnHC) = 9.4448 [with lag order of (1,0,0,1,0) selected by the SBC] is greater than both the 95% Upper Bound critical value of Narayan (2004) and Pesaran et al. (2001) which is 4.000 and 4.4778 respectively. However, taking each of the

[25] In Microfit 5.0 these critical value bounds are computed automatically and reported after the ARDL regression estimates. These are close to the values provided by Pesaran et al (2001), but have the advantage that unlike the critical values provided by Pesaran et al (2001), they are applicable even when dummy variables are included amongst the deterministic variables [see Pesaran and Pesaran (2009)].
[26] Pesaran and Shin (1997) and Narayan (2004) suggested two as the maximum order of lags in the ARDL approach for the annual data series.

remaining four variables (i.e. lnGDS, lnGDI, lnLF and lnHC) as a dependent variable never establishes co-integration since the calculated F-statistic is less than the 95% Lower Bound critical value in all cases.[27] The existence of single co-integrating equation, according to Pesaran et al. (2001), indicates that there is unique long-run relationship among the variables under consideration.

Before estimating the long-run relationship and the short-run dynamics of the model, it is important to analyze performance of the ARDL estimates through the diagnostic tests. As can be seen from the result, R-squared is 99 percent and it is statistically significant (with P-value = 0.000) at 1% level of significance implying that the model fits well. Moreover, the model (ARDL estimates) is free from the problem of serial correlation, functional form, heteroskedasticity and normality as revealed in LM version of tests because we cannot reject the null hypothesis of each test statistic. See appendix III: A and B for details.

Table 5.3 below presents the estimated coefficients of the long-run relationship along with the diagnostic tests of the model. Based on the results given in Table 5.3, the long-run growth equation is given as below:

$$\ln RGDP = -7.3464 + 4.2666 \ln LF + 0.33434 \ln GDI + 0.026485 \ln GDS$$

$$- 0.15569 \ln HC \quad \ldots\ldots (5.2)$$

The estimated coefficients of the long-run association [Table 5.3] show that gross domestic investment and labor force have a statistically significant positive impact on economic growth, which is in line with theoretical argument that investment and labor force positively contributes to economic growth. More specifically, the elasticity of labor is about 4.2666 implying that a 1% increase in labor force leads to 4.2666% increase in economic growth on average, keeping other things constant. Similarly, the long-run elasticity of gross domestic investment is 0.33434 which implies that a 1% rise in gross domestic investment results in about 0.33434 percent increase in economic growth. The result coincides with the findings of Abenet (2005) and Hailemariam (2010) for the case of

[27] See Appendix II for details.

Ethiopia, Were (2001) for the case of Kenya and Iyoha (1999) for the case of SSA countries.

Table 5.3: Estimated Long Run Coefficients using the ARDL Approach

Estimated Long Run Coefficients using the ARDL Approach ARDL(1,1,0,0,0) selected based on Schwarz Bayesian Criterion			
Dependent variable is lnRGDP			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
$lnLF_t$	4.2666	.97564	4.3731[.000]**
$lnGDI_t$	.33434	.095876	3.4872[.001]**
$lnGDS_t$	.026485	.060355	.43882[.664]
$lnHC_t$	-.15569	.097673	-1.5940[.120]
Constant	-7.3464	3.6299	-2.0238[.051]
R-Squared	.97740	R-Bar-Squared	.97561
S.E. of Regression	.069192	F-Stat. F(3,38)	547.7733[.000]
Diagnostic Tests			
Test Statistics	**LM Version**		
A: Serial Correlation	χ^2_{auto} (1) = .35302[.552]		
B: Functional Form	χ^2_{RESET} (1) = .019774[.888]		
C: Normality	χ^2_{Norm} (2) = .74315[.690]		
D: Heteroscedasticity	χ^2_{Het} (1) = .41234[.521]		

*Notes: ** and * indicate significance at 1% and 5% level of significances. Figures in parenthesis are p-values. A: Lagrange multiplier test of residual serial correlation, B: Ramsey's RESET test using the square of the fitted values, C: Based on a test of skewness and kurtosis of residuals, D: Based on the regression of squared residuals on squared fitted values.*

However, human capital (lnHC) has an insignificant effect on economic growth. This result is in line with the findings of Hailemariam (2010), Wondwessen (2011), Pritchett (1996), Pritchet (2001) and World Bank (1995). . The reason why human capital is insignificant in explaining the Ethiopian economic growth is due to the fact that the initial stock of human capital in developing countries, in general and in Ethiopia, in particular, is low. Evidences are showing that the initial stock of human capital, not the change in human capital, affects economic growth.[28] Moreover, it might be attributed to the low level of illiteracy rate in the nation. That is, almost 50% of the annual production of the nation in the rural areas is

[28] See Krueger and Lindahl (2000).

contributed by illiterate labour force where they are reluctant to adopt new methods and technologies. Moreover, the long-run model suggests that gross domestic savings has statistically insignificant effect on economic growth. This result is coherent with the findings of Roman (2012) for Ethiopia and Budha (2012) for Nepal. This could be due to low level of savings which resulted from lack of continuous saving behavior in Ethiopia over time which is in turn primarily attributable to the subsistence nature of the economy where output is barely enough for consumption.

The study applied a number of diagnostic tests to the long-run model as depicted in Table 5.3 above. There is no evidence of autocorrelation in the disturbances. The model passes normality test, implying that the errors are normally distributed. The RESET test points that the model is correctly specified.

The existence of a stable and predictable relationship between the dependent variable and its determinants is regarded as an essential condition for the formulation of policy strategies. The stability of the long-run coefficients is used to form the error-correction term in combination with the short run dynamics. Some of the problems of instability could stem from inadequate modeling of the short-run dynamics characterizing departures from the long run relationship (Dritsakis, 2011). Hence, it is useful to include the short run dynamics for constancy of long run parameters. Considering this we employ the CUSUM and CUSUMSQ tests, which were developed by Brown et al. (1975).

The CUSUM test is derived from the cumulative sum of recursive residuals based on the first set of n observations. It is updated recursively and is plotted against the break points. If the plot of CUSUM statistic stays within 5% significance level, then estimated coefficients are said to be stable. Brown et al. (1975) suggests that the CUSUMSQ test provides a useful complement to the CUSUM test, particularly when the divergence from constancy of the parameter is haphazard rather than systematic. Similar method is used to perform the CUSUMSQ that is based on the squared recursive residuals. The graphical presentation of these tests is presented in Appendix IV: A and B.

