

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

**THE IMPACT OF FOREIGN AID ON ECONOMIC
GROWTH IN ETHIOPIA: ACCOUNTING FOR
TRANSMISSION MECHANISMS**

BY

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DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sorts of materials used for this thesis have been duly acknowledged.

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LIST OF ABRIVATIONS

| |
|---|
| ADF - Augmented Dickey Fuller test |
| AIC - Akaike information criteria |
| DAC - Development assistance committee |
| ECM - Error Correction Model |
| HIPC - Heavily indebted poor countries |
| HQ - Hannan-Quinn statistics |
| LDCs - Less developed countries |
| IMF – International monetary fund |
| MEDAC- Ministry of economic development and cooperation |
| MoFED- Ministry of finance and economic development |
| NBE- National Bank of Ethiopia |
| ODA- Official development assistance |
| OLS- Ordinary least square |
| SB- Schwartz-Bayesian criteria |
| UNDP- United nations development program |
| VAR - Vector Autoregressive |
| WB - World Bank |

ABSTRACT

Developing countries in general and Ethiopia in particular has been experiencing huge amount of saving gap, trade gap and fiscal gap for more than four decades. Consequently, there has been a significant net inflow of official development assistance (foreign aid). Therefore, the main objective of the study is to examine the impact of foreign aid on economic growth and the transmission mechanisms (i.e. investment, import and government consumption expenditure) of Ethiopia using Johansson maximum likelihood approach over the period of 1970/1 to 2008/9.

The co integration test result indicates the existence of long run relationship among the variables entered in all models. In the long run foreign aid has a positive and significant impact on growth through its significant contribution to investment and import. However, the dynamic short run model points out that aid to have a significant impact on growth it has to be assisted by good monetary, fiscal and trade policy. In addition, in the short run aid has significant impact on government consumption expenditure, which confirms the existence of aid fungibility. The study also confirms the existence of debt overhang problem in the Ethiopian economy. Generally, the theoretical view of the gap models is proven in this study. Aid can enhance growth by financing the three gaps. However to mitigate the problems with aid fungibility and debt overhang problem, foreign aid has to be linked to a good policy framework.

CHAPTER I: INTRODUCTION

1.1. Background of the study

Official development assistance, in the form of foreign aid or unilateral capital transfers, represents an important channel through which resource is transferred from rich, developed nations to poorer, underdeveloped economies. The transfer of external resources enables the recipient country to raise the level of investment and to increase the supply of commodities that cannot domestically produced.

The beginning of foreign aid traces back to the 1940s marshal plan in which its purpose was to reconstruct the war- torn economy of Western Europe (Todaro, 1994). However, from that time on developing countries have been increasingly receiving foreign aid from multilateral and bilateral sources, which had two objectives. The first objective was to promote long term growth and poverty reduction in developing countries. The second one was to promote short-term political and strategic interests of donor countries (WB 1998) as stated by Jafir (2002).

The amount of foreign financial assistance that is given to the developing countries in general and for African countries in particular has been increasing from time to time. In Africa, the share of Official Development Assistance (ODA) to GDP has significantly increased over the years. It drastically increased from 1.9 percent in 1960-61 periods to 2.9 percent in 1970-71 and to 5 percent in 1983-84 and reached 9.6 percent in 1990-91 periods (WB 1992). And also, the share of foreign aid to GDP has also increased to 18 percent during 2000-2010 fiscal years.

In Ethiopian case, the high import intensity of the economy, limited capacity to produce capital goods, low levels of domestic savings and limited capacity to generate foreign exchange make the development effort in Ethiopian beyond domestic capacity. All these factors have provided an apparently objective justification for the huge inflow of foreign aid. Consequently, foreign aid has been playing a critical role in the development efforts of Ethiopia since the 1950s. During the third five-year plan period (1957-1973), 25 percent of the required total investment was covered by external public capital. It was often argued that the direction of foreign aid was characterized by negligible long run objectives, in favor of infrastructure services compared to direct investment activities for agriculture and industry sectors. Similarly, during the post revolution period, 37 percent of the total annual campaign of 1979-83 was financed by foreign aid (Tolessa, 2001). Although, these share of foreign aid on total investment has increased to 83.3 percent in 2000/01-2008/09 (Getnet, 2010).

Despite such increase flow of external finance to the African countries a number of empirical studies argue that the role of aid in promoting the development potential of Africa remained unsuccessful. For instance, between 1970 and 1997, the real per capital GDP of Sub Sahara Africa has been 0.6%, despite huge flow of aid to the region (Gomanee et al, 2001).

Generally, a number of studies have been conducted on the impact of foreign aid in LDC's. Nevertheless, these studies do not provide clear-cut conclusions. Different time series and cross-country investigations have come up with different results and different policy implications. Most of these cross sectional analysis suggest that the growth impacts of foreign assistance vary among countries that pointed out the need for empirical study for individual countries.

1.2. Statement of the problem

It is a fact that developing countries in general and African countries in particular experience a slow or negative economic growth. Ethiopia is one of such countries which have been experiencing a slow growth for the past sixth decades. Even its growth rate is far below than those that are described by the World Bank (2006).

In addition to its dependency on the rain feed agriculture, the economy of the country is known for its low level of domestic saving which is insufficient to finance the investment level that is prevailed in the country. This gap is increased from 15.5 percent of GDP in 1992-2000 to 18.8 percent in 2005-2009 (MoFED).

High level of budget deficit has been also one of the characteristics of the Ethiopian macro economy. Regardless of the government's high expenditure in developmental projects, the revenue that it gets is insufficient to finance such spending. This created a gap between the two variables. According to Getnet (2010), based on MoFEDs data, this gap has increased from 3.1 percent in 1990-2005 to 7.24 percent of the country's GDP in 2005-2009.

Similarly, the external trade performance of Ethiopia remained weak. The export sector, dominated by few agricultural commodities, suffered from weather fluctuation and price instabilities in the international market. On the other hand, the dependency on imported goods continued to be substantial. Thus the external trade sector recorded an increase in the trade gap; it is increased from 10.1 percent in 1992-2000 to 19.7 percent of the country's GDP in 2005-2009. (MoFED, 2010)

According to Abeba (2002) lack of capital is one of the main problem for the sluggish growth of the country's economy. Perhaps capital is believed to be the major scarce factor in developing countries in general and in Ethiopia in particular. Thus, capital formation in those economies is important to increase production and productivity. Basically, capital formation is determined by the saving rate but developing economies have faced by low level of income and hence low level of saving rate. Therefore, this low level of saving rate and the required rise in capital stock (or investment) create a resource gap. To fill this gap, least developed countries have looked for resource inflows or foreign assistance.

External financial assistance (foreign aid) is believed to be the way to the growth for such developing countries. According to Bacha (1990), one of the way to finance such resource gaps in the developing countries in general and in Ethiopia is through external financial assistance (foreign aid). However there is high debate on foreign aid and that its impact on the growth of the country.

Actually, a few studies have been conducted on the impact foreign aid in Ethiopia. Nevertheless, there is no recent study conducted on aid effectiveness through financing the three constraints of growth of the country's economy. Thus, this paper attempts to examine the growth impacts of official development assistance through financing investment, import requirement and government consumption expenditure.

1.3. Objectives of the study

The main objective of this paper is to show the effectiveness of foreign aid in enhancing economic growth accounting for the three transmission mechanisms.

Specific objective of the study:

- i. Identify whether foreign aid has an impact on the so called transmission mechanisms (on investment, import and government expenditure)
- ii. Show the impact of foreign aid on economic growth through such transmission mechanisms.
- iii. Show whether foreign aid effectiveness is policy dependent or not.
- iv. Give concluding remarks and policy projection for the sustainable development of the country which is based on the foreign aid.

1.4. Data and methodology

For the purpose of analyzing the impact of foreign aid on the economic growth through its transmission mechanism, secondary data source, from 1970/01 to 2008/9, is used. The major data sources for the problem under investigation are publications of National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED) and Central statistics Authority (CSA) of Ethiopia. Besides, IMF CD-ROM and WB CD-ROM were used. In this study four models have specified and estimated by using Vector Autoregressive (VAR) model.

1.5. Hypothesis of the study

Based on empirical literature on the relationship between aid and economic growth in developing countries, the writer propose the following relationships to hold true in our analysis.

- a) There is a positive and significant impact of foreign aid on Growth, investment, import and Government consumption expenditure in the long run.
- b) There is positive and insignificant contribution of Foreign aid on the economic growth of the nations in the short run.
- c) There is a significant and positive impact of aid on government consumption expenditure in the short run.
- d) There is a positive and significant impact of foreign aid on Growth in the short run when it is assisted by good policy.

1.6. Significance of the study

The literature on the impact of aid on economic growth are mainly in the cross sectional analysis of developing countries. Particularly, in Ethiopian case, the number of studies conducted so far is limited in number and scope, in which further study is required. Additionally aid effectiveness based on its impact on the transmission mechanism is also limited in the country level. Therefore this study will help in filling knowledge gap in such area.

As commonly known aid is a back bone of the Ethiopian economy, therefore the expected outcome from this study could also be useful in improving policy design, institutional setup, implementation, monitoring and evaluation of foreign aid.

1.7. Scope and limitation of the study

The study would assess all the transmission mechanisms through which aid affects economic growth. To achieve this objective, the time series data ranging from 1970/1 to 2008/9 is used. Since data was available for all the variables, except capital flight, involved in the model, the whole period is chosen.

