ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THE EFFECT OF EXPORT EARNING FLUCTUATION ON PHYSICAL CAPITAL FORMATION IN ETHIOPIA

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A PROJECT SUBMITTED TO THE SCHOOL OF GRADUATE OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF ARTS IN ECONOMICS (COMPETITION AND REGULATORY ECONOMICS)

June, 2009

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Acknowledgement

Above all, I am thankful to **Almighty God**, for giving me abundant life and helped me to finalize my study.

I would also thank my advisor Dr. Girma Estiphanos, who gave me valuable advice and guidelines to complete this paper.

My word of thanks also goes to my father, mother, sisters and relatives who assisted me in different ways in the completion of my study.

Finally, I extend my gratitude and appreciation to my best friends who helped me materially and morally.

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Abstract

Physical capital plays a key role in determining economic development in a country. Based on this fact, the main objective of this study was to investigate the effect of export earning fluctuation on physical capital formation in Ethiopia by employing data ranging from 1970/71 to 2007/08 using time series technique.

The study used unit root and cointegration tests to see the characteristics of the data series. In addition, Vector Error Correction Model (VECM) was developed to investigate the effect of variation of the explanatory variables in the short run on physical capital formation.

The finding of the study shows that expected level of output and aid affects the level of physical capital formation in the country for the period of study positively and significantly.
Export income fluctuation and real effective exchange rate, on the other hand, affects physical capital formation negatively and significantly.
The rate of gross domestic saving has positive short run implication on the rate of physical capital formation as indicated in the short run dynamics during the entire period of study.

1. Introduction

Sub Saharan Africa is generally described as the poorest region, characterized by the lowest per capita income, high population growth, low physical and human capital formation and less developed infrastructure (World Bank, 2005(a) cited in Bayaktar and Fofack, 2007). This fact in turn has created further obstacle in physical capital formation which is a key requirement in economic growth.

Physical capital formation occurs as a result of investment. Society does not consume the whole of current productive activity to the needs and desires of an immediate use, but directs some of it in making of capital goods such as buildings, factories, bridges, hospitals, tools, equipments, machineries, cars, transport facilities and all other various forms of capital, which can increase the efficiency of productive effort (Mohammed F. Mahmoud, 1989).

In the Neo classical growth theory, production function is used to explain the source of economic growth. It is argued in Solow (1956) and Harrod (1936) physical capital formation, labor and technical progress are essential in explaining economic growth.

The capital needed for economic growth can be obtained from various sources. According to Solow (1956), the long run output per worker is directly related to the rate of investment. On the other hand, investment is financed through gross national saving. The other source of income is generated through export which

ensures the availability of foreign currency in order to finance import of capital equipments and finally, from external sources such as aid, technical assistance, foreign direct investment and foreign borrowings (UNO, LDC Report, 2006).

Poor countries like Ethiopia have advantage in enhancing economic development and reduce poverty rapidly. The growing literature on income and convergence among countries seems to suggest that developing countries have benefited to a relatively smaller degree from being back ward.

The high growth potential can be explained in various ways. It has been argued that poor nations with limited level of physical capital and huge population can enjoy rapid output growth through import of capital due to increasing return to physical capital per worker. (See UNO, LDC Report, 2006). Besides, developing countries are technologically late comers in the sense that they are behind the technological standard of developed nations. In this regard, developing countries can adopt the existing technologies rather than starting from the grassroots in innovation.

The level of interaction and openness also plays a decisive role in determining the import of crucial inputs required. Moreover, some studies indicate that out ward looking strategy, promotion of competitive environment for production and market liberalization greatly influence the level of economic development in a nation.

In Ethiopia, the gross capital formation has shown a drastic rise over the last two decades. Gross capital formation in the country was 13.6 percent, 14.1 percent and 18.3 percent of the GDP for the periods 1980-84, 1989-1993 and 1999-2003, respectively. On the other hand, the gross national savings were 6.5 percent, 4.7 percent and 5.4 percent of the GDP for the same period (See UNO, LDC Report, 2006). Hence, the domestic saving rate is not even sufficient to generate the physical capital formation, where finance from external source plays fundamental role in filling the gap.

Promotion and diversification of exports ensure the availability of foreign currency for financing imports. However, exports of least developed countries are characterized by low price and low income elasticity in international markets. Besides, these countries export limited commodities which exposes them to vagaries of nature and highly volatile international markets.

In recent years, Ethiopia has experienced remarkable increase in export performance and has shown some degree of diversification. The country also imports physical capital and raw materials from the rest of the world. During times of high outflow of exports, the import of capital equipments is increased and the opposite is the case when the volume deteriorates. Contrary to this, the volume of import is consistently rising at a greater rate widening the gap between the two. Hence, in order to ensure unwavering long run capacity to import, stable export earnings are essential.

This paper aims at exploring the association between export income fluctuation and physical capital creation in Ethiopia. Thus, it is highly essential to carry out a detail exploration and it contributes to the existing knowledge in greater magnitude. However, there are also some specific objectives, which are to be met in the due process of the investigation.

1. The paper analysis the trends of physical capital formation in Ethiopia.
2. It examines the sources of income in generating physical capital in Ethiopia and more emphasis will be given to the role of domestic saving and the external source of financing.
3. It tries to look to different variables, which affect the physical capital formation in the country, in addition to export earning fluctuation.

The remainder of the paper is organized as follows. The second part presents theoretical and empirical literature review. The third section deals with methodology and model specification. The fourth part presents the major finding of the paper while the last section is concerned with conclusion and policy implications.

2. Literature Review

2.1 Theoretical Literature Review.

The core processes through which productive capacities develop are capital accumulation, technological progress and structural change. Physical capital accumulation refers to the creation and addition of means of production which comprises machines, equipments, infrastructure, automobiles, appliances, residential investments and accumulation of inventories by producers. The availability of physical capital in the economy determines the level of output. However, physical capital changes over time and these changes can lead to fluctuation in economic growth.

Investment is the vital component which increases the rate of accumulation of physical capital. Investment refers to the flow of spending that adds to the physical stock of capital. It is the amount of money spent to add to the existing capital. Fluctuation in investment accounts for the movement in the GDP in business cycle. It is argued that the fluctuation arises from the fact that investment depends on the pessimistic and optimistic belief of investors. (Dornibusch and Fischer, 1994)

Differences in the level of development among countries are explained by investment fluctuation (See Gordon, 2002). Accordingly, countries that tend to invest greater share of their GDP show faster economic growth than others do, even though, it is only for transitional period.

Another component, which brings change in the level of physical capital in the economy, is depreciation. According to Dornibusch and Fischer (1994), depreciation has two components. The first component is the wear and tear of physical capital arising from use and age, while the second component is economic depreciation, resulting from stoppage of the function of the capital due to various reasons such as rise in the price of input used along with the capital and technological change.

In nutshell, physical capital in the economy is accumulated through increase in the investment rate and depletes through depreciation. In the following section, the focus is to give the role of physical capital in the development process and different theories that indicate the physical capital formation.

2.1.1 Physical Capital Stock in the Production Process.

The explanation of the sources of economic growth gained wider attention during the 1950's and 1980's. The best known contributor was Robert Solow (1956) who coined the Neo Classical growth theory. The most recent one is known as the endogenous growth theory, with greater contributors such as Paul Romer and Robert E. Lucas.

In the Neo Classical growth theory, production function is used to show and explain the economic growth. Output in the economy grows through the increase in the level of labor, physical capital and through improvement in the level of technology. It explains growth through the interaction among factor supplies,

productivity growth, saving and investment. Physical capital is important component on explaining growth rate. As the amount of capital per worker increases, the output also rises. On the other hand, physical capital growth rate is determined by the national saving rate, which depends in turn on income. Income or output in turn depends on capital. Thus, we are set in with an interdependent system in which capital growth depends via saving and investment in the stock of physical capital (Gordon, 2002).

According to Solow(1956) as cited in Dornibusch and Fischer(1994), based on data in USA ranging for the period of 1909 to1949, the economic growth in this period was largely explained through technological improvement (accounting for about 80 percent), while physical capital formation accounts for the smallest portion. However, it is argued that the technological improvement arising over this span of time is embodied in physical capital. Hence, physical capital formation plays decisive role in explaining economic growth.