Results reveal that the estimated model is consistent (stable) because the plots of CUSUM and CUSUMSQ statistic lie within the critical bands at the 5% significance level.

5.3. The Short Run Dynamic Modelling (Error Correction Model)

After estimating the long-run coefficients, we obtain the error correction representation of the ARDL model. The ECM represents the speed of adjustment to restore equilibrium in the dynamic model following a shock. The ECM coefficient shows how slowly/quickly variable come back to equilibrium. This is expressed as follows;

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \ \Delta \ln RGDP_{t-i} + \sum_{i=0}^{q_1} \eta_i \Delta \ln GDS_{t-i} + \sum_{i=0}^{q_2} \gamma_i \ \Delta \ln GDI_{t-i}$$

$$+ \sum_{i=0}^{q_3} \theta_i \Delta \ln LAB_{t-i} + \sum_{i=0}^{q_4} \pi_i \Delta \ln HC_{t-i} + \Psi ECM_{t-1} \text{..............................} \quad (5.3)$$

Where Ψ the speed of adjustment and ECM_{t-1} is is error correction term lagged by one time period.

The results of the short-run dynamic growth model and the various diagnostic tests are presented in Tables 5.4. About 67 percent of the variation growth is explained by explanatory variables included in the model. R-squared which is 66.9 is statistically significant at 1% level of significance implying that the model fits well since the explanatory variables are jointly significant at 1% level of significance.

Based on the results given in Table 5.4, the short-run dynamics of growth equation is given as below:

$$\Delta \ln RGDP_t = 0.12875 \Delta \ln GDI_t + 0.010199 \Delta \ln GDS_t + 0.79235 \Delta \ln LF_t$$

$$- 0.059956 \Delta \ln HC_t - 0.38509 ECM_{t-1} \text{...} \quad (5.4)$$

The result reveals that the estimated coefficients of lnLF and lnGDI are statistically significant with the positive sign. In line with the postulates of growth theories, labor and investment have a positive effect on real gross domestic product of Ethiopia in the short-run. However, gross domestic savings (lnGDS) and human capital (lnHC) do not have any impact on the economic growth of Ethiopia in the short-run. The reason is that it can take a long time before benefits from human capital arrive, as it takes time to build human capital. This result is consistent with the findings of Woubet (2006) and Seid (2000).

The estimated coefficient of the ECM $_{t-1}$ is equal to 0.38 which states that departure from the long-term growth path due to a certain shock is adjusted by 38 percent over the next year, significant at the 1% level of significance and complete adjustment will take about three years.

The model passes all the diagnostic tests. The diagnostic tests applied to the error correction model point out that there is no evidence of serial correlation and heteroskedasticity. Besides, the RESET test implies the correctly specified ARDL model. Skewness and kurtosis of residuals based normality test shows that the residuals are normally distributed.

Table 5.4: Short Run Dynamics Result for the Selected ARDL Model

Error Correction Representation for the Selected ARDL Model ARDL(1,1,0,0,0) selected based on Schwarz Bayesian Criterion			
Dependent variable is ΔLNRGDP			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
$\Delta lnLF_t$	.79235	.26355	3.0065[.005]**
$\Delta lnGDI_t$	.12875	.036201	3.5565[.001]**
$\Delta lnGDS_t$	.010199	.022716	.44898[.656]
$\Delta lnHC_t$	-.059956	.031455	-1.9061[.065]
ECM_{t-1}	-.38509	.086777	-4.4377[.000]**
R-Squared	.66926	R-Bar-Squared	.61089
S.E. of Regression	.039245	F-Stat. F(5,35)	13.7597[.000]
Diagnostic Tests			
Test Statistics	**LM Version**		
A: Serial Correlation	χ^2_{auto} (1) = .32617[.568]		
B: Functional Form	χ^2_{RESET} (1) = 3.4656[.063]		
C: Normality	χ^2_{norm} (2) = .68080[.711]		
D: Heteroscedasticity	χ^2_{Het} (1) = .041579[.838]		

*Notes: Figures in parenthesis are p-values. Δ represents the first difference. ** and * means the coefficients are significant at 1% and 5% level of significance respectively. A: Lagrange multiplier test of residual serial correlation, B: Ramsey's RESET test using the square of the fitted values, C: Based on a test of skewness and kurtosis of residuals, D: Based on the regression of squared residuals on squared fitted values.*

The stability of the regression coefficients is tested using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the recursive residual test for structural stability (Brown et al., 1975). Plots of CUSUM and CUSUMSQ of the growth equation in its short-run version are given in Appendix IV: C and D. As can be seen from the graphs, the regression equation seems stable given that neither the CUSUM nor the CUSUMSQ test statistics go beyond the bounds of the 5% level of significance.

5.4. Granger Causality Test: Toda-Yamamoto and Dolado-Lutkepohl (TYDL) Approach

5.4.1. Lag Length Selection

A vital element in the specification of VAR models is the determination of the lag length of the VAR. Braun and Mittnik (1993) showed that impulse response functions and variance decompositions derived from the estimated VAR are inconsistent when the lag length differs from the true length. Moreover, Lutkepohl (1993) suggests that over fitting (selecting a higher order lag length than the true lag length) causes an increase in the mean-square-forecast errors of the VAR and that under fitting the lag length often generates autocorrelated errors which results in inconsistent estimate.

To choose the appropriate lag length, therefore, the information criteria such as the Hannan-Quinn information criteria (HQ), the Akaike information criteria (AIC), the Schwarz information criteria (SIC), the Log Likelihood (LL) and the Final Prediction Error (FPE) should be used. However, several studies have shown that the AIC is superior to other information criteria particularly in small samples (Liew, 2004; David, 2010). Therefore, the lag length selected by AIC is used where the information criteria do not choose the same lag lengths.