Although this study attempts to investigate the impact of Foreign aid on economic growth and Transmission mechanisms it suffers from some limitations. One of the main problems in this study has been the inconsistent of data by different institutions. Even data arises from the annual reports of the National bank of Ethiopia shows different figures for the same year. Additionally, because of lack of data, it has been unable to use long period sample size for the study.

1.8. Organization of the Paper

The paper is structured as follows. The following section (section two) summarizes in brief the macroeconomic performance of Ethiopia. Literatures regarding the aid and growth relationship are reviewed in section three of the paper. Section four discusses the model and methodology whereas section five presents estimation results. Finally section six concludes and provides policy recommendations.

CHAPTER II: MACROECONOMIC PERFORMANCE OF ETHIOPIA

Ethiopia is one of the poorest countries which have been experiencing a slow economic growth for the last six decades. In different World Bank reports, it is located in the lowest rank on per capita basis (Befekadu and Birhanu, 2000). For example, in the year 2008/09 the per capita income of the nation was USD 318.7 which was low as compared to the average per capita income of the whole SSA. (OECD)

The Ethiopian economy is predominantly dependent on agriculture whose performance depends on the unpredictable weather. Apart from its dependency on the agricultural output the external performance of a country is dominated on few products like coffee, skins, hides and chat. In addition to this, recurrent drought and famine together with poor policies and civil war have made it impossible to bring about structural change of the country for the last three regimes.

2.1. Real GDP growth and its sector contribution

Table 2.1 GDP growth and its sector contribution

| Macro variable | 1960/1-1973/4 | 1974/5-1990/1 | 1991/2-2008/9 | Average |
|------------------------|---------------|---------------|---------------|---------|
| Growth rate of GDP | 2.7 | 1.7 | 8.04 | 4.1 |
| -share of Agriculture | 60.8 | 52.4 | 46.3 | 53.2 |
| -share of industry | 13.3 | 13 | 13.1 | 13.1 |
| -share of service | 25.9 | 34.6 | 41.3 | 33.9 |
| Growth rate of PC GDP | 0.07 | -1.2 | 7.4 | 2.1 |
| Population growth rate | 2.6 | 2.9 | 2.1 | 2.6 |

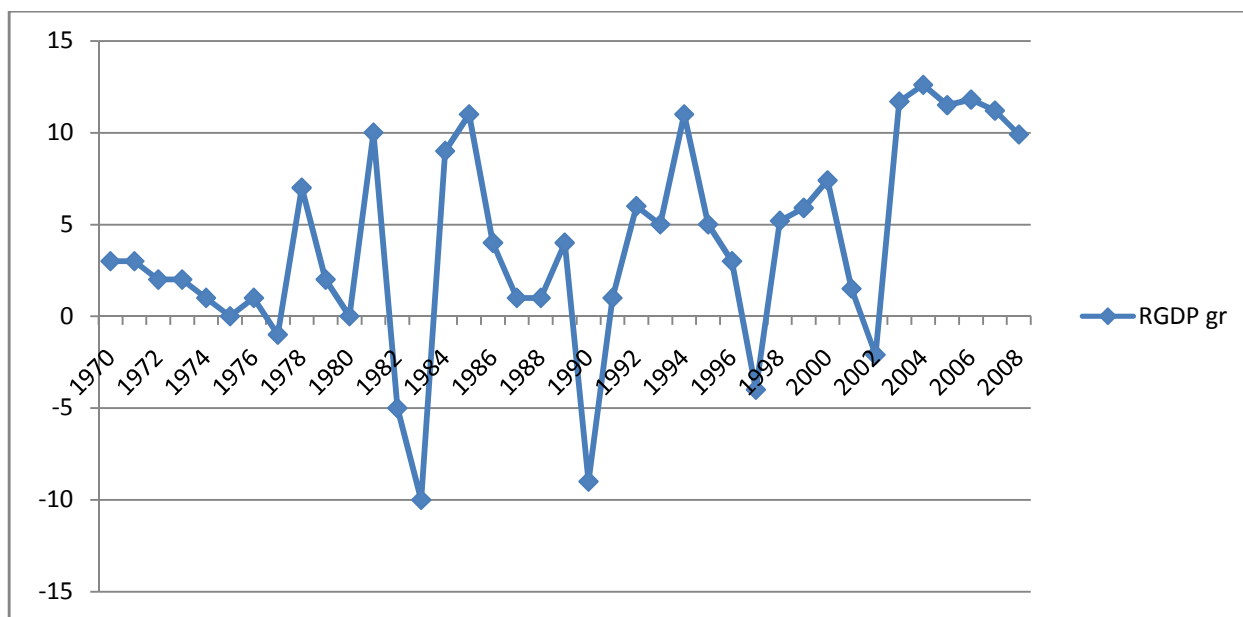
Source: Authors computation from MoFED data

From the above table, we can see that for the past four decades the Ethiopian economy has been increasing at an average annual growth rate of 4.1% while the population has been growing at annual average growth rate of 2.6 percent.

During the imperial regime (1960/1-1973/4) the economy and population of Ethiopia had been growing at 2.7 and 2.6 percent, however the average annual growth rate of GDP falls to 1.7 and population increases to 2.9 due to the civil war that was existed in the Derg regime. As a result during the military regime the country had a negative growth rate of per capita GDP.

In the post 1991 period the Ethiopian economy showed a relatively good performance. On average, the Ethiopian economy had been growing at 8 percent and per capita GDP had been growing at 7 percent. This high growth rate of Ethiopia is broad based and put the country among the top performing economies in Africa.

Figure 1 *growth rate of real GDP*



Source: MoFED

It is a fact that the Ethiopian economy is predominantly dependent upon agriculture, which is based on back ward technique of production. This can be shown from table 2.1 that agriculture

contributes a lion share in real GDP of the county in all three regimes. The share of agriculture, on average, was 53.2 percent, which is larger than the share of service and industry.

Even if the agricultural sector contributes the majority for RGDP of a country, its contribution had been reducing. During the fourteen year of the imperial regime, on average, the agricultural sector composed 67.7 percent of GDP. While the industrial and service sectors contributed 9.28 and 23.02 percent of GDP respectively. However, the share of the agricultural sector had been reduced to 52.4 and 46.3 percent during the Derg and the EPRDF government. In the contemporary, the share of the industrial and the service sector increases steadily in the three regimes.

In general, the overall economic growth of a country was highly dictated by the performance of the agricultural sector. However, of recently, the role of service sector in contributing to the growth of real GDP was significant.

2.2. Saving and investment in Ethiopia

It is well known that physical capital formation (investment) is significant determinant of economic growth in developing countries. Investment can be financed from different sources. The main source is gross domestic saving and the gap can be obtained from external debt, foreign aid and foreign direct investment. The trend of the gross domestic saving as a ratio of GDP and investment as a percentage of GDP is summarized in the following figure for the three regimes,

Table 2.2 saving and investment in Ethiopia

| Variable | 1960/1-1973/4 | 1974/5-1990/1 | 1991/2-2008/9 | Average |
|------------|---------------|---------------|---------------|---------|
| Saving | 17.7 | 7.3 | 5.4 | 10.1 |
| investment | 14.7 | 13.2 | 15.1 | 14.3 |
| Saving gap | -3 | 5.9 | 9.7 | 4.2 |

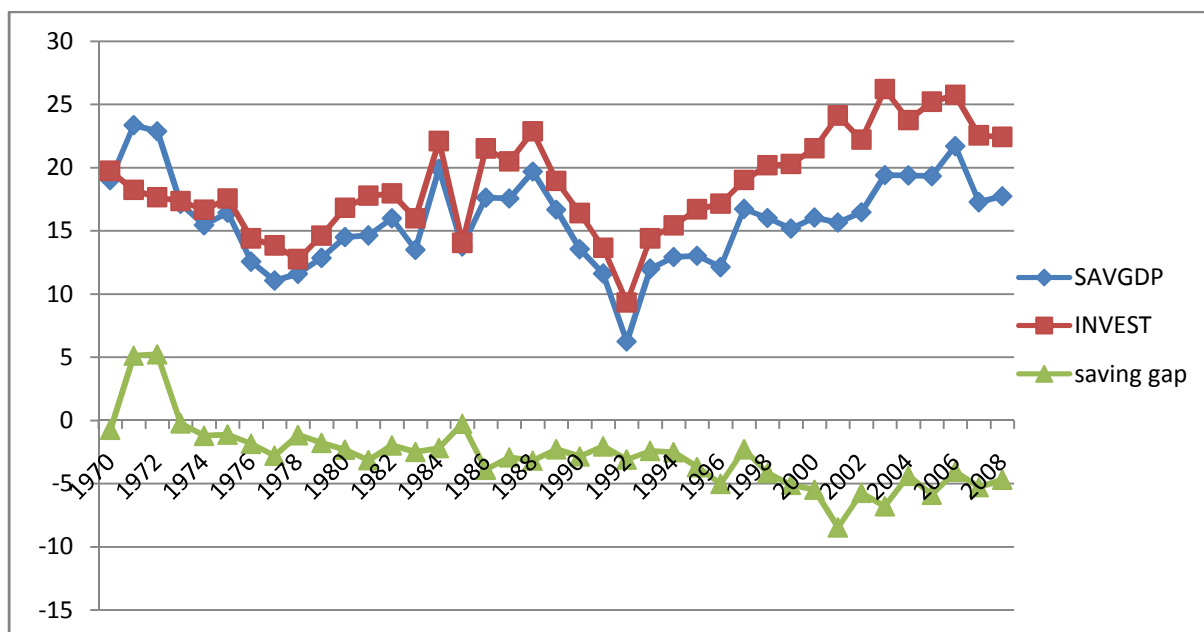
Source: Authors computation from MoFED data

For the period under consideration, GDS constitute on average 10.1 percent of GDP of a country. The performance of investment shows that between 1960/1 and 2008/9 its share in GDP had been 14.3 percent, which results in the average saving gap of 4.2 percent during the entire period.