According to Solow thus, capital stock, labor force and advancement in technology, which was assumed to be exogenous in the model of the Neo Classical economic growth, interact in the economy and influences the level of output. In this regard, firms substitute the factors of production based on the prices of each.

In 1980's economic growth was mainly explained through endogenous growth theory. This theory has gone one step forward in inclusion of human capital in

the neo classical growth theory. According to Romer (1996), human capital is defined as the sum of all nations human knowledge accumulated through education and training. In addition, the role of research and development was important in enlarging human capital. Thus, the exogenous factor in the Neoclassical growth theory is technical progress which now became part of the model, and hence, endogenous growth theory.

On the other hand, human capital accumulation brings a desired level of change in the economy if it is accompanied by physical capital. It is also contended that in nations where human capital is scarce, investment in physical capital cannot bring any incredible rise in the level of output. The endogenous growth theory also comprises the development of new idea that further creates innovation of new technology which is embodied in physical capital. Thus, it is strongly stressed that, in the new growth theory, physical capital accumulation is more effective and productive with only human capital.

2.1.2 Capital Stock Adjustment

The existing level of physical capital in the economy is different from the desired level. The desired level of capital is the amount of capital which producers tend to accumulate based on the expected rate of output. It is widely observed that firms do not immediately adjust their capital stock in response to shocks in demand. The difference between the two arises from the fact that capital accumulation is associated with high cost and requires more time to

invest in it. Hence, based on this, the mechanism of physical capital accumulation and adjustment can be formulated.

Based on the literature, the gap between the two is filled by the rate of investment on physical capital (See Mankiw, 2000). If for instance, the desired level of physical capital is high, then firms tend to invest at greater rate in order to fill the gap. However, it is contended that firms can not absolutely fill the gap, but minimize it, based on the rate of investment

2.1.3 Investment Theories

Investment is adding to the existing stock of physical capital and it is the volatile component of the GDP. This indicates that fluctuation in the level of investment affects the level of output and its components. In the following section, different theories of investments are discussed.

The first theory of investment was that of J.M. Keynes, in his book, The General Theory of Employment, Interest and Money. He indicated the rate of investment, which is accumulation of physical capital, depends on the level of interest rate and the return on capital. Investment, according to him, is highly volatile because it depends on the optimistic and pessimistic decision of the investor, regarded as "animal sprit". This demonstrates that there is no fundamental reason on which investors base their decision. They will change their expectations easily, which in turn has a power to alter the level of physical capital accumulation.

The second theory is referred to as accelerator model of investment, which emerged in1950's and 1960's. This model, according to Mankiw (2000) assumes that investment spending is proportional to the level of output. It is regarded as constant multiple of the level of output at that time. This idea was originated from the fact that business firms tend to accumulate more physical capital when they aim to produce larger output. Thus, according to this model, the level of output or aggregate demand influences the rate of physical capital accumulation. However, this model failed to explain the rate of accumulation of capital when firms have spare capacity to produce. Accordingly, if business firms do have spare capacity and expects that output grows in the future, they tend to use the existing capacity rather than accumulating capital.

The third theory of physical capital accumulation is referred to as the flexible accelerator. Flexible accelerator theory was based on the simple accelerator model. This model simplified some of the assumptions of simple accelerator model. Accordingly, expected output is dependant only on the last period's output, however, the flexible accelerator model argues that it depends particularly on the last period's actual output and partially on the expectation. On the other hand, simple accelerator model assumes that desired capital stock is a constant value times expected output. But, flexible accelerator theory contends that the value may vary due to various reasons. Finally, flexible accelerator theory allows for gradual adjustment for physical capital stock.

The Neo classical investment theory was developed in 1960's by Dale Jorgeson. It is regarded as business fixed investment. Business firms base their decision on its cost and benefit. It also emphasizes to the rate of marginal product of the physical capital, the level of interest rate on borrowed funds, the tax system and the rate of depreciation, referred to as the user cost of capital. The user cost of capital was derived from microeconomic theory based on profit theory. If the rate of profit that firms expect to obtain in the future is higher than the user cost of capital, then they tend to invest in physical capital in order to produce more.

The final theory of investment is the Tobin Q, developed by Tobin in 1969. This theory of investment is linked to stock market. Q is defined as the ratio of the market value of the installed physical capital and replacement cost of the installed capital. If the expected market value of the physical capital is greater than the current value of the capital, then firms tend to invest more in physical capital.

Literatures that are more recent introduced an element of uncertainty in to investment theory. The argument is that the cost of investing in machinery and equipment is usually not recoverable by future resale. The sector specific characteristics of the investment would imply the high degree of uncertainty. The other source of uncertainty is the policy environment. When for instance,

policy reform is introduced, it is very unlikely that private sector will see it as suitable.

2.1.4 Determinants of Physical Capital

2.1.4.1 Gross Domestic Saving

Gross domestic saving creates physical capital through investment. Gross domestic saving in this case comprises saving of household, corporations and the government. Early theories of economic growth emphasized the rate of saving as a source of economic growth. The Neo classical growth developed in 1950's and 1960's also emphasized the importance of saving in economic growth process. According to the Neo classical growth theory, it is assumed that in order for economic growth to materialize, saving must be translated in to investment i.e. saving must be equal to investment at least in the context of closed economy. Studies also indicate that there is a positive correlation between saving and growth (for instance Coroll and Weil, 1994), Elbadawi and Mewega, (1998) as cited in Alemayehy et al. (2004).

As indicated in Dornibusch and Fischer (1994), saving either causes physical capital to grow or replaces capital that wears out. However, it is indicated that saving affects growth in the short run only by changing the rate of investment. If saving rate increases, the economy will have larger capital and hence larger output. Nevertheless, the increased saving rate affects growth until the economy reaches new steady state. However, the presumption that all saving is directed to investment must be seen carefully. This is due to the reason that not all savings

are directed to productive investment, but due to the availability of financial market some of the savings can be transferred to what is called portfolio investment and some portion of it is used to smooth consumption.

2.1.4.2. Expected Output

According to the accelerator theory of investment, the rate of physical capital formation is determined by expected rate of output. Business firms increase the rate of physical capital formation if they expect that in the future the level of output rises.

2.1.4.3. Taxes

The rate of physical capital formation is affected by the tax system that the country follows. Corporate profit tax and investment tax credit are some of the important components. Corporate profit tax is a tax collected on the profit created by the corporations. On the other hand, investment tax credit is the provision that encourages firms to accumulate physical capital. It reduces firms' tax by certain amount on each capital.

2.1.4.4. Real Exchange Rate

Real exchange rate is another factor which determines physical capital formation especially in developing countries. Developing countries import capital equipment and new technologies from developed nations, where the real exchange rate has great implication. Exchange rate volatility and real devaluation causes import of capital to be more expensive, thus, contributes to

the reduction in the economic growth. On the other hand, it is contended that devaluation can reactivate the export sector of the economy.

2.1.4.5. Rental Cost of Physical Capital.

The rental cost of physical capital refers to the cost of using one more unit of capital in production process. According to Mankiw (2000), the rental cost of capital comprises interest rate, rental price of physical capital and depreciation. The real interest rate is the difference between the nominal interest rate and the rate of inflation, which determines physical capital formation negatively, if firms use borrowed funds. The rental price of capital is the price charged by firms when renting out capital to other firms. The rental price of capital depends on the existing stock of capital, the amount of labor and the level of technology. On top of this, the wear and tear of physical capital influences the level negatively. Producers replace physical capital until marginal product of capital is equivalent to the user cost of capital. However, a decline in the marginal product of capital lowers the level of output and hence, the level of physical capital accumulation.

2.1.4.6. Foreign Direct Investment (FDI) and Foreign Aid.

Foreign direct investment (FDI) and Aid plays important role in formation of physical capital in developing countries. Through FDI and Aid, developing nations get the access to tap foreign savings and this helps to smooth out capital formation, if gross domestic saving falls short of the capital formation.

However, the empirical evidence suggests that the impact of FDI on domestic economy is ambiguous. According to Harrison (1999), as cited in Alfaro L. et al. (2003) indicates that the net effect of FDI on productivity is quite small.

Contrary to this, Bourenstein et.al (1998) states that FDI has an exogenous positive effect on economic growth.