Table 5.5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	69.56111	NA	2.51e-08	-3.310826	-3.097549	-3.234304
1	235.8193	281.3599*	1.82e-11*	-10.55483*	-9.275171*	-10.09570*
2	254.2704	26.49403	2.71e-11	-10.21900	-7.872949	-9.377255
3	278.6671	28.77557	3.35e-11	-10.18806	-6.775624	-8.963706

Notes: indicates lag order selected by the criterion.*
LR: sequential modified LR test statistic

As can be seen from Table 5.5 above, the optimal lag length is one. Since all variables become stationary after the first differencing, it implies that d_{max} is also one. We then estimate a system of VAR in levels with a total of (d_{max} +k=1+1) which is 2 lags where k is the lag length selected by information criteria. Using this information, the system of equations (i.e. Equations 3.3-3.5) is jointly estimated as a "Seemingly Unrelated Regression Equations" (SURE)[29] model.

A range of formal diagnostic tests such as autocorrelation, non-normality, heteroskedasticity and stability tests are conducted for checking the adequacy of VAR model before using the model for Granger causality and related tests. The test results show that the model passed all diagnostic tests except that of non-normality (See Appendix V). However, Lutkepohl (2007) argued that normality is not a necessary condition for the validity of many the statistical procedures related to VAR models. Thus, the VAR model is adequate and can be used for Granger causality test as well as for formulating the impulse response functions and the variance decomposition.

Following the TYDL approach, the augmented VAR of order 2 is estimated and the Wald test is performed only on the coefficients of the first lag. The result of five variables VAR model estimated using SUR regression technique is presented in Table 5.6.

[29] Zellner (1962) suggests that the regression coefficient estimators obtained by the SUR are at least asymptotically more efficient than those obtained by an equation-by-equation application of least squares. Moreover, Rambaldi and Doran (1996) show that SUR regression makes the computation of modified Wald test statistic too simple.

Table 5.6 shows that the null hypothesis that 'Granger no-causality from gross domestic savings to economic growth' cannot be rejected even at 10% level of significance. However, there is an evidence to support the reverse even though it is weak (significant at 10% level). That is, growth is found to Granger cause savings. This result is consistent with the Carrol-Weil (1994) hypothesis which states that it is growth that causes savings but savings does not Granger causes growth. Moreover, the result is in line with the findings of Abu (2004) for the case of Ethiopia, Khan and Shahbaz (2010) for the case of Pakistan, Sinha and Sinha (2007) for the case of Mexico, Attanasio et al. (2000) for 123 countries' case, Abu (2010) for the case of Nigeria, and Elbadawi and Mwega (1998) for the case of Sub-Saharan Africa.

Table 5.6: Estimates of Long-run Granger Causality Based on TYDL Approach

Dependent variables	**Sources of Causation (Long-run)**				
	lnRGDP	lnGDS	lnGDI	lnLF	lnHC
	$\chi^2(1)$	$\chi^2(1)$	$\chi^2(1)$	$\chi^2(1)$	$\chi^2(1)$
lnRGDP	-	2.3469	11.4169***	17.3323***	1.0928
lnGDS	3.1669*	-	7.2279**	11.8651***	0.0332
lnGDI	7.1825**	6.4726**	-	4.8342**	1.3805
lnLF	3.1985*	0.0309	0.0204	-	0.0119
lnHC	0.6351	2.6784	6.5711**	0.2373	-

*Notes: *, **and *** indicates that significance at 10 %, 5% and 1% respectively.*

The result also reveals that the Granger causality between gross domestic savings and gross domestic investment is bi-directional. That is, gross domestic savings Granger causes gross domestic investment and there is a feedback from gross domestic investment. This result supports the empirical finding of Budha (2012) for the case of Nepal. However, it contradicts the finding of Abu (2004) for the case of Ethiopia.

Similarly, Granger causality between gross domestic investment and economic growth is bi-directional. The implication is that the data can be viewed either through the Keynesians/ neoclassical glasses or with an accelerator model in mind. This result corroborates the empirical findings of Tang et al. (2008) for the case of China, Alfa and Garba (2012) for the case of Nigeria, and Elbadawi and Mwega (1998) for the case of Sub-Saharan Africa.

Labor force precedes and Granger causes both economic growth and gross domestic investment. Moreover, it Granger causes gross domestic savings suggesting that economic growth increases the income of workers relative to that of non-workers (children and retirees).Hence workers' saving could rise. There is no Granger causality between human capital and the remaining other variables except gross domestic investment in which Granger causality runs from gross domestic investment to human capital.

5.5. Impulse Response Functions and Variance Decompositions

Variance decomposition and impulse response functions enable us to capture out-of-sample Granger causality in macroeconomic activity in a dynamic context. In order to provide further insight on the relationship among savings, investment and economic growth in Ethiopia in a dynamic feature, the variance decomposition and the impulse response functions are calculated. This sub-section, therefore, presents these two approaches to find out the dynamic properties of the system and allow us to determine the relative impact of the variables of interest on one another outside of the sample period.

5.5.1. Generalized Impulse Response Functions

An impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamical system (Pesaran and Shin, 1998). Impulse response function indicates whether the impact a certain shock is positive or negative, or whether it is a transitory jump or long-run persistence. Accordingly, impulse response functions are computed to give an indication of the system's dynamic behavior. An impulse response function indicates how a variable in the VAR system responds to a single one percent exogenous change in another variable of interest. In this study, we used the generalized impulse response function as it does not need orthogonalization of innovations and is invariant to the ordering of the variables in VAR.

Table 5.7 to Table 5.9 illustrates the estimated generalized impulse response functions of variables of interest (i.e. LNRGDP, LNGDS and LNGDI) for ten years. In response to a one standard deviation disturbance in current economic growth (Table 5.7), future economic growth increases by 4.8 percent in the first year, by 3.59 percent in the fifth year and gradually reduces to 3 percent in the 10th year.