During the imperial period gross domestic more or less covered domestic investment. During this period gross domestic saving on average constitute about 17.7 % of GDP while investment contributes on average about 14.7% of GDP.

Since 1974/5, saving to GDP ratio showed a tremendous fluctuation but remained significantly lower than the amount recorded in the imperial period. On average, gross domestic saving and gross fixed investment as a percentage of GDP for the DERG regime was 7.3 and 13.2 percent, respectively. This implies there was a great saving gap during this era.

Figure 2 Saving investment and saving gap



Source: MoFED

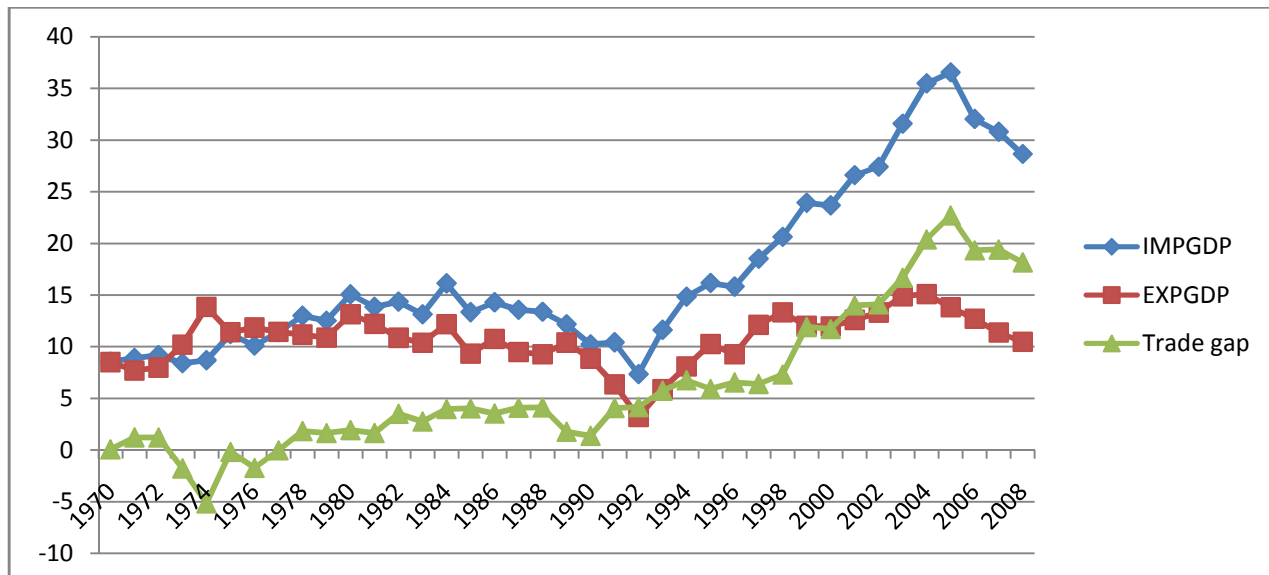
As shown in the figure about the saving gap has been increasing also with fluctuation during the EPDRF period. During this period, on average, GDS and investment as a ratio of GDP registered 5.4 and 15.1 percent respectively with the gap of 9.7 percent of GDP. From this we can conclude how the importance of external financing method.

2.3. Import, export and Trade gap

Import is a basic element in the growth and development process of developing countries in general and Ethiopia in particular. Capital goods and intermediate goods which are the engines of growth come from outside world through import.

Although import is important, export is useful since it provides foreign exchange which is required to pay for the imported goods. However the export of the country is predominantly dependent on few agricultural commodities with low and uncertain price elasticity of income.

Figure 3 Import, export and trade gap



Source: MoFED

From the above figure the external balance of Ethiopia has been negative for the last three regimes except the last two years of the imperial era. In the period 1960/1 – 1973/4 the trade balance, on average, recorded a deficit of about 0.99 percent of GDP. It rises to about 5.8 and 10.1 percent of GDP per annum during the Derg and EPRDF period respectively.

The reason for this high level of deficit is a high level of import accompanied with stagnant export earnings, the decline in international primary commodity price, significant devaluation that increases the local currency of import.

2.4. Revenue and expenditure and the fiscal gap

The developing economy is characterized by underdeveloped physical and social infrastructure, low level of saving and investment. This situation justifies an active participation of the government in the economy. However the performance of Ethiopia in this regard showed a substantial gap between revenue and expenditure variable which highlighted the importance of

foreign finance in bridging the gap. The following table depicts the revenue and expenditure performance of the country,

Table 2.3 revenue, expenditure and fiscal gap

| variables | | Imperial era | Derg regime | EPRDF | average |
|-------------|-----------------|--------------|-------------|-------|---------|
| revenue | %age of GDP | 9.6 | 11.3 | 13.8 | 11.5 |
| | Tax share | 72.5 | 66 | 60 | 66.2 |
| | Non tax share | 11.9 | 21.7 | 24 | 19.2 |
| | grant | 15.6 | 12.7 | 16 | 14.8 |
| expenditure | % of GDP | 11.9 | 16.6 | 18.4 | 15.9 |
| | recurrent | 80.4 | 73.4 | 67.7 | 73.8 |
| | capital | 19.6 | 26.6 | 32.3 | 26.2 |
| Deficit/GDP | Excluding grant | 2.3 | 5.3 | 4.6 | 4.1 |

Source: Authors computation from MoFED and NBE data

From the above table, for the period viewed tax was a major source of revenue in Ethiopia, on average, tax revenue, composed of 66.2 percent of the total revenue collected however the share of tax revenue reduces over time. In the imperial regime, its contribution to the allover revenue was 72.5; however this contribution reduces gradually to 66 and 60 in the Derg and post Derg regimes respectively.

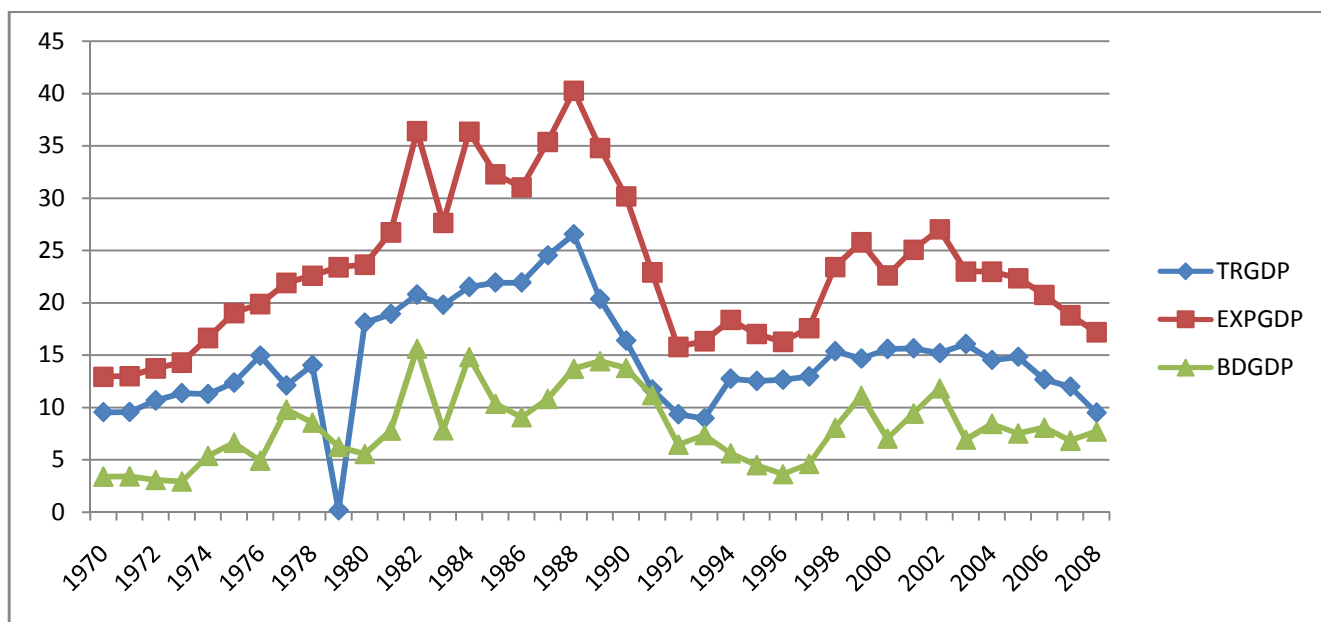
The contribution of Non- tax revenue, that composed mainly of charges and fees, sales of goods and services, residual surplus and investment income, sales of movable property and repayment of loans, has been however increasing for the last three regimes . For instance the contribution of non tax revenue in the imperial regime was 11.9 percent however this amount is increased to 21.7 percent in the Derg and 24 percent in the post Derg regime.