2.1.5 The Role of Export in Economic Growth.

The role export promotion to improve the growth potential of a country occupies the center stage in especially development literature where export promotion has gradually replaced import substitution. Thus, trade appears to raise income by speeding the accumulation of physical capital and human capital, transformation of new technology and increases output for a given level of output. The infant industry argument proposed by Hamilton (1974) and List (1841) as depicted in Gulzar S. et al. (2006) was replaced by export led development, liberalization of the market and more openness. Export promotion enhances economic growth through the following arguments.

The Keynesian argument is that a rise in export increases output via export multiplier. Export also plays decisive role in acquiring foreign exchange, which in turn allows the provision of physical capital imported from foreign market. Increased openness to trade, on the other hand, enhances competition for firms producing for international market. Such environment generates incentives for an increased productivity and incentives for innovation and also creates possibility to pay higher wages. Besides, liberalization creates an opportunity for the economy to be highly related to the international market and enhances the attraction of investment in the tradable sector on the economy and thus, increases productivity. It also equips nations with power to have increased

power in international negotiations in trade and tariff barriers. The integration of a country to the world on the other hand, increases the flow of FDI and plays vital role in physical capital accumulation.

Export diversification can lead to higher growth in countries that are dependent on one or two commodities for export, since they may face export instability. According to Tsen (2006), as cited in Adric C. Jordaan et al. (2006) sated that the experience of East Asian countries provide good example for the importance of this sector to economic growth. This emphasizes that export is regarded as an engine of growth.

2.2 Empirical Literature Review

In the following section the relationship between export earnings fluctuation and physical capital formation conducted by various scholars are reviewed. However, the literature on the impact of export income fluctuation on physical capital formation is scarce. Rather it easy to find the impact of export income fluctuation on economic growth, which is an indirect approach.

Accordingly, let us first see the impact of export income fluctuation on physical capital formation. Akpokodje G. (2000) explained the association between export income fluctuation and capital formation in Nigeria using cointegration technique. The finding of the study suggests that the current level of export income fluctuation adversely affects investment, which is the capital formation, in the short run.

Peter K. et al. (2004) conducted a study to investigate the relationship between export income fluctuation and capital formation for four South African Development Community (SADC) countries, i.e. Botswana, Mozambique, Zambia and Zimbabwe. The study used cointegration and error correction model and the finding shows that in the long run export earning fluctuation positively and significantly affects capital formation in Zambia only. In the rest of the countries, export earning fluctuation has insignificant effect on capital formation.

UN Report in Least Developed Countries (LDCs) (2006) shows that capital formation in developing countries is highly dependent on external finance. According to this study, the resource gap, which is measured as the difference between gross capital formation and gross domestic saving was 8.4 percent of the GDP in the period 1999 to 2003. In the same study, it is depicted that foreign direct investment (FDI) is another factor which determines the formation of capital stock. FDI as the share of GDP has increased by 10 percent in these nations.

Among other studies that examine specially the relationship between export earning fluctuation and investment was conducted by Stordel (1990), as indicated in Mohamed A.W.Mohamed, (2003). He estimated separate equation for twelve Least Developed Countries. His result suggests that in seven of the

twelve countries export income fluctuation negatively influences the rate of investment.

Let's now return to the indirect approach, which shows the impact of export earning fluctuation on economic growth. With this regard, some studies find a positive relationship among export instability and economic growth, while others find a negative relationship. Others still find that there is no any relationship between the two.

Sinha D. (1999) conducted a study in nine Asian countries to find the correlation between export instability and economic growth. The study employed time series data and the findings suggest various outcomes for countries involved in the study. Accordingly, for India, the impact of export instability on economic growth is of mixed result, while for courtiers such as Japan, Malaysia, Philippines and Sirilanka, the evidence suggests a negative relationship between the two. It is contended that export income instability influences the availability of intermediate inputs and capital stock for production. Finally, for countries such as Korea, Pakistan and Thailand, there is a positive relationship. In this case, the explanation forwarded is as follows. If we assume uncertainty and risk averse behavior about export earnings, it can lead to reduction in consumption and increase in saving and investment in turn, which brings growth in the output.

As indicated in Heiko Hesse (2008), Gyimah-Brempog used average data for the period 1960 to1986 for thirty-four sub Saharan African courtiers. His cross section data using production function works suggests that export instability has negative result on economic growth.

An indirect method was used by Heiko Hesse (2008), where the relationship between export diversification and economic growth was analyzed. The study suggests a positive effect of export diversification on economic growth. This means countries that depend on narrow export face export earning fluctuation and hence, negative influence on economic growth.

K.A.Al Mamuna et al. (2005) conducted a study to find out the relationship between export and economic growth using time series data for Bangladesh. It shows evidence for long run relationship between export and output.

Andric C. Jordaan et-al.(2006) analyzed the causality between export and growth for Namibia for the period 1970 to 2005 using time series economic analysis and the finding suggests export growth led strategy through various incentives do have a positive influence on economic growth in the country.

Per-ola M.(2008) analyzed export growth for Argentina and Mexico using cointegration and causality techniques and the finding indicates an outward looking or export led growth has a positive and significant impact on economic growth.

Kagnew Wolde (2007) examined the relationship between export performance and economic growth in Ethiopia using multivariate time series analysis. The data ranges from 1960/61 to 2003/04 and the finding suggests that export growth is positively and significantly influences the rate of economic growth.

Faye Ensarmu (2002) conducted a study to find the relationship between export and economic growth in Ethiopia for the period of 1950 to 1986 using cobb douglas production function and cointegration system. The findings of the study suggest that the real export has a positive effect on economic growth.

3. Model specification and Methodology

3.1 Measurement of Export Earning Fluctuation Index

There are several approaches of finding the export earning fluctuation index. One approach is known as least square method, which involves fitting a function to export earnings (see Naya, 1973). Another method is the log variance method. This method approximates the average year-to-year percentage variation in earning form export adjusted for constant percentage. However, the study uses the combination of standard normalization and moving average approach as a measure of export earning fluctuation (see Akpokodje G. 2000). The following formula is used as a proxy of real export earning fluctuation.

$$E_t = \frac{x_t - \bar{x}}{\delta}, \qquad \bar{x} = \frac{1}{n} \sum_{i=0}^{n} xt$$

where x_t is the real export earning in period t and σ is the standard deviation of export earning of the entire period over which the export series spans. This method has the advantage of yielding independent observation overtime and it is able to differentiate between rise and fall.

3.2 Model Specification

The model of physical capital formation in an economy specified in this study is based on the existing theoretical and empirical literature conducted previously (see Akpokodje G., 2000 and Peter K. et.al, 2004).

The model specified captures different variables such as real interest rate, expected level of output, proxied by real gross domestic product, gross

domestics saving, export income fluctuation, effective exchange rate and aid which determines the physical capital formation in an economy. Thus, the regression equation is specified as follows,

$K_t^* = \beta_1 + \beta_2 RINT + \beta_3 REFE + \beta_4 RGDP + \beta_5 EFLUE + \beta_6 GDS + \beta 7 AID + \epsilon_t$ ------- (1)

K_t^* refers to expected physical capital formation

RINT stands for real interest rate, which is expected to influence the rate of physical capital formation negatively.

REFE represents real effective exchange rate and it is expected to have negative relationship with physical capital formation.

RGDP stands for expected output and it is expected to have positive relationship with capital formation.

EFLU represents export earning fluctuation, with negative influence on the rate of physical capital formation.

GDS represents gross domestic saving which is regarded as the main source of physical capital formation and have positive relationship with the rate of physical capital formation.

AID represents Aid.

ϵ_t is error term, which is expected to be white noise.

Equation (1) is stock adjustment process, which claims that the desired level of physical capital stock in the economy is a linear function of all the variables stated above. However, the desired level of physical capital is not observable in the economy; thus, the following adjustment process is conducted.

$K_t - K_{t-1} = \pi (K^*_t - K_{t-1})$ ---------- (2)

where $0<\pi \trianglelefteq$, which refers to the coefficient of adjustment.

$K_t - K_{t-1}$ is the actual change in the level of physical capital stock, while

$K^*_t - K_{t-1}$ is the desired change in the physical capital stock.

The above equation states that the actual change in the level of physical capital at any time is the function of π of the desired change for that specified time.