Table 5.7: Generalised Impulse Responses to one SE shock in the equation for lnRGDP

Horizon	lnRGDP	lnLAB	lnGDI	lnGDS	lnHC
0	.047048	.0095923	.057428	.099884	-.0093927
1	.048689	.0066556	.048201	.072994	.0049663
2	.044466	.0062991	.037725	.035628	.016623
3	.040776	.0061394	.036527	.026656	.026324
4	.038062	.0057860	.039486	.029033	.034307
5	.035905	.0053597	.043468	.032838	.040926
6	.034130	.0049557	.047667	.036150	.046540
7	.032714	.0046035	.051978	.039199	.051435
8	.031651	.0043070	.056363	.042220	.055826
9	.030921	.0040645	.060776	.045258	.059870
10	.030496	.0038731	.065186	.048300	.063687

A one standard deviation disturbance originating from economic growth results in an approximately 4.8 percent increase in gross domestic investment in the first period. But it continuously declines to about 3.65 percent in the third period and starts increasing after the third period and reaches about 6.5 percent in the 10th period implying that the impact of growth on gross domestic investment is permanent.

A one standard deviation disturbance originating from economic growth results in more or less 7.3 percent increase in gross domestic savings in the first period. However, this figure declines to about 2.7 percent in the third period but starts rising afterwards. Accordingly, it reaches about 4.8 in the 10th period implying that the impact of economic growth on gross domestic savings is not dying out.

The impact of economic growth on labor force is very small (about 0.9 percent in 1st period and declined to 0.38 percent in the 10th period). This shows that the impact of economic growth on labor force in temporarily lived phenomenon.

Table 5.8 below presents the generalized impulse response to one SE shock in the equation for natural log of gross domestic investment. As can be seen from the table a one standard deviation shock arising from gross domestic investment results in about 12.3 percent rise in gross domestic investment itself in the first period which decreases to about 9.97 percent in the 8th period and starts increasing afterwards. The response of natural log of gross domestic savings to one SE shock in natural log of gross domestic investment is relatively stronger as compared to that economic growth as it leads to approximately 10.5 percent increase in gross domestic investment in the first period while economic growth increases only by about 2.5 percent during the same period. The impact of gross domestic investment on economic growth and gross domestic savings never dies out as the impact increases to 3.9 percent in the 10th period in case of economic growth and the impact on gross domestic savings follows rising pattern since the 4th period. The implication is that the impact (due to shock) of gross domestic investment on economic growth and gross domestic savings is permanent one.

Table 5.8: Generalised Impulse Responses to one SE shock in the equation for lnGDI

Horizon	lnRGDP	lnLF	lnGDI	lnGDS	lnHC
0	.017455	-.0016986	.15479	.16778	.7630E-3
1	.024765	-.7289E-3	.12277	.10461	.018907
2	.027820	.0010622	.10380	.070731	.033965
3	.030372	.0022943	.096102	.063526	.046448
4	.032505	.0030168	.093404	.064042	.056793
5	.034131	.0034579	.093027	.065543	.065517
6	.035382	.0037470	.094177	.067267	.073064
7	.036432	.0039451	.096508	.069434	.079778
8	.037406	.0040871	.099741	.072077	.085912
9	.038386	.0041975	.10365	.075107	.091658
10	.039420	.0042935	.10807	.078434	.097162

The result for the generalized impulse responses to one SE shock in the equation for LNGDS is presented in Table 5.9. The result shows that the gross domestic savings shocks have larger and permanent effects on gross domestic savings itself which fluctuate in the whole period followed by its impacts on gross domestic investment. On the other hand, the impulse response of economic growth, human capital and labor force to one SE shock in gross domestic savings is very small.

Table 5.9: Generalised Impulse Responses to one SE shock in the equation for lnGDS

Horizon	lnRGDP	lnLF	lnGDI	lnGDS	lnHC
0	.018476	.0051713	.077601	.33698	-.015776
1	.024873	.0031404	.029256	.033717	-.0068556
2	.014623	.0052719	.010690	.042509	-.012765
3	.018097	.1090E-3	.012112	.10581	-.039820
4	.010215	.0020092	.0041055	.0011190	-.021164
5	.0080112	.0016481	.0090689	-.013663	-.016185
6	.013995	.0030371	.011921	.040131	-.0069576
7	.013295	.0020535	.033315	.042336	-.0072510
8	.011168	.0046928	.014742	.0063691	.0050799
9	.019218	.0018838	.031883	.084983	.0036835
10	.017615	.0025139	.016634	.026111	.0089586

5.5.2. Generalized Forecast Error Variance Decompositions

Despite the fact that impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Therefore, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR (EViews 6 User's Guide II, 2007). However, it must be noted that unlike the orthogonalized forecast error variance decomposition the total variance in case of the generalized forecast error variance decomposition does not sum to 100 percent since the covariance between the original shocks is non-zero as suggested by Tang and Lean (2009).Table 5.10 - Table 5.12 present the generalized variance decompositions of variables of interest (i.e. lnRGDP, lnGDS and lnGDI) for ten year time horizon.

The results in Table 5.10 below point out that disturbance arising from lnRGDP itself imposed the greatest variability to future lnRGDP: it contributes up to 78.26 percent variability one year ahead and approximately 50 percent four quarters ahead. This result indicates that current change in economic growth heavily determines future changes in economic growth. LnLF dominate over all other three variables (i.e. lnGDS, lnGDI and lnHC) in influencing economic growth. It accounts for approximately 46.3 percent and 41.8 percent of the total variance in economic growth two year and three year ahead respectively.

The third largest source of variation in economic growth appears to be from lnGDI, which describes for approximately 15.6 percent of the variance in lnRGDP one year ahead and increases to 35.3 percent ten year ahead. The remaining two variables (i.e. lnGDS and lnHC) accounts for very little percentage of variations in lnRGDP. This result is in line with the result obtained from the TYDL approach to Granger causality that the natural logarithm of labor force, lnLF, and the natural logarithm of gross domestic investment, lnGDI, cause economic growth.

Table 5.10: Generalised Forecast Error Variance Decomposition for variable lnRGDP

Horizon	lnRGDP	lnLF	lnGDI	lnGDS	lnHC
0	1.0000	.14763	.13764	.093131	.016593
1	.78267	.43216	.15673	.049200	.0067165
2	.70245	.46322	.18114	.031315	.0045814
3	.65949	.44486	.20965	.023474	.0047034
4	.62657	.41874	.23780	.019071	.0059821
5	.59737	.39302	.26354	.016243	.0082316
6	.57044	.36900	.28637	.014336	.011376
7	.54538	.34682	.30644	.013035	.015309
8	.52200	.32640	.32405	.012156	.019899
9	.50013	.30762	.33951	.011580	.025009
10	.47966	.29034	.35313	.011224	.030504

Table 5.11 below presents the generalized forecast error variance decomposition for variable lnGDI. The result shows that the largest source of variation in the forecast error of lnGDI goes to its own innovations. In the second period, for example, about 82% of the variation in lnGDI is explained by the innovations of lnGDI itself which gradually declined to about 54% in the 10th period. LnRGDP is the second largest source of variation in lnGDI followed by lnGDS suggesting that both gross domestic savings and economic growth Granger cause gross domestic investment which corroborates the result obtained from TYDL approach.