The government spends the revenue that collected from non tax and tax in different recurrent and capital expenditures. The table above depicts that, most of the revenue collected has been used in

the recurrent expenditure in the three regimes; however the amount has been reducing. In the Imperial period 80.4 percent of the total revenue had been spend in the recurrent expenditure, in the Derg and the post Derg regimes 73.4 and 67.7 percent was spend in the recurrent account. Despite of the recurrent share, the share of capital expenditure has been increasing from 19.6 percent in the imperial period to 26.6 percent in the Derg and 32.3 percent in the post Derg period.

Generally, as shown from the following table, the increasing gap (in absolute terms) between the level of expenditure and revenue indicates the importance of our huge reliance to foreign finances.

Figure 4 Revenue, expenditure and fiscal gap of Ethiopia



Source: NBE

2.5. Foreign aid performance of Ethiopia

Development aid is a means of resource transfer to poor countries in the form of technical assistance, total grant and loans with concessional terms (Befekadu and Birhanu, 2001). There are a number of reasons to highlight the importance of development aid to Ethiopia. Among other uses, development assistance is instrumental in financing deficit, bridging the gap between import and export, and expanding the level of investment beyond domestic capacity.

Table 2.4 performance of Aid in Ethiopia

| Variables | 1960/1-1973/4 | 1974/5-1990/1 | 1991/2-2008/9 | Average |
|---------------------|---------------|---------------|---------------|---------|
| Growth of ODA | 13.9 | 18.2 | 21.14 | 17.8 |
| Share of ODA to GDP | 2.3 | 7.13 | 12.42 | 7.3 |

Source: MoFED

Official development assistance has been increasing over time. During the thirteen year considered in the imperial period, foreign assistance grew slowly with an average annual rate of 13.9 percent however it started to grow sharply since 1978/9. In 1970/71, foreign aid receipts were about 1.95 percent of GDP and after a decade this share increased to 4.5 percent. Generally, the share official development assistance to GDP has been increasing for the period considered with an average growth rate of 17.8 percent.

In terms of composition, official development assistance to Ethiopia has two components: foreign grants and loans. During the period 1974/75-1990/91, the volume of aid was 11,185 million Birr from which grants constituted 48.1 percent (5375.5 million Birr) and loans amounted to 5,809.6 million Birr (51.9 percent). Thus, grants and loans had almost equal share during the Derg regime. The volume of aid has increased to 20,182.9 million Birr during the period 1991/92-1999/00. In this period, more than fifty percent of the total aid flows is

contributed by grant. The composition of ODA in terms of sources reveals that about 70 percent of aggregate foreign aid flows were from bilateral. Since 1991/92, the share of bilateral sources declined. For instance, in 1995/96 from the total aid comes to the country 99.8 percent was from multilateral agencies and only 0.2 percent comes from bilateral sources.

CHAPTER III: LITERATURE REVIEW

3.1. Theoretical view of foreign aid

3.1.1. Definition and classification of foreign aid

Foreign aid is a bilateral, multilateral, concessional and non concessional resource transfer between countries. It is, according to OECD, financial, technical assistance, and commodity transfer that are designed to promote economic development and welfare as their main objective. Foreign aids are mostly provided as either grants or subsidized loans.

According to them, as stated by Tsegay (2008), it is only if it has a grant element of 25% that loan will be considered as foreign aid. This means the present value of the loan must be at least 25% below the present value of a comparable loan at the conventional 10% interest rate.

Mathematically the grant element (GE) of a given loan can be calculated as:

$$GE = \left(1 - \frac{\int_0^T P_t e^{-rt} dt}{L} \right) * 100 \dots\dots\dots (3.1)$$

Where L is loan, P_t is the annual payment, r is the discount rate (conventionally set as 10%), T>1 is the maturity. In short it is the difference between the nominal value (face value) of the loan and the sum of the discounted future debt service payment (net present value) to be made by the borrower, expressed as a percentage of the face value of the loan. Such definition of foreign aid

does not include military assistance, trade and investment financing, funding for promoting cultural exchange and loans at market interest rates.

Based on different criteria's, many classifications can be considered for foreign aid. Based on the direction of foreign aid flow, OECD classified foreign aid into three. The first one is official development assistance (ODA), which is the largest and consists of aid flow to low and middle income countries by donor country. Another category of aid, which is provided for richer countries with per capita income higher than \$9000, is known as official assistance. The third category is private voluntary assistance that includes grant from non-governmental organizations (i.e. religious groups, charities, foundation and private companies for development and welfare purpose).

Bilateral and multi lateral aid is another classification of foreign aid based on how it is transferred. Bilateral aid is aid that is directly transferred from one country to the other. However multilateral aid is an aid which is provided through intermediate organizations such as IMF, WB and various UN organizations.

Based on the degree of freedom in which the receiving country has on the use of aid resources, aid can be referred to as Tied and untied. If donor country sets restriction in the use of aid, i.e. use of it for purchasing only its goods and services, specific investment project such as public infrastructure projects, it is a tied kind of aid. However if the receiving country have a complete freedom on for what purpose to use the aid then the aid becomes untied.

Another classification of aid which is provided by OECD is its distinction between program and project aid. Aid resources provided for specific capital investment such as infrastructure and

production sector are project aid. This category of aid was dominant in the 1950s and 1970s. Program aid refers to overall budget and balance of payment support such as financing of import aiming at macroeconomic stabilization and adjustment.

3.1.2. Why foreign aid?

Foreign Aid is a one means in which resource is transferred from developed countries government and international institution to developing countries for different purposes. The beginning of this foreign aid traces back to the 1940s and 1950s 'Marshall Plan' in which the western economy gave financial assistance for the war ridden economy of Eastern Europe after savior devastation in Second World War.

Following this Marshall plan, however the direction of the flow of foreign aid changed from these countries to less developed ones. The success story of development aid given to Western Europe in the 1940s and 1950s led many institutions to believe that similar transfer to developing countries would permit them a comparably similar transformation (Krueger 1986). Consequently, developing countries continues to receive increasing amount of development aid from various bilateral and multilateral sources from time to time.

Even if the amount of aid flow to the developing countries increases from time to time there is one question that must be answered "why do donors give aid? Or what determines aid inflow? Different literatures have been giving different arguments for this question. The two main arguments are economic and geo-political motivation and humanitarian and development motivations.

3.1.2.1. Economic and geo-political motivation

Most studies suggest that the main motivation for foreign aid is for donor countries strategic, market and economic purpose. Todaro (1994) suggested that political motivation have been the more important factor especially for the major donor country, the United States. From the very beginning in the late 1940s under the Marshall plan, United States has viewed foreign aid as a means of curtailing the international spread of communism. When the balance of cold war interests shifted from Europe to the third world in the mid 1950's, the U.S aid program made a shift towards giving economic, political and military support for 'friendly' and geographically strategic less developed nations.

Opeskin (1996) explains the national self-interest as one of the important motivations of foreign assistance in three different forms. First, rendering of financial assistance to poorer states that share similar political values may encourage the spread of an ideology that is attractive to donor states. Second, aid may enhance demand for the donor states products by stimulating the recipient state's economic growth. Third, maintenance of social and economic stability in poorer countries may serve the interest of wealthier states, which would otherwise have to shoulder the burden of an unwanted influx of refugees. Mosley et al (1987) also suggested that bilateral aid is mostly used to increase export and buy political support from the donor country. They also identified three universal reasons for aid. These are, redistributive (governed by responsibility for the poor), allocative (since capital market is imperfect) and stabilization (to augment world aggregate demand and reduce unemployment). Bauer and Yamey (1982) claimed that 'foreign aid is the source of North-South confrontation, not its solution. The pervasive consequence of aid has been to promote or exacerbate the politicization of life in aid-receiving countries' [cited in Meir, 1995]

3.1.2.2. Humanitarian and development motivation

Even if much of the aid given to the developing country is for donor country's good, some literatures argued that there are also some aids which have developmental and humanitarian intentions.

According to Ali et al (2003) the purpose of foreign aid is diplomatic, commercial, cultural and developmental. It is typically used to fund expenditures for the purpose of facilitating development in the receiving country. In most cases, aid has been used to finance discrete investment projects such as building of road, building of schools, providing training and education, family planning and so on. Resource flows to these projects is in the form of concessionary loans and grants which is known as Official Development Assistance as quoted in Jifar (1999).

Todaro (1994) argued that some development assistance may be motivated by moral and humanitarian desires to assist the less fortunate (i.e. emergency food relief) programs, but there is no historical evidence to suggest that over longer periods of time, donor nations assist others without expecting some corresponding benefits (political, economic, Military, etc) in return.

3.1.3. The gap models and debates on the impact of aid

As aid in developing countries expanded, its impact on recipient countries becomes a central issue and the concept of aid dependency emerged. There has been a great deal of debate on the impact of aid on economic growth of the developing countries. There are two theoretical approaches that are used to test the impact of aid: the gap models (conventional view) and the usual way (modern view).