On the other hand, the desired level of physical capital change depends on the expected level of output. This means that if investors and other economic agents expect in the future that the level of output rises, then they increase the level of physical capital formation and vice versa. Based on this, the actual level of physical capital stock depends on some portion of π of the desired level of capital stock. This happens due to the reason that investing in physical capital takes more time and it is expensive. Therefore, the actual level of capital stock is not equivalent to the desired level of physical capital stock.

Alternatively, equation (2) can be written in the following way,

$$K_t = \pi (K^*_t - K_{t-1}) + K_{t-1}$$

$$K_t = \pi k^* - \pi K_{t-1} + K_{t-1}$$

$$K_t = \pi k^*_t + (1-\lambda) K_{t-1} \quad \text{---------- (3)}$$

Equation (3) indicates that the observed capital stock at period t is weighted average of desired capital stock at period t and capital stock during the previous period.

By substituting equitation (1) in to (3), we obtain,

$K_t = \pi (\beta_1 + \beta_2 RINT + \beta_3 REFE + \beta_4 RGDP + \beta_5 EFLU + \beta_6 GDS + \epsilon_t) + \beta 7 AID + (1-\lambda) Kt_{-1}$,

which can be written as follows,

$K_t = \alpha_1 + \alpha_2 RINT + \alpha_3 REFE + \alpha_4 RGDP + \alpha_5 EFLU + \alpha_6 GDS + \alpha_7 K_{t-1} + \alpha_8 AID$---- *(4)*

Equation (4) above gives the final model which is to be estimated. The expected level of output can be generated in a number of ways. The following approach has been found to yield robust result in some studies in developing countries (see Peter K. et.al, 2004).

$RGDP = \beta + €\ln RGDP_{t-1}$

3.3 Data Source and Description.

The reliability of any econometric analysis depends on the quality of the data used. Thus, it is crucial to describe and discuss the nature and sources of the data. The study uses secondary data generated from domestic sources. The Ministry of Finance and Economic Development (MOFED) and the National Bank of Ethiopia (NBE) are the prime sources of the data. The choice of the period of study i.e., 1960/61 to 2007/08 is based on the availability of the data. For the description part, data which spans form 1960/61 to 2007/08 is used. However, for the econometric analysis, data ranging from 1970/1 to 2007/8 is employed. This is simply for the reason of not obtaining the data in all the entire period for variables such as real interest rate and real effective exchange rate.

The data for Gross Capital Formation (GCF), Gross Domestic Saving (GDS), export, import and Gross Domestic Product (GDP) are secured from MoFED, while, real interest rate and real effective exchange rate are obtained from the NBE. With respect to GDP, GCF, GDS, exports and imports measurement, the MoFED used different methodologies in generating the data. The methodology

used for the period that spans from 1960/61 to 1988/89 is different from that of the period 1989/90 to 2007/08. Thus, in order to avoid the differences, a link on the two series of data has been conducted.

3.4. Methodology

3.4.1. Stationary and Non-stationary Series

Econometric modeling of time series between economic variables requires time series data of the variables. However, such time series data create several problems.

Regressing a time series variable on another time series variable yields high R^2, even though there is no meaningful relationship between the two variables. This is called spurious or non sense regression (Gujirati, 2007).

On the other hand, the Standard Ordinary Least Square (OLS) assumes that the variables under consideration are stationary. Stationary series has time independent value and, a finite variance. This means that their mean, variance, covariance are time invariant. As a result, shocks to the series are temporary and overtime will dissipate. However most macroeconomic variables are non stationary in perception that the mean and the variance depend on time and there are no tendencies for them to hold back to a given value and hence shocks have permanent effect. Non stationary results due to many reasons such as changes to the economic structure, changes in policies, technological changes and political turmoil. Therefore, in conducting OLS estimates in time series variables, checking for the stationary of the time series variables are necessary.

3.4.2. Unit Root Test

Regressing a time series data on another time series data yields spurious regression, thus, checking for the existence of non stationary is essential before conducting the estimation. The test of stationary that has been widely popular over several years is the unit root test. The presence of unit root indicates that the series is non stationary. The Dicky Fuller and the Augmented Dicky Fuller test are the most popular techniques for testing the presence of unit root in the literature.

Consider Autoregressive model of order one AR (1)

$Y_t = \beta + \theta Y_{t-1} + \epsilon_t$

Where $\theta = 1$ corresponds to unit root. As shown in Dicky & Fuller (1979) the standard t ratio does not have a t distribution, not even asymptotically. The reason for this is the non stationary of the process invalidating the standard results on the distribution of the OLS estimator θ. The null hypothesis, which corresponds to the presence of unit root, is when $\theta = 1$.

On the other hand, Augmented Dicky Fuller test can be used to check for the presence of unit root test. In the Dicky Fuller test, the error terms are assumed to be uncorrelated. But in case the error terms are correlated, Dicky and Fuller have developed a test known as Augmented Dicky Fuller (ADF) test. This test is conducted by "augmenting" the equation by adding the lagged values of dependent variables. This idea is to include enough terms so that the error terms are uncorrelated.

ADF test is criticized on the ground that it is unable to discriminate between stationary and non stationary series of high degree autocorrelation. To take care of the problem, the ADF is supplemented by Phillips – Perron test (PP). The PP has an advantage over the ADF test as it gives robust estimate when the series has several correlation, hetroskedasticity and structural breaks (Harris, 1995).

3.4.3 Cointegration

The Classical Ordinary Least Square (OLS) assumes that the underlying variables are stationary, thus, the t test and others are statistically significant. However, many macroeconomic variables exhibit stochastic trend and are non stationary. Regressing such variables on another yields what is called spurious regression, where the R^2 is high, though there is no meaningful relationship among the variables. Thus, to take care of the spurious regression and confirm that the long run relationship materializes, the concept of cointegration is used. Subjecting each variable to unit root test may yield that they are integrated of order one i.e. I(1). The linear regression of such variables, however, result an interesting outcome where the stochastic trends cancel each other and the regression becomes reasonable. This is basically the concept of cointegration. Economically speaking, two variables are cointegrated if they have long run relationship between them. The residual obtained from such regression are used to check whether cointegration prevails. Thus, subjecting the error terms to unit root test and if it is found to be integrated of order zero i.e. I(0), then there exists long run relationship among the variables.

3.4.3.1 Tests of cointegration

There are two methods of cointegration test that has been widely used. The Engle and Granger (1987) method which is based on checking whether a single equation estimates the equilibrium error term appear to be stationary. Application of Dicky Fuller (DF) and Agumented Dicky Fuller (ADF) can be used on residuals obtained as the test of cointegration. However, since the estimated error terms are based on cointegrating parameter, the DF and ADF critical values are not quite appropriate. Thus, Engle and Granger have calculated the values. The present DF and ADF in this context are known as Engle Granger (EG) and Augmented Engle Granger (AEG) test.

There are two steps which are employed in testing for cointegration in Engle Granger method. The first step is to determine the order of integration of the variables through the use of unit root test. If the variables are I(1) and the residual obtained from such regression is found to be I(0), then it is argued that there is a long run relationship between the variables.

The second step is to estimate the Error Correction Mechanism (ECM). The ECM states that if two variables, say X and Y is cointegrated, then the relationship between the two can be represented as ECM. In this case, the equilibrium error term is included in the first difference of the variables, which is represented as a short term indicators. This formulation helps to show the

variation form the equilibrium position and how the adjustment towards the equilibrium is made.

The Engle Granger method has shortcoming, even though it is easy for application. One of the main problems of Engle Granger method occurs when there are more than one cointegrating relationship exists. This means on the other hand, there are more than one cointegrating vectors.

Another alternative approach which does not suffer from the problem stated above was proposed by Johansen (1988), who developed a maximum likelihood estimation procedure. This will also allow for a number of cointegrating relationships.

In order to conduct this test the equation must be expressed in Vector Autoregressive form (VAR). VAR describes a dynamic evolution of a number of variables form their common history. Each equation in the system describes the behavior of certain variables which appear on another equation as explanatory variable. It is simply a K equation, with a K variable linear model, in which each term is expressed by its lagged value and lagged values of the remaining K-1 variables. This phenomenon helps in capturing evolution and interdependence between multiple time series variables.

The Johansen's method uses the VAR technique which is specified as follows,

$$Z_t = \gamma_1 Z_{t-1} + \gamma_2 + Z_{t-2} + \text{----------} + \gamma_p Z_{t-p} + \epsilon_t \quad \text{----------} \quad (6)$$

where Zt represents the Kx1 vector which contains K variables. All the variables stated in this paper are incorporated.