Table 5.11: Generalised Forecast Error Variance Decomposition for variable lnGDI

Horizon	lnRGDP	lnLF	lnGDI	lnGDS	lnHC
0	.075776	.015284	1.0000	.24330	.0027923
1	.10886	.028821	.89995	.15839	.0030344
2	.069766	.038175	.82020	.092736	.0021076
3	.071803	.033263	.79192	.078630	.0021871
4	.078504	.044348	.74055	.075432	.0026312
5	.10464	.040423	.68890	.077713	.0078832
6	.11945	.038696	.65024	.080989	.010003
7	.14713	.035661	.61623	.077240	.013376
8	.17357	.032424	.58207	.074227	.014853
9	.19616	.029435	.56116	.069033	.015004
10	.21714	.026572	.54193	.064144	.014094

Table 5.12 below shows that the largest variation in the forecast error of gross domestic savings, lnGDS, arises from its own innovations which accounts for about 80.6 percent the first period and 50 percent even in the 10th period, while gross domestic investment (i.e. lnGDI), which is the second largest source of variation in lnGDS, contributes 37.9 percent and 35.4 percent in the second and seventh period respectively. The variation of forecast error of lnGDS due to lnGDI is relatively strong that it contributes about 35.2 percent of the variation in lnGDS even in the 10th period. LnRGDP is the third largest source of variation in lnGDS contributing about greater than 10 percent of forecast error variance of lnGDS. The results tend to confirm the conclusion found by within sample TYDL causal

analysis which states that lnRGDP and lnGDI Granger cause lnGDS even though Granger causality from economic growth of gross domestic savings is relatively weak.

Table 5.12: Generalised Forecast Error Variance Decomposition for variable lnGDS

Horizon	lnRGDP	lnLF	lnGDI	lnGDS	lnHC
0	.15173	.2951E-5	.30551	1.00000	.011697
1	.15902	.091922	.26225	.80595	.061629
2	.12289	.073538	.37931	.61098	.057608
3	.11556	.077920	.41635	.58166	.056722
4	.10327	.098960	.38310	.54588	.058725
5	.10232	.098026	.36711	.53709	.058475
6	.10038	.10193	.36112	.53234	.057249
7	.10036	.10067	.35469	.52757	.059997
8	.10569	.099650	.34972	.52000	.060631
9	.11189	.098397	.35001	.51330	.061667
10	.11396	.097229	.35216	.50178	.062914

CHAPTER SIX

CONCLUSION AND POLICY IMPLICATIONS

6.1. Conclusion

Savings and investment plays a key role in promoting economic growth. Macroeconomic theory suggests that savings causes investment and thereby economic growth. However, the issue of causality between savings, investment and economic growth is debatable both theoretically and empirically. Empirical literatures are mixed and do not provide conclusive empirical evidences. Most of the existing empirical literature studies the relationship between savings, investment and economic growth within a bivariate framework. Little attention has been given to treating the causality between these variables under a multivariate framework. Therefore, the main objective of this paper is to investigate the causal relationship among gross domestic savings, gross domestic investment and economic growth in Ethiopia using annual time series data for the period of 1960/70 to 2010/11 within a multivariate framework. Result from descriptive analysis shows that the Ethiopian economy is at risk of saving and investment gap. The gap has been widening, specially, from 1990s onwards due to the fact that investment has been increasing while saving has been declining.

All variables in the model are integrated of order one, I(1) as revealed by the ADF and the PP unit root tests. The ARDL Bounds Testing based cointegration test result shows that the long-run relationship exists among savings, investment, growth, labor and human capital only when GDP is taken as a dependent variable implying the existence of unique co-movement among the variables of interest. As the determinants of growth, the long-run coefficients of the natural logarithm of gross domestic investment and labor force are both positive and statistically significant at 1% percent level of significance implying that these two variables have a significant and positive impact on growth in the long-run. Specifically, a 1% increment in labor force leads to 4.27 % rise in economic growth in the long-run, on average, keeping other things constant. Similarly, a 1% change in gross domestic investment results in 0.33% change in economic growth in the long-run, on average, ceteris paribus. However, the long-run coefficients of gross domestic savings and human capital are both statistically insignificant.

Besides, ARDL based short-run dynamic modeling (Error Correction Model) for growth equation is conducted and the result shows that labor and investment have statistically significant positive effect on growth in the short-run. Particularly, in the short-run, a 1% changes in gross domestic investment leads to 0.128% change in economic growth while a 1% change in labor force increases economic growth by 0.79%, on average, other things remaining constant. Furthermore, the stability of the estimated parameters of both short-run and long-run relationships is supported by CUSUM and CUSUMSQ stability tests. Therefore, the model can be used for policy formulations.

The direction of causal relationship among the gross domestic savings, gross domestic investment and economic growth using the Granger causality tests based on the TYDL framework has also been examined. The empirical result suggests that the direction of Granger causality is from savings to investment and then to economic growth which is in line with the conventional wisdom. Additionally, the Granger causality runs from economic growth to investment and then to savings. This implies that there is two-way causal relationship between gross domestic savings and gross domestic investment and between gross domestic investment and economic growth. However, Granger causality running from investment to savings and economic growth is the strongest as suggested by impulse response and variance decompositions. The result also shows that there is unidirectional Granger causality running from economic growth to gross domestic savings which is consistent with the Carrol-Weil hypothesis.

Labor Granger causes savings, investment and economic growth. However, human capital doe not Granger cause any the variables of interest. Similarly, only investment Granger causes human capital.

6.2. Policy Implications

Based on the empirical results obtained from the analysis, the following policy implications are drawn. Results from Granger causality show that there is bidirectional causality between gross domestic savings and gross domestic investment as well as between gross domestic investment and economic growth. However, the Granger causality running from gross domestic investment to gross domestic savings and to economic growth is stronger as witnessed by variance decomposition.