3.1.3.1. The planning approach (The gap models)

The gap model has been the most widely used tool in the determination of the foreign capital and foreign assistance requirements of the less developed countries started from the 1940s. Gap analysis is based on the recognition of the importance of physical capital to economic growth and, therefore, is mainly related to the study of the gap between resources required to undertake certain level of investment in capital goods compatible with a given rate of growth and resources available to finance it.

The gap models had in common the Harrod-Domar tradition of stressing physical capital formation as the central driving force of economic growth. In the Harrod-Domar growth model output depends upon the investment rate, and on the productivity of that investment. Investment is financed by saving, and in an open economy total saving equals the sum of domestic saving and foreign saving (Hjertholm et al, 1998).

Chenery and Strout (1966) were the first to derive the gap model by identifying and combining two gaps (i.e. saving gap and foreign exchange gap). According to them the saving gap is determined as follows: via a fixed capital output ratio (ICOR), the level of required investment in capital goods is derived from a target growth. Next, domestic savings are estimated. A savings gap is said to arise if domestic savings alone are insufficient to finance the investment required to attain a target rate of growth (e.g. Rosenstein and Rodan 1961). This gap is, therefore expected to be filled by external capital inflow.

In addition to the savings gap there is also a trade gap, which is based on the further assumption that not all investment goods can be produced domestically. Hence a certain level of imports is required to attain desired investment (i.e. once again the investment required to achieve the

target growth rate). If exports are not sufficient to cover the whole bill the availability of foreign exchange (forex) to purchase imported capital goods (rather than the supply of domestic savings) may become the binding constraint on growth. Hence, there is binding trade gap, also called the foreign exchange (forex) gap. Once again a distinction is made between the ex ante trade gap (the difference between desired imports and exports) and the ex post gap (the difference between actual imports and exports). According to Hjertholm et al (1998) foreign aid (foreign capital inflow) is the source of foreign exchange, which can be used to fill this gap and expand the capacity to import.

Critics of the approach argue that this difference between ex ante and ex post could only emerge if markets were suppressed through fixed exchange rates regime: if exchange rates are flexible then there can be no gap. But this argument misses the point that the gap has to be defined with reference to a target growth rate, in which case a gap may be present even if there markets are liberalized (though the “gap” may be less if controls held back exports). The trade gap formed the basis of work carried out by the UN in the 1950s (and was sometimes called the Prebisch gap) (Hjertholm et al, 1998).

According to Chenery and Strout(1966), growth will be constrained by the larger of the two ex ante gaps. The most binding is the relevant one in the sense that once this gap is filled the other will automatically be overfilled. If aid is insufficient to fill the larger of these gaps the desired growth rate cannot be attained. That is, the gaps are not additive: aid can simultaneously fill both gaps (by paying for imported capital equipment a single aid dollar relaxes both saving and foreign exchange constraint). Rosenstein and Rodan (1961) also derived the two gap model with the same path as Chenery and strout(1966) with a slight modification.

Chenery and Strout's (1966) two gap model gave further economic argument for aid. They posited that there were three stages of transition leading developing economies to self-sustaining status. In each of these stages foreign aid flows were given an exalted role in fulfilling the requirement of the economy's transition. During the first phase, aid was required to bridge the gap between incremental investment and incremental domestic savings. In the second phase, although overall investment and savings had increased, the saving rate was still below the investment rate, hence aid is still required. During the third phase of transition, in the absence of adequate foreign exchange earnings, the economy required aid to finance imports that the domestic economy does not have the capacity to finance as cited by Hjertholm et al, 1998.

There have been recent concerns over the third gap, i.e. fiscal gap, between government revenue and expenditures, which is illustrated by the three-gap models of Bacha (1990) and Tylor(1991, 1993). Although the fiscal gap is a subset of the savings gap, the former may be the binding constraint if there is some limit on public spending (say, through a borrowing target) and private investment is linked to public investment through a crowding in (or out) relationship.

Despite the traditional two-gap model, which sees imports as aiding capital accumulation, more recent statements of the three-gap model reflect the fact that output may be constrained by low capacity utilization due to lack of spares and intermediate goods rather than lack of investments (e.g. Nalo 1993 and the country studies in Taylor 1993). So import has a direct impact on growth.

Capacity utilization, the extent to which new and existing productive capacities are utilized, has been found to be of major importance for growth in developing countries (Hjertholm et al, 1998). According to them the impact of foreign aid (foreign assistance) in closing the fiscal gap

is very large, particularly in aid dependence countries. Even if increasing the level of tax revenue is helpful, it takes a long time and needs to be carefully balanced with the objective of encouraging economic growth. Therefore, aid has a major role to play.

An important aspect of the fiscal gap also relates to capacity utilization through government spending on infrastructure, education, and health services. These efforts to increase capacity utilization may be hindered when government resources for investment and imports are insufficient, as a result of large public debt service. Indeed, evidence is available suggesting that government expenditure in the Sub-Saharan African region has been curtailed by foreign debt service (Hjertholm et al, 1998). The closing of this gap could thus be facilitated by external resources directed to the government budget.

In addition to Bacha's three gap model, Nalo (1993), Ndulu (1991), and Taylor (1993) stated that output may be constrained by low capacity utilization due to lack of spares and intermediate goods rather than lack of investments. These models thus disaggregated imports, so that import composition matters as well as the level of imports.

Chenery and Strout(1966), also raised the possibility of skill gaps at the early stage of development, whereby a lack of technical expertise would constrain the level of investment which could be attained. In recent years a number of other gaps have been identified, such as the technology gap, the food gap, the gender gap and the environment gap (Hjertholm et al, 1998).

In general, the gap models predicted that official development assistance (external assistance) has a positive impact on economic growth by supplementing domestic savings, export earnings and government revenue and helping closing the gap. Even though this gap models show how

aid affect growth through its transmission mechanism (investment, import and fiscal behavior), they does not have a model that clearly show the specific impact of foreign aid on economic growth.

3.1.3.2. Recent views of foreign aid and government fiscal behavior

The impact of foreign aid on economic growth of the least developed countries has attracted considerable attention since the mid 1950s. Rostow (1997), as stated by Wondwossen (2003), argued that aid is necessary for developing nations to supplement scarce domestic resources enabling them to advance from what he called ‘take-off’ stage to self-sustaining growth.

Similarly, Rosenstein-Rodan (1961) (in line with the basic Harrod-Domar growth model) stated that aid is required to fill the saving gap and ultimately make transition to self-sustained growth. This is only possible if the marginal propensity to save exceeds the average saving rate. Overtime, domestic saving will be sufficient to finance the desired growth rate without external finance. [Rosenstein Rodan 1961, cited in White, 1992]

The above view was based on the assumption that developing economies are constrained by capital resources to reach their target growth rate. Thus, foreign capital inflow is important for these economies believing that it is all invested. However, the rapid increase in aid during the 1970’s was accompanied by deteriorating growth performance. Despite high and rising aid inflows, several countries in Africa have experienced negative income growth during the 1980’s [World Bank, 1988]. Griffine and Enos(1970) and Weisskopf (1972) suggested that even if foreign aid can be a substitute for saving, it has a crowding out effect since large fraction of is used for consumption rather than investment.

Obstfeld (1999) using an endogenous growth model analyzed the effect of aid inflows on capital formation (physical and human) and growth. He used a Physical/human capital and growth model initially developed by Uzawa (1965) and Lucas (1988). It is a Ramsey-Cass- Koopmans (RCK) type model and hence based on infinitely lived households.

The production functions used in the model is Cobb-Douglass in which output, y , depends on physical capital, k , human capital, h , and a constant productivity coefficient, A .

$$y = Ak^\alpha (uh)^{1-\alpha} \dots\dots\dots (3.2)$$

Where $u \in [0, 1]$ is a fraction of the economy's human capital stock allocated to production, and remaining $1-u$ is used for producing new human capital (such as education). Hence the Stock of human capital evolves as follows

$$\dot{h} = B(1-u)h - \theta h \dots\dots\dots (3.3)$$

Where B is a constant productivity coefficient and θ is human capital depreciation rate. Based on such model Obstfeld (1999) concluded that aid has a one to one impact on steady state level of consumption. According to him aid has no effect on the steady state value of productivity of physical capital and productivity of human capital.

Even if such kind of theoretical model adds a new and important literature to aid-growth relationship, it is criticized in the ground that considers human capital, such as investment in education, as driver of growth has been challenging empirically. As stated by Tsegay (2008), Klenow (2000) also found that only 20% of growth difference in countries was explained by

schooling. The above frame work also assumes infinitely lived agents in which it is not true realistically; therefore analyzing an aid-growth relation using such framework is misleading.

Several theoretical explanations however point out the potential of aid to substitute domestic savings effort and depress investment and economic growth. This occurs due to a number of interrelated factors as discussed below,

A. Aid fungibility

Foreign aid influences the policies of the recipient country in areas of public expenditure (Dervaraja et al, 1999). At the same time aid relaxes the budget constraint of the government. The fungible of aid, therefore, refers to the potential of foreign aid to divert resources into other expenditures. In this regard fungibility of aid is said to exist when an aid recipient country adjust its overall expenditure following the inflow of foreign aid or when government investment fails to increase by the amount of aid.

Foreign aid could be fully fungible, partially fungible or non fungible at all (Dervarajan et al, 1999). That is, if aid money purely supplements domestic resources, then aid is said to be fully fungible. On the other hand, if it is part of the (aid) money that is treated as a supplement to domestic resource then aid is said partially fungible. But if there is no diversion of resources, then foreign aid is fully non fungible.