The VAR stated above can be reformed in to Vector Error Correction Model (VECM) as follows,

$$\Delta Z_t = \pi Z_{t-1} + \Gamma_1 \Delta Z_{t-1} + \Gamma_3 \Delta Z_{t-2} + \text{-------} + \Gamma_{p-1} \Delta Z_{1-P+1} + \epsilon_t \quad \text{---------- (7)}$$

The above formulation indicates how long run impacts of the K variables are incorporated in short run dynamics. It contains both the short run and long run adjustment to change in the variables. The Johnson's technique is based on estimating the long run vector π, which can be decomposed in to matrix of σ and β, thus, $\pi = \sigma \beta'$, β represents the long run coefficient.

The analysis of the long run relationship of the above model is based on the rank of matrix π. If the matrix has full rank (r =K linearly independent variables), then the vector column is stationary. If the rank of π is equivalent to zero, then this shows that there is no cointegration. If 0<r<K, the rank is termed as the reduced rank showing that there are multiple cointegrationg vectors.

In order to test the above, Johansen developed two techniques. It is simply finding the rank of the vector π. The first test is known as trace test, which is given as follows,

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{K} \log(1-\lambda) \quad \text{---------- (8)}$$

Where λ is the estimated value of the characteristic root, which is also called the eigen value of the matrix and T is the sample size. This technique checks whether the smallest K-r eigen values are significantly different from zero.

The alternative test is called the maximum eigen value test, which its statistic is given as follows,

$\lambda_{max}(r,r+1) = -T \ln(1-\lambda_i)$---------- **(9)**

This tests the null that the number of cointegrating vector is r against the alternative r+1 cointegrating vector.

4. Discussion of the Result

4.1. Descriptive Analysi

4.1.1. Real GDP and its Sectoral Growth Rate

The Ethiopian economy has passed through different growth episodes in the period of study i,e 1960/1 to 2007/8. These periods are characterized with different strategies and ideologies that were manifested in the outcome of the economy.

Table 4.1: Trends of growth of GDP and its sectors.

Period	Growth rate of GDP	Agriculture		Industry		Service	
		As% of GDP	Growth rate	As % of GDP	Growth rate	As % of GDP	Growth rate
1960/1-1973/4	3	72	2	10	7	18	8
1947/5-1991/2	2	59	2	12	1	26	3
1992/3-2007/8	6	49	4	12	8	34	9
1960/1-2007/8	4	60	3	11	5	26	7

Source: own computation.

The above table illustrates the growth rate of GDP and its components in the three prominent regimes. During the Imperial regime, the Ethiopian economy

has registered some significant economic growth. This is indicated by an average growth rate of 3 percent in GDP.

The contribution of agricultural sector to GDP was high during the regime. This was due to the fact that the then existing government has used and implemented three consecutive Five Year Development Plans, the establishment of development package programs and other conducive environment which ultimately led to the growth of GDP.

The remarkable growth trend registered during the Imperial regime, however, lived for a short period, because of the revolution which took place in 1974. The monarchy was overthrown and the military Junta named Derg took power and implemented centrally planned economic management system. The overall period has shown poor macroeconomic performance. During this period, the economy has grown on average by 2 percent and showed a decline from what it used to be during the Imperial regime. In addition, the share of agricultural sector from the total output declined and the share of industry and service sector has shown growth.

The poor performance of the overall economy in this particular period is attributable to the political and economic policies that prevailed in the country. The government nationalized enterprises which were once owned by private sector and thus, reduced the role played by the private sector and the resources available in the country were mainly diverted in financing the prolonged civil war.

After the fall of the Derg regime in 1991, the Ethiopian People's Revolutionary Democratic Front /EPRDF/ took power and introduced reform programs in 1992/3. The reform comprised the liberalization of market, reduction of the role of government and enhancing the participation of the private sector in the economy. The period witnessed GDP growth rate of 6 percent on average. The agriculture and service sector also registered remarkable growth as indicated in the above table. Moreover, the share of agriculture sector from GDP showed decline from 59 percent during the Derg regime to 49 percent in the reform period. A notable growth was witnessed in the service sector which was 26 percent of the GDP during the Derg regime and grew to 34 percent after the Derg.

4.1.2. Trends of Export and Import

The level of development in the economy, its openness, resource endowments and economic policies perused determine the export structure of a country.

Table 4. 2: Trends of Export and Import.

Period	Export		Import	
	Export as % GDP	Growth rate of Export	Import as % of GDP	Growth of import
1960/6-1973/4	7	5	9	7
1974/5-1999/2	7	-2	12	4
1992/3-2007/8	12	15	24	15
1960/1-2007/8	9	6	15	8

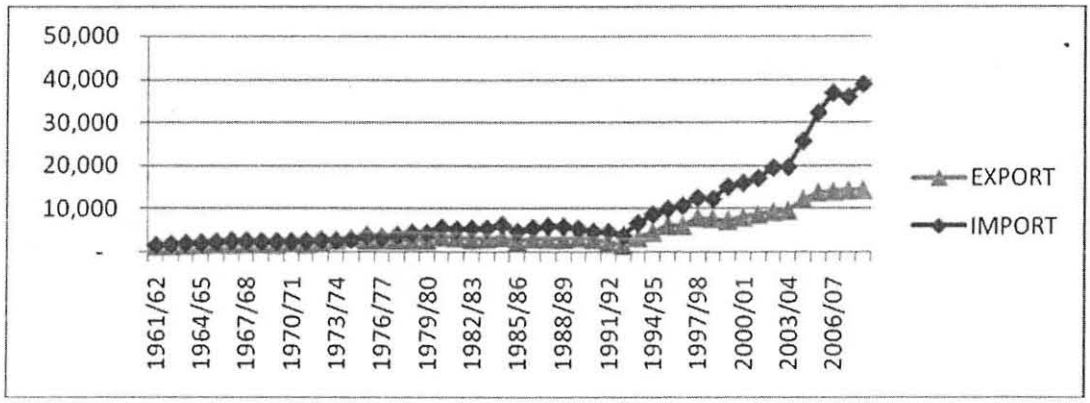
Source: own computation.

The above table summarizes the share of export and import from GDP and shows the growth rate of each. The performance of export and import during the Imperial regime indicates that it has grown on average by 5 and 7 percent respectively and both comprise 7 and 9 percent of the GDP respectively.

Following the fall of the monarchy, the growth rate of both import and export witnessed poor performance. The export sector's growth rate has declined by 2 percent on average and the share of import from the GDP has increased to 12 percent from what it used to be during the Imperial regime.

The introduction of reform and adjustment to the macroeconomic policies after the fall of the Derg regime has contributed to the good performance of the export sector. It has witnessed a growth rate of 15 percent and comprise 12 percent of the GDP, on the other hand, the import of goods and services from abroad has also shown a incredible increase which is indicated through its growth rate and share from the GDP.

Fig. 4.1 Trends of export and import



Source: Own computation

The above figure shows the trends of export and import over the period of study. It is clearly seen that import is growing at a rate which is faster than the export. The gap between the two, which is referred to as trade balance, is widening largely. Yet, one interesting outcome to be noted is that during the Imperial regime, the income received from export is less than the import expense in small gap. However, during the Derg and post Derg regime, the gap is persistently widening, indicating the weak capacity of export sector in generating income to finance the import sector. In addition, the periods witnessed a sharp rise in volume of import due to high domestic demand, for commodities such as fuel, capital equipments and semi finished goods. This was mainly due to the fact that the Ethiopian economy is characterized by the dominance of agricultural sector and was not transformed in to production of industrial commodities, thus, the economy heavily depends on imported goods.

4.1.3 Sources of Gross Capital Formation (GCF) and its Trend in Ethiopia.

Physical capital formation is regarded as one of the requirements which lead to economic growth. However, the low rate of investment has greatly impeded the country's economic growth. Gross Capital Formation (GCF) is financed from different sources. The main source is Gross Domestic Saving (GDS) and the gap between the two, if it exists, can be obtained from external sources through Foreign Direct Investment (FDI), aid and foreign borrowing.