The most important mechanism for spurring growth, according to this result, is investment since it Granger causes savings and economic growth. Thus, the country is required to set an encouraging environment in order to stimulate domestic investment. Therefore, the government should reduce lending rate through monetary policy in order to boost so as to bring high and sustained economic growth.

Savings should be increased for two main reasons. On the one hand, investment has to be financed some way or the other and therefore savings should be considered. Ensuring an adequate level of gross domestic savings is vital in closing the gap between savings and investment and reducing an extreme dependence on foreign capital which can be a risky due to its volatility. On the other hand, it Granger causes investment thereby economic growth and this higher growth reinforce savings and investment. Therefore, the government is required to set a sound and fertile environment in order to foster domestic saving that is adequate enough to finance investment and to realize sustainable economic growth. To do this, the government should:

- Increase the deposit rate of the commercial banks through monetary policy at the disposal of the Central Bank.
- Transforming the financial system of the country.
- Create favorable condition in order to mobilize domestic savings from the small depositors.

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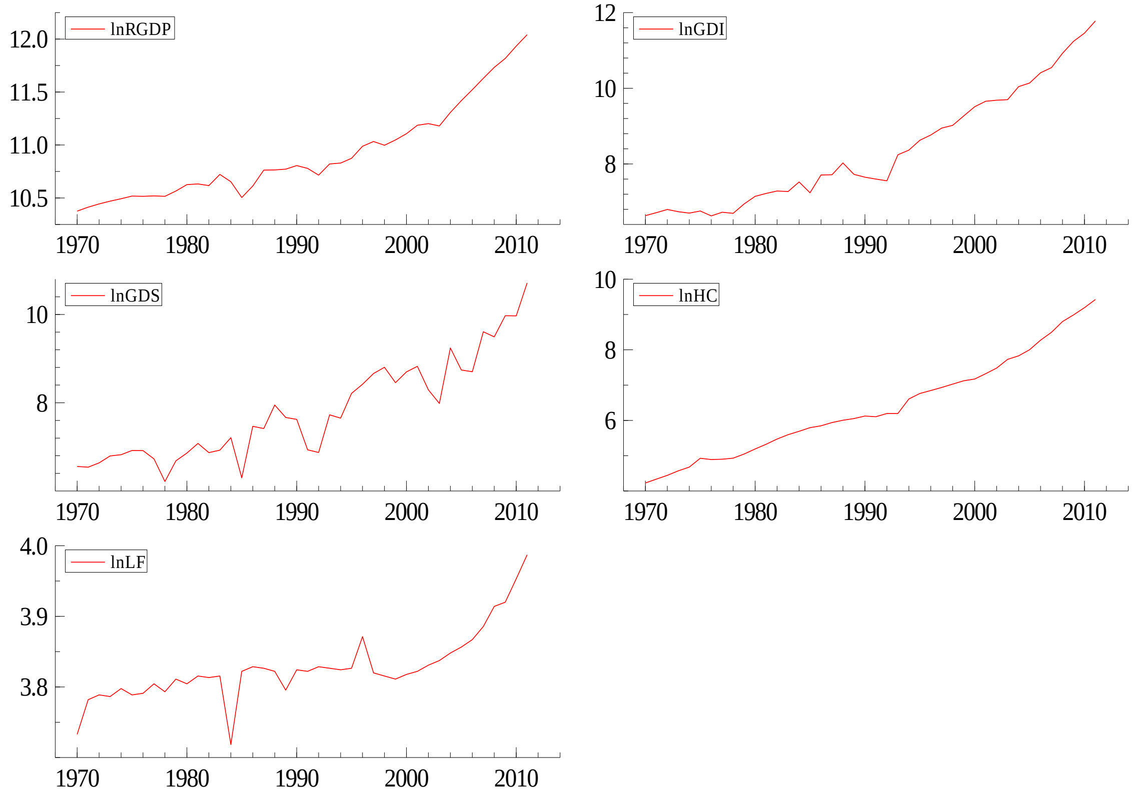
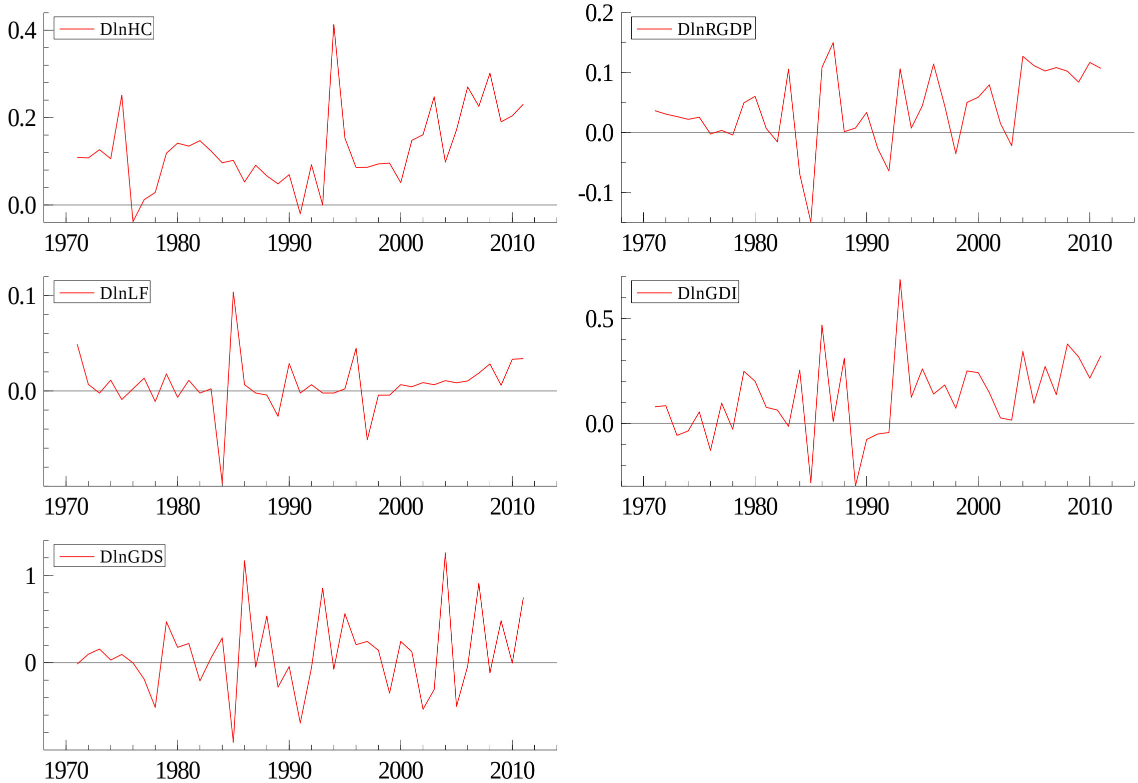
APPENDICES