It is worth mention the analysis of Griffin (1970) in order to see the fundability of aid and the relationship between aid and domestic saving. Griffin started his analysis by assuming income to be consumed in the current period (C_t) or saved, invested and consumed in the next period.

Future consumption (C_{t+1}) will be $(1+r)$ times the value of saving in time t in which r being the return on capital.

Assume for the given level of income the budget constraint is KL , and assuming standard preferences, the consumption bundle is at point C_t with domestic savings of $L-C_t$. Now suppose there is an aid inflow of value A , equal to LN , this shifts the budget constraint out to MN . In the gap models, aid is assumed to be non fungible. Thus according to the gap model, it is assumed that aid is used only to increase investment only, so consumption in period t remains unchanged at point P . However, Griffine argued that aid can in reality be treated like any other income and shared between consumption and savings according to their respective marginal propensities. Thus consumption in period will move to point Q , and domestic savings fall to $L-C_t^2$. At such point, there is no longer a one to one relation between aid and savings, investment, so aid fungibility exists.

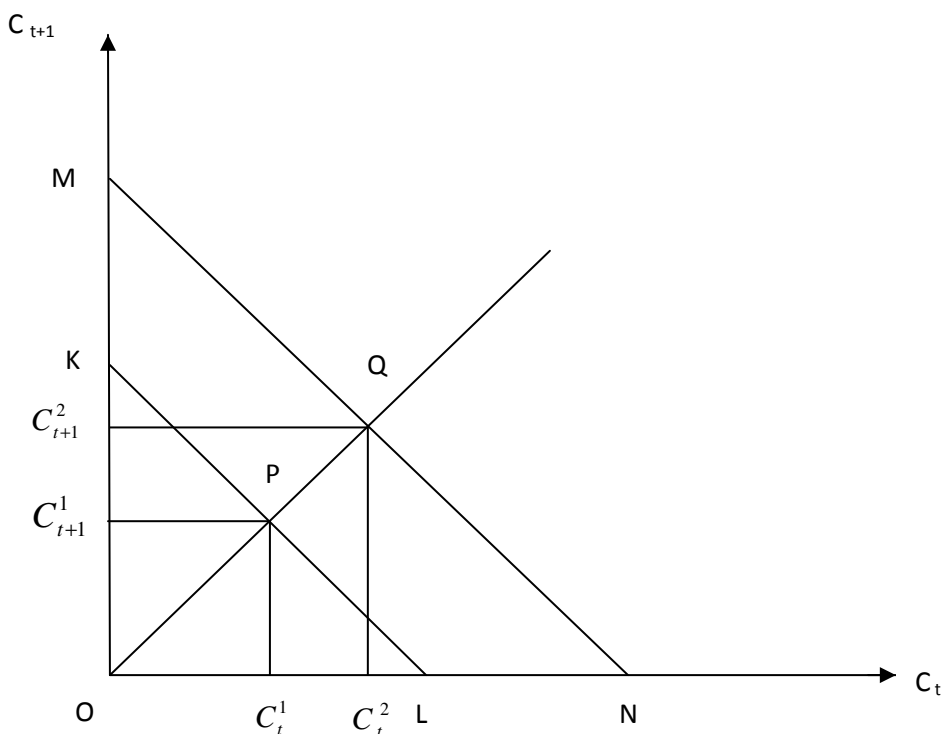


Figure 5 Griffine's graph of aid and saving

One underlining assumption behind the above argument is that it treats aid as a free resource (i.e. as a part of income) which may be allocated exactly as the recipient wishes. However, at least, some part of aid that flows to the developing countries is a tied type of aid.

Let assume now a tied type of aid and the donor directs the aid to investment in such a way that budget constraint with aid changes from being MN in figure 5 to MNL as shown in figure 6. It follows that aid remains fungible as long as the preferred consumption bundle lies along MN. Yet, if the preferences dictate that a point to the right of N should be chosen. This is no longer feasible. In this case aid fungibility is limited. According to Hjertholm et al (2002) such situation appears, *ceteris paribus*, when aid finance is large relative to domestic resources, or if little resource is devoted to investment in the absence of aid.

At the same time if L is chosen in period one, there will not be any domestic savings. In this case aid will be allocated to investment in full and there will be a one to one relation between aid and investment. There will be no aid fungibility.

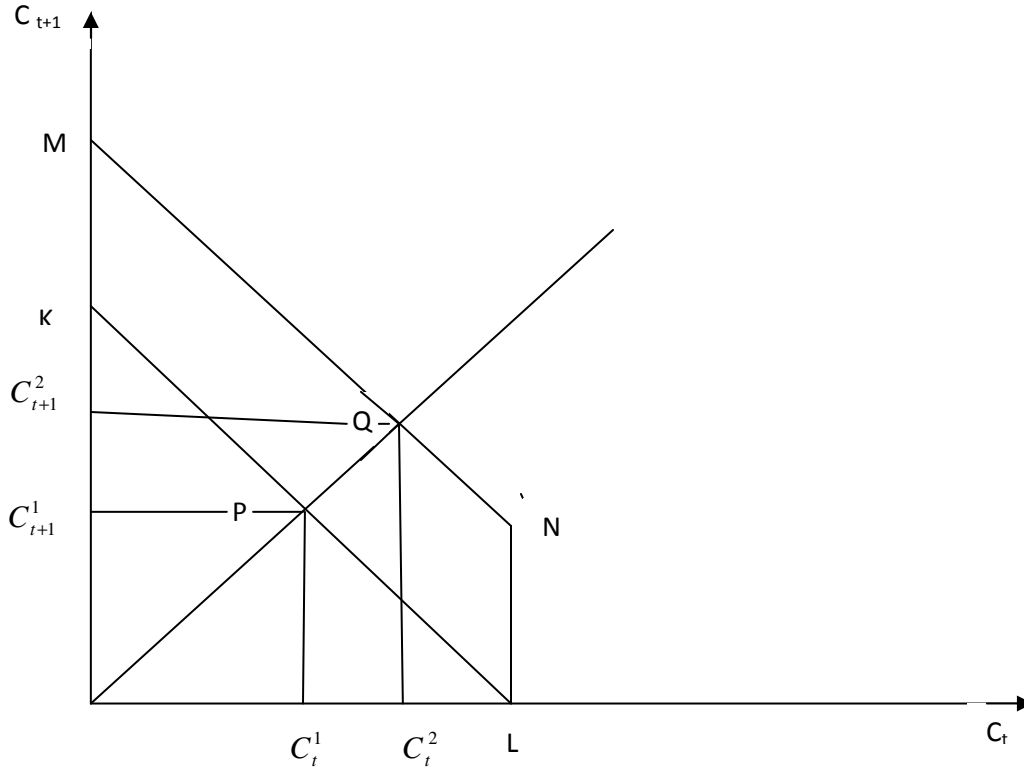


Figure 6 the Kinked Budget constraint

However it is worth mentioning that fungibility of aid may not be a problem, if aid recipient has more about how to maximize the impact of aid , then fungibility may in fact be growth enhancing , assuming that the aid recipient pursue growth and development objective and policy in effective manner. In general, it is clear that the fungibility of aid is an important issue in understanding how aid impacts on government behavior and growth in aid receiving country.

B. Dutch disease effect

The Dutch disease phenomenon basically describes a situation where an inflow of foreign exchange in any forms (i.e. from export earnings, private capital inflows and foreign aid) puts an upward pressure on the real exchange rate of the recipient country by stimulating more rapid

domestic inflation. A large inflow of foreign aid may therefore results in a loss of competitiveness of exports, contracting other efforts to increase export. Hjertholm et al (1998)

Dutch disease was first used to reflect the decline in the Netherlands export competitiveness following the discovery of the Groninger gas fields in the early 1970s [Benjamin et al., 1989] Thus, most studies of Dutch Disease have been done for developed countries.

Edwards and Van Wijnbergen (1989) suggested that the effect of increased incomes from natural resource is similar to an increase in foreign aid inflows especially for developing economies. The similarity between the two lies in; first, both are almost certainly temporary. Second, both increase availability of foreign exchange at little or no additional use of domestic factors of production. Third, both revenues are at least partially spent on non-traded goods and thus leading to an appreciation of the real exchange rate. [Edwards and Wijnbergen, 1989: 1485]. However, Benjamin et al. (1989), as quoted by Wondwossen (2003), claimed that the impacts of a discovery of natural resources or an influx of foreign revenues may be different in developing countries for three main reasons:

- (a) It is agricultural sector rather than the manufacturing sector that is most likely to be hurt,
- (b) As domestic price rise, consumers may not shift entirely to imported goods since the domestically produced manufactured goods are imperfect substitutes for goods sold in the world market thus there is no way for foreign aid to be used for import of consumption goods.
- (c) The resources movement effect associated with the influx of foreign revenues may be limited if the booming sector uses mainly imported capital and labor. He then concluded that if

foreign aid is spent on imports, there might be little or no impact on the RER (no Dutch disease effect).

As quoted by Abeba (2002), Jytte and Howard Suggested that the impact of aid on real exchange rate is undetermined since an inflow of aid may raise the productivity of the traded goods sector, for example by lowering transportation costs or raising the educational level. Aid which increases overall productivity in the traded goods sector serves to improve international competitiveness. I.e. to increase the supply of traded goods at any given price (determined by the world market prices, if the country is a price taker).