4.1.3.1 Trends of Gross Capital Formation and Saving.

Gross Domestic Saving (GDS) stimulates the accumulation of physical capital through investment i.e. saving must be directed to investment. Trends of capital

formation and saving are discussed below for the period which spans from 1960/1 to 2007/8 GC in Ethiopia.

Table 4.3: Trends of growth of GCF & GDS

Period	GCF as % of GDP	CDS as % of GDP	Growth rate of GCF	Growth rate of GDS	Resource gap
1960/1-1974/5	20	22	3	4	2
1975/6-1991/2	16	11	-4	8	-5
1992/3-2007/8	21	7	11	11	-14
1960/1-2007/8	19	13	6	8	-6

Source: own computation.

The above table summarizes the share of GCF and GDS from real Gross Domestic Product (GDP) and the resource gap. During the Imperial period, GCF has grown at an average growth rate of 3 percent. It also accounts on average 20 percent of the real GDP for the same period.

During the socialist regime, the share of GCF from real GDP, however, declined to 16 percent on average and has shown growth rate of (4) percent. The lower share and decline of GCF form total GDP was attributable to the investment policies of the Derg regime. Ownership of means of production was mainly restricted to the government and the role of private sector in the economy was deliberately reduced. In addition, foreign investment declined due to the socialist ideologies and the political turmoil that prevailed during these periods. The

publicly owned large enterprises, which could have expanded the rate of physical capital formation, were less productive and contributed low level.

The share of GCF form the real GDP has shown improvement during the post Derg regime. The period registered GCF of 21 percent from the total GDP. On top of this, the average growth rate of GCF was 11 percent

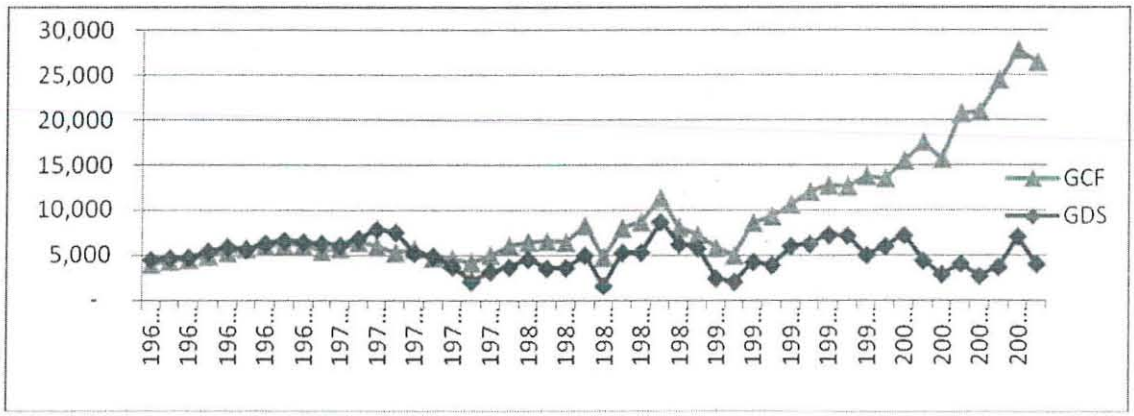
The improvement in physical capital formation was mainly due to the better economic environment created by the government led by EPRDF. It encouraged private sector participation in the economy and reduced the role of the government. Moreover, the review of the investment policies contributed to the growth.

The above table also illustrates the trends of saving in the country over the study period. During the Imperial regime the share of gross domestic saving form real GDP was 22 percent and it showed an average growth rate of 4 percent. After the down fall of the monarchy, however, the GDS declined to 11 percent of the real GDP. This might be due to the saving policy followed by the government.

The government aimed at taxing luxury goods heavily and increased the saving of workers. In actual case, however, the opposite materialized where the private saving were declined and government saving was also reduced due to huge expenses on civil war. The period also witnessed huge fluctuation in the rate of domestic saving.

After the downfall of the Derg regime, GDS as a share of GDP declined to 7 percent. It is important to note here that the share of saving has shown persistent decline, however, there were remarkable improvement in the growth rate of savings and the trend is also moving upward. The following diagram shows the trend of GCF and GDS in the period ranging from 1960/1 to 2007/8.

Fig. 4.2 Trends of GCF & GDS.



Source: Own computation

The difference between GDS and GCF is known as the resource gap. The gap was positive during the Imperial regime and this indicates that the domestic resource is more than sufficient in generating physical capital required. Nevertheless, the gap between the two turned negative in the consecutive periods as shown in above table. The gap increased from 5% of the GDP during the Derg regime to 14% in the post Derg period. This situation indicates that the domestic resource is not enough in financing physical capital formation in the respective periods. The above figure also illustrates the widening gap between GCF and GDS.

4.1.3.2 Foreign Direct Investment (FDI), Aid and Gross Capital Formation

In the above section it is illustrated that the ratio of GCF to GDP is higher than that of saving to real GDP for the majority of the period. This poses the issue of relying on external sources to bridge the gap between the two. FDI, Aid and foreign borrowing are some of the means that a country resorts to in order to minimize the gap.

Table 4.4: FDI and Aid

Period	FDI as % of GDP	AID as % of GDP
1981-1991	6	0
1992-2003	9	1
1981-2001	8	0

Source: Own computation.

As indicated in the above table, the share of FDI from GDP has shown increase from 6 percent to 9 percent for the period 1981-1991 G.C and 1992-2003 G.C respectively. The increase in the share of FDI from GDP is attributable to the good economic conditions created for the attraction of foreign investors. On the other hand, Aid from the share of GDP was almost negligible in the period 1981 to 1991 and increased to 1% of the GDP in the period 1992-2003.

4.2 Econometric Analysis

4.2.1 Unit Root Test

The first step in time series econometric analysis is to carry out the unit root test on the variables of interest. The test examines whether the data series are stationary or not. To conduct the test, Augmented Dicky Fuller test is employed. The null hypothesis in this test claims that the series under investigation has unit root. On the other hand, the alternative hypothesis claims that the series is stationary. In addition to ADF test, Phillips Perron test, which is non-parametric, is also used in order to obtain reliable result.

The lag length of each variable is selected based on minimizing both Akakie's Information Criterion (AIC) and Bayesian Information Criterion (BIC) and both intercept and trend are chosen for conducting the test.

As shown in table 4.5 below, all the variables I.e. Gross Capital Formation (log GCF), Expected level of output (log RGDP), Gross Domestic Saving (log GDS), Export income Fluctuation (EFLU), Real interest Rate (RINT), Effective Exchange Rate (REFE) and Aid (log AID) are non stationary at level.

On the other hand, when the variables are differenced once and subjected to the ADF and PP test, it is indicated that the test statistics exceed the critical values in absolute terms. Thus, all the variables are stationary when differenced once, which means that they are integrated of order one. Hence, the variables can be cointegrated.

Table 4.5 Unit root test.

Variables	Lag length	ADF test		Phillips Perron (PP) test	
		Level	1st Difference	Level	1st Difference
Log GCF	1	-2.51	-4.29*	-2.80	-8.24*
Log RGDP	3	0.79	-3.35***	0.90	-5.55*
Log GDS	1	-3.11	-4.89*	-3.84*	-4.89*
EFLU	1	-0.88	-4.22**	-0.67	-5.09*
RINT	1	-0.12	-3.40**	0.22	-3.70**
Log REFE	1	-1.97	-3.90***	-1.67	-4.26*
Log AID	1	-2.70	-3.90***	-2.96	-6.50*
Critical values ADF 1% = -4.23 5% = 3.54 10% = 3.19					
PP 1% = -4.22 5%= 3.53 10% =3.19					
*,**,*** represents 1%, 5% and 10% respectively.					

4.2.2 Cointegration Test

The result of unit root test discussed above showed that all the variables are integrated of order one, thus, we can perform the cointegration test.

The data congruency of the VAR is selected based on conducting VAR estimation at different levels of lags and minimizing the AIC and BIC. Thus, based on this, lag length of one is selected. Moreover, large lag length is not proffered because of the smallness of the sample and it also reduces the degree of freedom greatly. The cointegration test result is conducted by using

Johansen's maximum likely hood technique, which has an advantage over the Engle Granger method.