Appendix I: Plot of Variables Used in the Study

A) Plot of All Variables at Level



B) Graph of All Variables in Their First Difference



Appendix II: Result of Bounds Test for Cointegration

Dependent Variable (intercept included)	**Order of ARDL**	**F-statistic**	**Decision**
F_{LnRGDP}(lnRGDP|(lnGDS,lnGDI, lnHC,lnLF)	(1,0,0,0,1)	9.4448*	Cointegration
F_{lnGDS}(lnGDS|(lnRGDP,lnGDI, lnHC, lnLF)	(1,0,1,0,0)	2.2021	No cointegration
F_{lnGDI}(lnGDI|(lnGDS,lnRGDP, lnHC, lnLF)	(1,1,0,0,0)	1.5523	No cointegration
F_{lnHC}(lnHC|(lnGDS,lnGDI, lnRGDP, lnLF)	(1,1,1,0,0)	2.6799	No cointegration
F_{lnLF}(lnLF|(lnGDS,lnGDI, lnRGDP, lnHC)	(0,0,0,0,0)	Not applicable as lag of dependent variable is zero	

Critical Values		
Type	95% Lower Bound	95% Upper Bound
Pesaran et al. (2001)	3.2055	4.4778
Narayan (2004)	2.893	4.000

*Note: * means it is greater the 95% Upper Bound critical value.*

Appendix III: Results of Autoregressive Distributed Lag Estimates and Diagnostic Tests

A) Results of Autoregressive Distributed Lag Estimates

Autoregressive Distributed Lag Estimates

ARDL(1,0,0,1,0) selected based on Schwarz Bayesian Criterion

Dependent variable is LNRGDP

41 observations used for estimation from 1970 to 2010

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNRGDP(-1)	.49655	.091548	5.4239[.000]
LNGDS	.15579	.027661	5.6322[.000]
LNGDI	.13253	.033317	3.9779[.000]
LNLF	.76532	.26821	2.8535[.007]
LNLAB(-1)	.90384	.31232	2.8939[.007]
LNHC	.33928	.24449	1.3877[.175]
TREND	-.0056146	.0022011	-2.5508[.016]
CONSTANT	-2.6885	1.1799	-2.2785[.029]

R-Squared	.99377	R-Bar-Squared	.99244
S.E. of Regression	.038268	F-Stat. F(7,33)	751.3990[.000]
Mean of Dependent Variable	10.9294	S.D. of Dependent Variable	.44020
Residual Sum of Squares	.048328	Equation Log-likelihood	80.0616
Akaike Info. Criterion	72.0616	Schwarz Bayesian Criterion	65.2073
DW-statistic	1.9119	Durbin's h-statistic	.34819[.728]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
7.2181*	3.9343	5.2128	3.3148	4.4312

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
36.0904*	19.6716	26.0638	16.5738	22.1559

*Notes: * means F-statistic and W-statistic are greater than 95% Upper Bound critical value.*

B) Results of Diagnostic Tests of ARDL Estimates

Diagnostic Tests				
Test Statistics	**LM Version**		**F Version**	
	χ^2 -statistic	P-value	F-statistic	P-value
A:Serial Correlation	$\chi^2(1) = .0014087$	.970	F(1,32) = .0010995	.974
B:Functional Form	$\chi^2(1) = .96043$	.327	F(1,32) = .76758	.387
C:Normality	$\chi^2(2) = .58304$	.747	Not applicable	
D:Heteroscedasticity	$\chi^2(1) = .69952$	.403	F(1,39) = .67694	.416

Notes: Figures in () are degrees of freedom.

A: Lagrange multiplier test of residual serial correlation with the null of no serial correlation

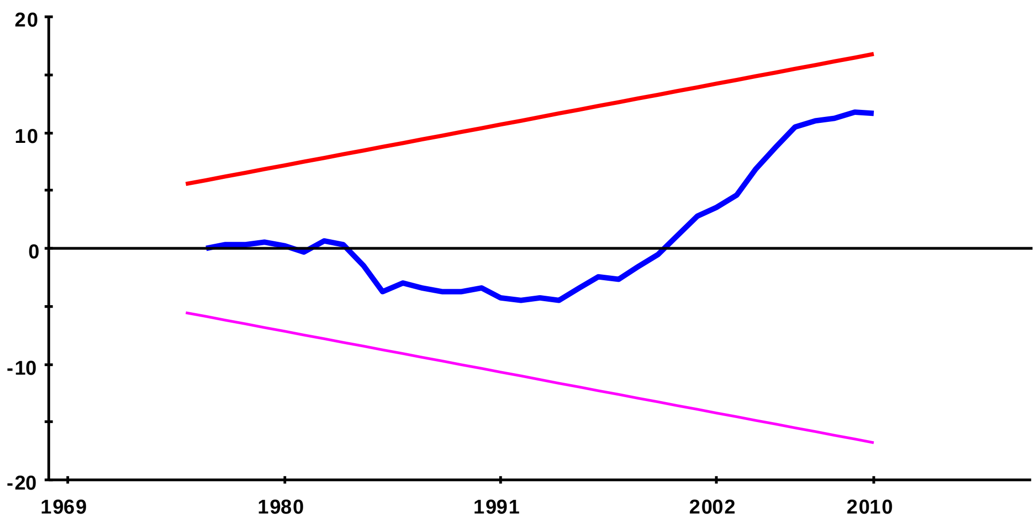
B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values with the null hypothesis of no heterosckedasticity.