C. Aid and Uncertainty

Macroeconomic uncertainty has an adverse effect on investment. This is due to the irreversibility nature of investment once undertaken without incurring considerable cost (Serven, 1996). Thus, the existence of uncertainty has the potential to affect aggregate investment.

Since foreign aid is one source of investment finance, uncertainty of its inflow has the potential to influence the level of investment in the economy. That is, unlike the deliberate switch of resources into non-productive expenditures mentioned previously, this refers to the rational response of governments to postpone aid supplemented investment activities when instability of anticipated aid takes place (Lensink and Morissey, 2000). The argument here is that governments can anticipate the amount of future development aid based on past experience. In view of this, the likelihood that anticipated aid would be used for investment depends on the stability of its inflow. Otherwise, it will result in unanticipated decline of government revenue. Uncertainty of aid inflow, therefore, exerts pressure on economic growth by its direct impact on

government investment. When government investment is curtailed following instability of aid inflow, it is likely to influence the private investment participation.

3.2. Empirical literatures

Aid-growth relation has been the center of the various empirical studies for the last 50 years which is based on different data, model and method of data analysis. However there is no unique relation between aid and growth that is predicted.

Although there have been major advances in growth theory, the conceptual underpinning of the link between aid and growth remains rooted (implicitly if not explicitly) in the two-gap model pioneered by Chenery and Strout (1966). The analytical framework is grounded in a Harrod-Domar growth model where savings are needed to fund the investment required to attain a target growth rate, conditional on the productivity of capital. Even if many criticisms have been developed on this approach, it is still important in identifying how aid may affect growth. Bacha (1990) and Tylor (1993) identified three constraints to growth: the limit on investment due to low level of domestic savings, the limited ability to import investment goods due to low level of export earnings, and fiscal constraint on investment. Therefore according to them it is by relaxing such constraints that aid can affect growth.

Most researchers viewed economic growth to be affected by aid through its effect on investment by assisting domestic saving (gap models). Papanek (1973), in a cross-country regression analysis of 34 countries, treating foreign aid, foreign investment, other flows and domestic savings as explanatory variables, finds that foreign aid has a greater effect on growth than the other variables. He explains that “aid is supposed to be specifically designed to foster growth

and, more importantly, is biased toward countries with a balance-of-payment constraint” means aid has greater impact on growth through its impact on import financing. He also finds a strong negative correlation between foreign aid and domestic savings, which he believes contributed to the growth performance.

Mosley et.al (1987) used an expanded version of Papenek’s (1973) model by including export and labor force as additional variables explaining growth. He employed OLS regression on a panel data of 80 countries for the period 1960-1983. The general finding shows that aid has insignificant negative role on growth. A separate analysis conducted on three sub-groups revealed that, for Africa, aid appeared to have negative and insignificant contribution while for Latin America the result was insignificantly positive. For Asia, on the other hand, aid produced positive and significant impact on growth. They also found that, on average, the share of aid allocated for development purpose is higher in high growing countries. With this, they postulated that high growth is attributed not only to the degree of aid flow, but also to the share of aid allocated to development activities (investment).

Levy (1987) also specified a consumption equation where development assistance and relief aid appear in the equation separately. Using a panel data obtained from 39 countries for the period 1970-1980, the OLS regression result shows that the propensity to consume out of development aid is 0.4. Based on this result, he argued that aid is effective since most of the development aid has been saved and invested. With this he concluded that in assessing the growth impact of aid, the question that has to be addressed is how efficient aid funded investments are in enhancing economic growth. In general, the argument of Levy (1987) is acceptable.

Chenery and Carter (1973), following the previous two-gap derived model of Chenery and Strout (1966) and using data from 50 countries over the period 1960-1970, show that the Effects of Official Development Assistance (ODA) on the development performance of Countries under study are different among certain groups of countries. In five countries, namely Taiwan, Korea, Iran, Thailand and Kenya, foreign assistance accelerated economic growth whereas in six cases it retarded growth, that is, India, Colombia, Ghana, Tunisia, Ceylon and Chile.

In recent study Karuna et al (2005), by identifying three transmission mechanism of aid to economic growth (i.e. investment, import financing and government spending), tried to analyze the impact of aid on economic growth on 25 sub-Saharan African countries. They used residual regressor approach on the pooled data collected over the period 1970 to 1997. Based on such data they found a significant positive effect of aid on economic growth. On average, each one percentage point increase in the aid/GNP ratio contributes one quarter of one percentage point to growth rate. According to them African poor growth performance should not be attributed to aid ineffectiveness.

In general, aid is found to have a positive impact on economic growth because it increases investment, increases the capacity to import capital goods or technology, aid does not have an Adverse impact on investment and savings and lastly because aid increases the capital productivity and promotes endogenous technical change (Morrissey, 2001).

In recent time, by criticizing the methodological as well as theoretical frame work of the gap models, many researcher and scholars come into the argument having their view of aid effectiveness as a policy variable. Dowling and Hiemenz (1983) used a panel data of 31 high growing Asian countries to assess the growth impact of foreign aid and various policy

instruments during 1970s. The result obtained from OLS regression points that foreign aid, degree of openness, and financial liberalization significantly contributed to growth. The public sector and tax revenue variables appeared to be statistically insignificant. With this result they come to conclude that liberal trade regime and sound financial policies have helped the growth impact of aid.

Burnside and Dollar (1997, 2000) tested the impact of policy on the aid- growth relationship using a new technique. The analysis is conducted based on data obtained from 56 countries for the period 1970-1993. The model is specified using aid, policy and other variables designed to capture the impact of institutional and social qualities on per capita growth. Both the OLS and 2SLS regression results show that aid is insignificant in promoting growth. But, when aid interacted with policy index the result became positive and significant. Hence, they conclude that aid significantly promotes growth if the policy mix is favorable (or conducive). In view of the result, they recommend disbursement of aid to be conditional on good policy environment. The findings of Burnside and Dollar (1997, 2000) have been questioned by a number of recent studies. According to the investigation of Hansen and Tarp (2001), aid tends to increase the rate of growth even without the inclusion of interacted term. Dalgaard and Hansen (2000), on the other hand, pointed that the result of Burnside and Dollar is very fragile. They argue that inclusion of five additional countries to the data set destroys the conclusion of Burnside and Dollar. Similar critics were forwarded by Lensink and Morrissey (2001), Hansen and Tarp (2000).

Burnside and Dollar (1997) extended their study to examine the possibility of endogeneity between policy and foreign aid. They specified an aid equation with initial GDP per capita,

population, policy and dummies for institutional quality as explanatory variables. The policy equation, on the other hand, is composed of aid, initial GDP per capita and dummies intended to capture the institutional quality and political condition of the recipient country. Using data obtained from 191 countries for the period 1970-1993, the 2SLS regression result revealed that policy has a positive and significant impact on aid while the contribution of aid on policy is insignificant. This made them to conclude that good policies are rewarded by donor countries, but there is no systematic effect of aid on policy. Nevertheless, evaluation of the analysis points that there is a reason to be skeptical about such conclusion. This is because the estimation is done using data obtained from almost all countries that received aid. But, the importance of aid is not expected to be similar across all countries. Those who need foreign aid badly are likely to suffer from unhealthy policy condition (such as high inflation rate, and huge level of deficit among others). On the other hand, countries that need aid the least may be under good policy environment. Hence, to establish conclusive relationship between aid and policy, the analysis must be based on either specific country or on sub-group of countries that are in similar status.

Ekanayake and Chatrna (2008) analyses the effects of foreign aid on economic growth of developing countries. The study uses annual data on a group of 85 developing countries covering Asia, Africa and Latin America and the Carrebean for the period 1980-2007. They tested the hypothesis that foreign aid can promote growth in developing countries using the panel data series for foreign aid, while accounting for regional differences in Asian, African, Latin American, and the Carrebean countries as well as difference in income levels. While the findings of previous studies are generally mixed, their result also indicates that foreign aid has mixed effects on economic growth in developing countries.

This study makes an effort to establish whether there exist long-run and short-run relationships between foreign aid and economic growth using country specific data. We have selected the six poorest Sub-Saharan African countries, whose real per capita GDP is the lowest in the world. Moreover, these countries are classified as Highly Indebted Poor Countries (HIPC).

The empirical result shows that in five out of the six countries, the natural log of foreign aid as a percentage of real GDP has a significant negative long run effect on the natural log of real GDP per capita. In the short run aid growth has no significant effect on economic growth per capita for most of the countries except for Niger. These negative results appear on the surface to indicate the long-term deleterious effect of international aid on living standards in these countries (Mallik, 2008).

Ngang (2008) analyzed the impact of foreign aid on economic growth and development in Cameroon using descriptive statistics for the data from 1997 to 2006. The result shows that foreign aid significantly contributes to the current level of economic growth but has no significant contribution to economic development. The finding implies that Cameroon could enhance its economic development by effectively managing funds from aid and by strategically strengthening anti- corruption measures.