Table 4.6: Johansen's Cointegration test result

Ho: rank=p	Max.eigen value	95% confidence interval	Trace statistics	95% confidence interval
P=0	54.1**	45.3	144.2**	124.2
p≤1	33.31	39.4	90.06	94.2
P≤2	23.97	33.5	56.75	68.5
P≤3	18.56	27.1	32.78	47.2
P≤4	9.76	21.0	14.22	28.7
P≤5	4.33	14.1	4.45	15.4

** indicates rejection of the null hypothesis at 5% level of significance.

As shown in the above table, the result indicates that there is one cointegrating vector in the system. The null hypothesis that there is no cointegrating vector in the system ($r \leq 0$) is rejected at 5% level of significance. Thus, it can easily be inferred from the test result that one cointegrationg vector spans the variables under investigation.

The result of cointegration test conducted above will help us to take the first raw of α and column of β to explain the long run relationship among the variables of interest.

The β coefficient shows the long run relationship that prevails among the dependent variable and the explanatory variables. Accordingly, the long run

elasticity of log GCF with respect to log AID and expected level of output (log RGDP) are positive as expected. However, the relationship between the long run elasticity of log GCF and Real Interest Rate (RINT) is also positive, which is unexpected. On the other hand, the long run elasticity relationship between log GCF with respect Real Effective Exchange Rate (log REFE) and Export earning Fluctuation (EFLU) are negative as expected. Nevertheless, the relationship between log GCF and Gross Domestic Saving (log GDS) is unexpected, which is found to be negative. The result is indicated in the following table.

Table 4.7: Standardized eigen vector β

Log GCF	Log RGDP	Log GDS	EFLU	RINT	Log REFE	Log AID
1.000	-1.215	0.236	0.047	-0.840	0.098	-0.0062

Table 4.8: Standardized α coefficients

Variable	Coefficients
Log GCF	-0.099
Log RGDP	0.020
Log GDS	0.282
EFLU	0.263
RINT	-0.017
Log REFE	-O.104
Log AID	-0.081

The values of α obtained from the cointegration show the speed of adjustment of the long run parameters towards the equilibrium relationship. The cointegratd long run relationship discussed above corresponds to ΠXt-1, where, $\Pi=\alpha\beta$.

After determining the cointegrating rank, a rank of restriction can be imposed on both α and β. The restriction imposed of α, which is referred to as test of weak exogniety, helps to determine which variable is exogenous to the system. Thus, it will aid in distinguishing exogenous and endogenous variables.

The test result is summarized in table 4.9, the results of chi square distribution with one degree of freedom and their probability values are also presented.

Table 4.9: Test of weak exogniety.

	Ho: variable is weakly exogenous ($\alpha = 0$)	
Variable	Coefficient	LR test X2(1)
Log GCF	-0.099	4.089(0.0431)**
Log RGDP	0.020	3.088(0.0789)
Log GDS	0.282	4.0476(0.0442)**
EFLU	0.263	0.0328(0.856)
RINT	-0.017	10.37(0.0013)*
Log REFE	-O.104	1.814(0.1780)
Log AID	-0.081	0.9520(0.3291)

* and ** represents rejecting the null hypothesis at 1% and 5% level of significance.

The test depicts that weak exogniety is rejected for log GCF, log GDS and RINT which is rejected at 5% and 1% level of significance respectively. However, for the rest of the variables, weak exogniety is not rejected at different level of significance as shown in the above table. Thus, the long run relationship can be formulated by taking log GCF as endogenous variable, while, expected output (log RGDP), EFLU, REFE and log AID as exogenous variables. Therefore, the long run coefficients stated is as follows,

Log GCF = 1.215 log RGDP- 0.047EFLU-0.098 log REFE+0.0062 log AID----4.1

Once the long run relationship is defined, the next task is to formulate test of significance on the long run parameters. This test can be obtained by imposing restriction on β coefficients, which is termed as exclusion test. It helps to determine which variables are relevant or statistically significant in the cointegrating vector. The results of the test along with their respective probability values are reported on table 4.10.

Table 4.10: Test of zero restriction on β coefficients

Ho: the coefficient β is equal to zero (β =0)		
Variable	Coefficient	LR test X2(1)
Log RGDP	-1.215	2.936 (0.0866)***
LOG GDS	0.236	5.749 (0.0165)**
EFLU	0.047	4.912 (0.0266)**
RINT	-0840	1.786 (0.1814)
Log REFE	0.098	3.214 (0.073)***
Log AID	-0.0062	2.667 (0.0893)***

** and *** represents 5% and 10% level of significance respectively.

As shown in the table, log RGDP, log GDS, EFLU, log REFE and log AID explain the dependent variable, log GCF, at different levels of significance. However, RINT do not constitute the explanatory variable, since, the null hypothesis is rejected.

4.2.3 The Short Run Dynamics.

The information provided by the long run test can now be used to generate a set of Vector Error Correction Model (VECM), which captures both the long run and short run relationship. The change in the variable represent variation in the short run, while the coefficient obtained for the error correction term represents the speed of adjustment towards the long run relationship. The variation in the short run is now explained through change in variables which are integrated of order one.

The procedure of estimation is obtained through moving form general to specific, where we select large model by including many variables as much as possible and several lags and sequentially dropping the variables and lags which are insignificant. The Vector Error Correction Model (VECM) is estimated using the Ordinary Least Squares (OLS) technique and the result is summarized in table 4.11.

As indicated in table below, change in Expected level of output (log RGDP) and Gross domestic saving (log GDS) influences the level of physical capital formation, which is proxed by Gross capital formation at one percent level of significance

On the other hand, change in the level of aid causes negative influence to the level of physical capital formation at 5% significance level. Finally, the result of lagged error correction term (ECT-1) is significant at 1% level and the sign of the coefficient is negative and significant indicating that the adjustment towards the long run equilibrium is fast if there is variation in the short run.

The result of the Vector Error Correction Model (VECM), does not detect the problem of serial correlation and vector normality as indicated at the bottom of the table.

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The result of the Vector Error Correction Model (VECM), does not detect the problem of serial correlation and vector normality as indicated at the bottom of the above table.

Table 4.11: Short run dynamics.

Variable	Coefficient	Std.Error Value	t-value
Constant	-0.76900	0.27506	-2.796*
DlogRGDP	1.5288	0.54639	2.798*
DlogGDS	0.20137	0.057103	3.526*
DEFLU	0.016637	0.047313	0.352
DRINT	-0.092204	0.065121	-1.416
DlogREFE	-0.27174	0.14541	1.869***
DlogAID	-0.17231	0.083388	-2.066**
ECT_1	-0.47597	0.16727	-2.846*

AR 1- 2 = 1.8915 [0.1710]

ARCH 1 = 0.21724 [0.6450]

Normality = 0.055178 [0.9728]

Xi^2 = 0.49732 [0.8959]

R R^2 = 0.802695

*,** and *** indicates 1%, 5% and 10% level of significance respectively.

4.3 Discussion of both Short Run and Long Run Dynamics

The model shows the determinants of physical capital formation, which is proxied by Gross Capital Formation in Ethiopia for the period of 1970/1 to 2007/08 .Expected level of output reports significant direct long run effect on physical capital formation as well as in the short run. The long run result as depicted in equation 4.1, the coefficient 1.215 is positive and significant at 10% level. This indicates that a one percent rise in the level of expected output induces the level of physical capital creation to rise by 1.2 percent.

The positive impact of expected level of output on the level of Gross Capital Formation in Ethiopia is in line with accelerator theory of capital formation. This theory proposes if economic agents expect that in the future the level of output increases, then they tend to invest more today, which in turn enhance the level of physical capital formation.

On the other hand, the change in the level of expected output also positively explains the change in the gross capital formation in the short run at 1% level of significance.

The finding which is obtained from both short run and long run dynamics coincides with the result of recent findings in Sub Saharan African countries (Akpokdje G;2000 & Peter K. et.al. 2004).

Export revenue (EFLU) fluctuation has significant negative impact on physical capital formation as expected in the long run. In the short run, it also influences

negatively, however, it is insignificant. The elasticity coefficient indicated in equation 4.1 depicts that an upward fluctuation of 100 percent in the level of income earned form export of commodities to foreign market decreases the level of physical capital formation by 4 percent.

Export revenue fluctuation results from three sources: fluctuation in export prices, export quantities and exchange rates. Poor nations like Ethiopia, do not determine the prices of commodities at international market.