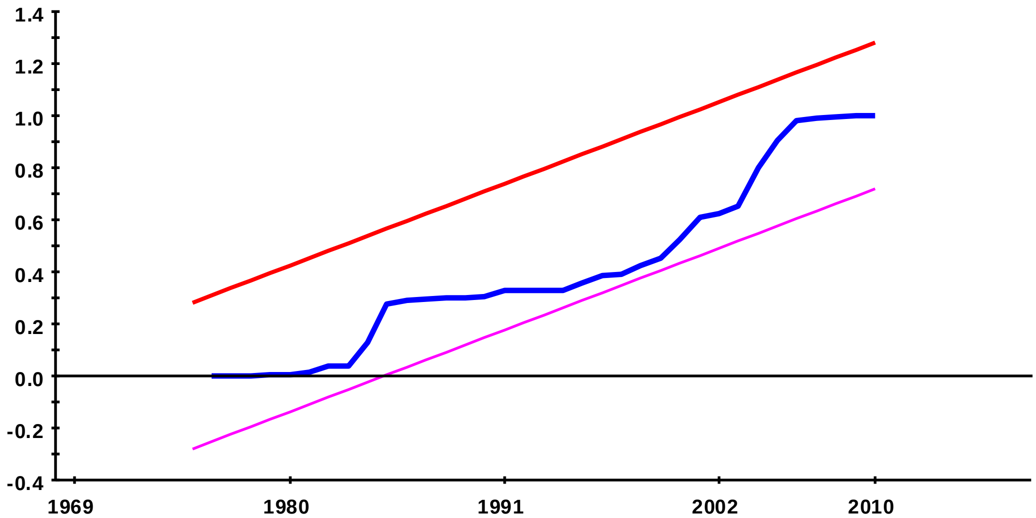
Appendix IV: Plots of CUSUM and CUSUMSQ

A) Plot of Cumulative Sum of Recursive Residuals (Long-run)



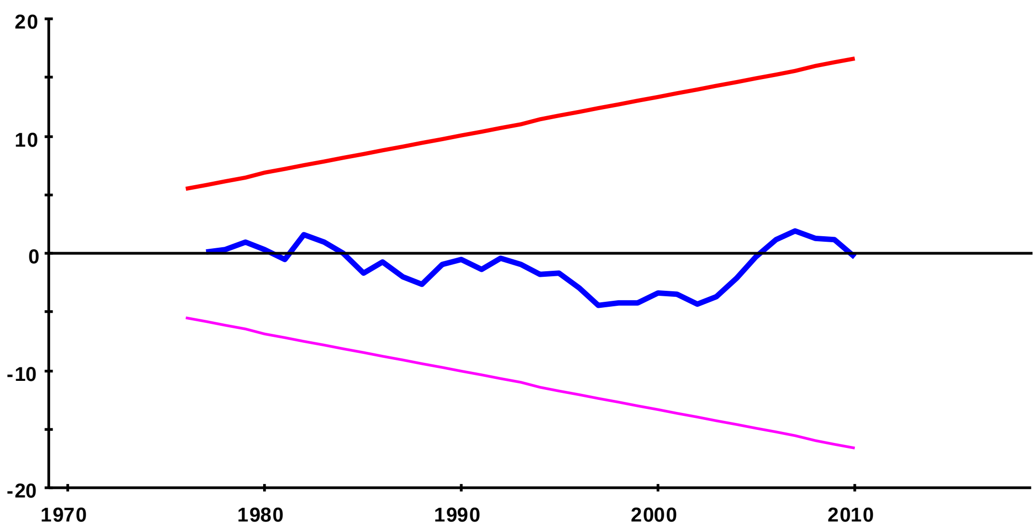
The straight lines represent critical bounds at 5% significance level

B) Plot of Cumulative Sum of Squares of Recursive Residuals (Long-run)



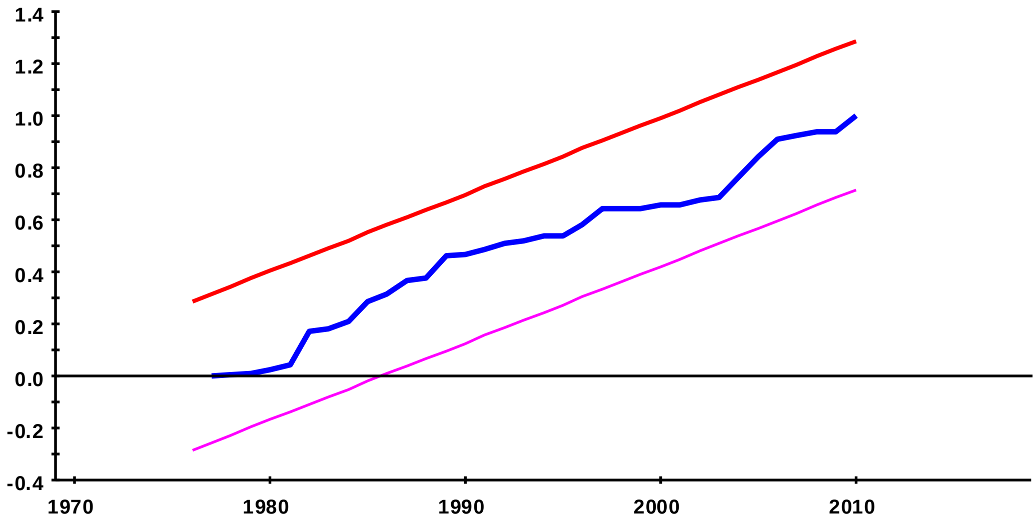
The straight lines represent critical bounds at 5% significance level

C) Plot of Cumulative Sum of Recursive Residuals (Short-run)



The straight lines represent critical bounds at 5% significance level

D) Plot of Cumulative Sum of Squares of Recursive Residuals (Short-run)



The straight lines represent critical bounds at 5% significance level

Appendix V: VAR Diagnostic Tests

Vector AR 1-2 test:	$F(50, 67) =$	1.2087 [0.2328]
Vector Normality test:	χ^2 (10) =	29.999 [0.0009]**
Vector hetero test:	χ^2 (330) =	305.28 [0.8317]

VAR Stability Test

Inverse Roots of AR Characteristic Polynomial