Export instability is believed to create uncertainty and reduce business confidence, which in turn adversely influences the level of physical capital creation. On the other hand, government revenue is also linked to export revenue.

Volatility in export income also influences public investment. Highly volatile export might push the government to make swift and costly fiscal changes that harm public investment.

Finally, export instability influences investment through variation in export income. The decline in export revenue creates challenges in importing essential capital equipments and raw materials that are the key requirement in the development process in a nation. It also leads to foreign exchange rate constraint.

The effect of export income fluctuation is in accordance with some of the findings obtained from some African countries such as Botswana and Cameroon (Peter.K et.al. 2004, Sunday.A.Khan, 2004).

Persistent devaluation and depreciation of the domestic currency has impacted physical capital formation negatively. This is indicated by the long run elasticity of physical capital formation with respect to real effective exchange rate (REFE) which is negative and statistically significant at 10%. The magnitude is (0.098). The same result is also manifested in the short run dynamics, where change in the level of physical capital formation is negatively influenced by variation in real effective exchange rate. The coefficient of the short run dynamics indicates that a 10 percent increase in real effective exchange rate cause the level of capital creation to decrease by 3.6 percent and it is significant at 5% level.

Persistent depreciation of local currency in terms of foreign currency induces capital equipments and other materials which are imported from foreign market to be expensive in home country and this in turn reduces the level of physical capital formation negatively. In this circumstance, countries that heavily depend on imported capital for economic growth are greatly affected adversely.
This finding is also in accordance with the result obtained from some African Countries such as Nigeria, Zimbabwe and Botswana (Akpokdje G; 2000 & Peter K. et.al. 2004).

Aid has also causes positive influence on the level of capital formation in Ethiopia in the long run though, the magnitude is small. Aid may bring positive influence on the level of growth in a country through altering production, income and consumption as a direct consequence of some projects. Aid in public projects for instance, releases resources that can be used for cuts in taxation and borrowings.

In line with the above result and investigation has been performed to find out the link between foreign aid and investment in Egypt. The result suggests a weak positive relationship between the two. Such weak relationship could likely occur as a result of tying the aid obtained from donors to politics and economic situation in the country. It is argued that aid mostly finances not the high priority investment, but more marginal investments. Thus, aid might contribute to the level of physical capital formation in a smaller magnitude (Muhammed. A. W. Mohammed, 2003)

The result obtained from Vector Error Correction is surprising, where the change in the level of aid influences the variation in physical capital formation negatively at 5% significance level.

In light with this finding, some authors have tried to use simple regression to establish the link between aid and growth, which is an indirect approach in our case. The result has been the case where no relationship has been observed between the two. Others also found that aid has significant negative impact on

the rate of saving. (Mosley, 1987; White, 1992 as cited in Arrene Biggsten and Alemayehu et.al, 2004).

On the other hand, Burnside & Dollar as cited in Arrene Biggsten (2004) found that aid significantly increases the rate of growth in good policy environment and is damaging in bad environment.

Real interest rate and gross domestic saving do not explain the long run capital formation in Ethiopia during the period of study as indicated in equation 4.1. However, the change in the level of gross domestic saving poses significant influence on change in physical capital formation in the country.

The change in gross domestic saving influences physical capital creation significantly and positively in the short run. The coefficient of elasticity indicated in table 4.10 shows that it is significant at 1% level.

The impact of gross domestic saving to the level of physical capital formation in the short run is obvious in the sense that it creates positive influence through creating capacity for enabling investor and government to engage in physical capital creation.

The result is also consistent with respect to Akpokdge G. (2000) and Peter K. et al. (2004). However, gross domestic saving does not influence physical capital formation in Ethiopia for the period of study in the long run as depicted in the long run determinants of the dependent variable.

Real Interest Rate causes negative impact on physical capital formation in the country only in the short run but it is insignificant. On the other hand, the same result is found for short run fluctuation in export earning income. In this case, the variation in export income impacts the level of physical capital formation only in the long run.

5. Conclusion and Policy Implications

This paper is an attempt to investigate the effect of export income fluctuation on physical capital formation in Ethiopia for the period which spans form 1970/1 to 2007/08 G.C. using time series econometrics.

In the study, it was found that during the last four decades, Ethiopia's economic performance did not change as expected since it continued to relay on agricultural sector. The economy performed poor as indicated in the performance of real gross domestic product.

In connection with this, the performance of Gross capital formation and Gross domestic saving is also low. This might happen due to subsistence economy in which the majority of the population is concerned only about day-to-day life and it influences the level of saving; ultimately reduce the level of physical capital creation. In addition to this, the prolonged civil war during the Derg regime has adversely contributed in less physical capital formation. The gap between the two is also widening during the period of study.

The performance of the export sector is also poor in the period. However, over the last decade export enhancement and diversification is getting wider attention. On the other hand, import is growing at an alarming rate and the gap between the two is widening. This indicates that export is not creating a good capacity for import and hence, low physical capital creation.

Before moving to the regression results, a study of the time series characteristics of the variables was carried out. Unit root test was conducted using ADF and PP tests. Accordingly, the result indicates that all the variables of interest are integrated of order one.

Cointegration test was conducted and the result shows the hypothesis of no cointegration was rejected at 5% level of significance and the existence of one cointegrating vector was supported.

Following the result of the cointegration test, test of weak exogeneity and significance of the variables in influencing the physical capital formation in the long run was performed. Finally, the Vector Error Correcton Model (VECM) was formulated in order to analyze the short run dynamics in identifying the variables that explain changes in the level of physical capital.

The econometric result depicts that expected level of output has positive and significant influence on the level of physical capital formation both in the short run and long run.

The result also shows that aid has positive influence on physical capital formation in the long run, though the magnitude is very small. However, the result obtained from the short run dynamics is surprising, where the level of aid has negative influence on capital formation.

The main focus of the study was to find the effect of export income fluctuation on physical capital formation in Ethiopia during the period of study. Accordingly, the test result indicates that export income variation has a negative effect on capital formation in the long run. On the other hand, the former has no impact on the latter in the short run dynamics.

The other variable of interest was real effective exchange rate. It's impact was found to be negative on physical capital formation both in the long run as well as the short run.

The rate of saving was found to be positive and significant in influencing the rate of physical capital formation in the country, but the result did not support long run influence of the former on the latter. The effect of real interest rate on the dependent variable was found to be insignificant both in the short run as well as the long run.

The study indicated strong link between expected levels of output both in the long run and short run. Thus, the policy of the government should be geared towards improving that level of real output. Participation of private sector in the economy and encouraging market oriented economic system needs to get further attention.

Gross domestic saving was found to influence capital formation in the short run. Based on this result, it is also crucial in giving attention to it. Promotion of

private and individual saving is essential. The government should give more attention in policy that formulates channels which suit small savings. Saving at firm level should also be encouraged.

The government can also play essential role in expanding the base of saving through taxation and inclusion of the informal sector. It must appropriately channel domestic saving in to productive investment activities.

On the other hand, encouraging capital inflows in to the country through FDI is helpful mainly to bridge the gap between the gross capital formation and gross domestic savings. In line with this, creation of conducive political system and macro economy in order to tap foreign saving is important.

The result of the regression shows that fluctuation in export adversely impacts long run physical capital formation. Expanding of the base of export is essential to diversify it from primary products. In addition to this, emphasis must be given for transforming the economy in to production of industrial outputs. Through this activity, the nation can reduce over reliance on few primary products. Expansion to foreign trade participation is fundamental in promoting and creating competitive environment for product exported in to foreign market.
The government should also emphasize in regulating terms of trade, which can occur through adopting suitable measure by which exports can be profitably

used for importing capital goods. Moreover, undertaking further market liberalization and trade are necessary.

The government should pay necessary attention when devaluing and depreciating the domestic currency, especially during the time when the terms of trade are deteriorating. It must be the case that the government needs to see the impact of devaluation on the level of export and import, if devaluation encourages export performance than the damage it causes to restriction of import, then it can be perused. However, if the opposite materializes, devaluation brings damaging effect to the economy.

The final recommendation forwarded is the use of aid in productive investments by the recipient nations. On top of this, the donors should follow the direction of the countries interest if it is found to be productive.

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Declaration

I, the undersigned, declare that this project is my original work and has not been presented for degree in any other university, and that all sources of materials used for it have been properly acknowledged.

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June, 2009