3.3. Ethiopian evidence

Even if there are no literatures conducted on the effectiveness of foreign aid using the gap models, the existing literature shows the aid growth relationship through its contribution on investment and import financing. Dawit and Yemiserach (2001) examined the aid growth relationship for the period 1970-1999 using an error correction model. They formulated three equations-output, investment and import equations. Based on the ECM result of the output

equation, they conclude that aid contributes negatively to economic growth whereas investment has a positive and significant influence on growth. The investment equation, on the other hand, found a positive and significant role of aid. With this result they argued that aid has helped growth through its contribution to capital formation. Similarly, they argue that aid has a positive significant impact on imports and therefore, it has helped growth through the acquisition of important inputs.

Review of the analysis and the results they arrived at calls for a criticism. The specification of the output equation is likely to be biased. That is, output is specified as a function of savings, aid, investment and other variables. Gomanee et al (2001) argued that when aid and investment are used together as explanatory variables to growth, the coefficient and significance of aid in the regression would be underestimated and provide incorrect result. This is due to a problem of double counting since investment captures part of the growth impact of aid.

Sewasew (2002) examined the relationship between import and GDP growth in Ethiopia for the period 1960/61-1999/2000. Using the Johansen (1988) procedure, he found that in the short run foreign exchange receipts has significant positive impact on imports. Since one source of foreign exchange receipt is aid, it can be argued that aid has positive impact on import. However, Sewasew's (2002) finding also revealed that imported capital goods have insignificant negative impact on the growth of real GDP. This suggests that a favorable impact of aid on import does not guarantee the aid growth link to be positive.

Haile and Alemayehu (2000) examined the relationship between savings, foreign aid and economic growth using 30 years data (from 1967-1997). They specified saving and growth

equation in the form of an error correction model. The conclusion they made, using the Johansen Procedure, is that foreign aid has insignificant negative impact on growth.

Nonetheless, the growth equation is specified in a fashion similar to Dawit and Yemiserach (2001). That is, both aid and investment are used as explanatory variables. In such formulation aid may appear insignificant because a portion of its contribution to growth is taken over by the investment variable. Hence, the result understates the growth impact of foreign aid.

In addition to an attempt made by the above researchers to analyze the effect of aid on growth, Pedro M.G. Martins (2007) tried to assess the impact of aid on government expenditure, revenue and domestic borrowing in Ethiopia using a data for the period 1964-2005 applying a fiscal response model. He concluded that foreign aid has had a positive impact on government investment, while it has a less effect on recurrent expenditure. Moreover he found that loans have a stronger positive impact on government investment than grants.

Tolessa (2001) examined the role of aid in the Ethiopian economy for the period 1964/65 - 1999/2000. He specified saving, investment, and growth equations. In the analysis, he desegregated foreign aid into grants and loan assuming that the two components have different impact. The estimation uses Johansen maximum likelihood procedure. From the investment equation he found that foreign loan has positive and significant long run impact on investment while foreign grant doesn't. The finding also revealed that domestic savings and foreign loan has positive and significant influence on long run growth. In contrast to this, the impact of foreign grant appeared to be significantly negative. Furthermore, the ECM shows that both foreign inflows are insignificant in affecting growth. With this, he recommended that the government should encourage domestic saving than foreign aid. He further incorporated a policy index into

the growth equation derived from a combination of a fiscal deficit, openness to trade and exchange rate premium. Based on a significant result obtained he argued that good policy improves effectiveness of aid.

However, Tolessa (2001) used the policy index in the growth equation without interacting it with foreign aid. In such formulation, the coefficient of policy index shows its impact on growth as any other variable stated in the model does. Therefore, his result does not show the role of policy in affecting aid effectiveness. In addition, the use of exchange rate premium (ERP) as one component in deriving policy index is very likely to produce misleading result. This is because ERP measures the rate of deviation of the official exchange rate (OER) from the parallel exchange rate (i.e., PER). Thus, the ERP measured in one period may substantially differ from another period while the gap between OER and PER is equivalent in both times. Therefore, using ERP to compare the macro economic situation may give misleading information. Rather, the deviation of OER from PER should have been used while formulating the policy index.

In similar study Abeba (2002) examines the impact of external assistance on the economic performance of the country for the period 1960/61-1999/00 using Johnson maximum Likelihood estimation procedures. Accordingly she found that external finance negatively affected the investment rate and hence the growth performance of the country.

The paper further investigates that unexpected negative relationship between foreign aid inflows and economic growth. The insignificant effect of external grant on domestic saving, negative impact of external grant on government consumption and the 'Dutch Disease' effect of both foreign grant and loan is responsible for the negative impact of foreign assistance on economic growth.

In addition, Wondwossen (2003) assess the relationship between aid and economic growth in Ethiopia for the period 1962/63- 2001/02 using Johansson maximum likelihood procedure. According to his finding foreign aid has a significantly positive contribution on investment where as uncertainty of aid flow (as a result of aid volatility) significantly and negatively affect the capital formation activity. The effect of foreign aid on economic growth appeared negative but insignificant. Aid interacted policy term, on the other hand, produce significantly positive result. The error correction model concludes that foreign aid is insignificant in the short run. Furthermore, the causality test shows that the causality runs from policies to foreign aid while the converse does not hold.

In most recent study Tsegay (2008) tried to assess the effect of foreign aid on economic growth through its impact on investment using the co-integrated vector autoregressive model. According to his finding, in the long run, output growth has been affected positively by private investment, grants, and public investment. However the gain from this is offset by imports and loans.

In the short run, in the other hand, private investment found to be volatile. However since he found crowd in relationship between private investment and public investment, he shows a possibility of affecting private investment by expansionary fiscal policy aimed at increasing output.

In summary, most of the studies reviewed suffer from problems associated with model specification. Besides, the impact of aid on economic growth passes through its impact on investment (assisting domestic saving), capital good import and helping government consumption spending. Hence, the studies were not strong enough to adequately identify the aid

-growth link. Therefore this study tries to show the aid-growth relationship through its transmission mechanism in Ethiopia, some attempt is also made to incorporate the impact of policy in the aid effectiveness.

CHAPTER IV: METHODOLOGY

4.1. Model Specification

There has been a lot of study conducted in the area of aid effectiveness, each based on different model. Based on the model they developed and the data they used, they come up with different conclusions. This paper is different from those in such a way that it tried to assess the impact of aid on growth accounting for transmission mechanisms.

Four equations are identified to assess the effectiveness of aid based on the equations that are derived by Gomanee et al (2001). The equations are designed to examine the role of aid in enhancing the growth of the country.

4.1.1. Growth equation

The growth equation this paper intended to use has its theoretical base from the 1970s Harrod Domar growth model in which the growth of a given country depends on the amount of investment.

$$g = \kappa/Q.I = \delta I \dots\dots\dots (4.1)$$

Where δ = incremental capital output ratio, I = investment level, Q = output level, and g = growth rate of output.

However, recently different scholars come to include various variables that are believed to affect the growth of a country. Rana and Dowling (1988) extended the Harrod Domar growth work by including variables like labor force and policy variables.

A wide range of growth models has treated human capital as a critical factor in determining growth rate of output (Lucas, 1988). It is an important source of long-term growth, either because it is a direct input to research (Romer, 1990) or because of its positive externalities (Lucas, 1988). Policies that enhance public and private investment in human capital, therefore, promote long-run economic growth. The inclusion of human capital variables in growth models are intended to capture quality differences in the labor force, as non-physical capital investment increases the productivity of the existing labor force. They commonly relate to education and are measured by an index of educational attainment, by mean years of schooling, or by school enrolment (Barro and Lee, 1993). However, none of this data are found in the required level so we use expenditure on education as a proxy to human capital.

Since the objective of this paper is to assess the growth impact of aid, attempts is made to include variables to further improve the above model and to be in line with the objective.

Based on the Harrod Domar model investment is identified as the main variable that determine growth. However, including aid and investment in the same equation is going to result in bias estimation because it results in double counting since some part of investment is financed by aid. Therefore, based on Gomanee et al (2001), in order to overcome such problems this paper includes the investment level that is not financed by aid.

Wondewossen (2002) identified two methods to calculate the investment that is not explained by aid. The first method is netting out the amount of loan and grants in the government capital expenditure to get the government investment, adding private investment results in total investment that is not explained by aid. However, there is a government investment from recurrent expenditure that this method overlooked. The second alternative is called residual

regressor. In this method first investment will be regressed on aid only. Then, using the residual from the regression, the investment level that is not a result of foreign aid can be constructed. Accordingly the investment level that is not financed by aid can be found from the following equation,

$$INV_o = INV - 2.12^1(AID) \dots\dots\dots (4.2)$$

Where, INV_o = level of investment not financed by aid, INV = total level of investment, and AID = foreign aid,

Bacha (1990) and Tylor(1993) stated that aid is the main determinant of growth in the third world countries. According to them aid has a positive impact on growth of a country by financing saving gap, trade gap and fiscal gap. Based on such theoretical framework of the gap models aid is identified as a determinant of growth.

However there has been a recent controversial argument on the effectiveness of aid. Burnside and Dollar (2000) argued that aid will have a favorable impact on growth only if it supported by good policy. Therefore the growth impact of aid is only noticed when it is combined with policy variable. Based on this argument, in addition to aid variable, aid interacted with policy variable is included in the growth equation to assess this theoretical framework.

Gomanee et al (2005) developed the policy index out of a regression result obtained from a growth which is only comprised of budget surplus, openness to trade and inflation rate as

¹ 2.12 represent the estimated coefficient from the regression of investment on aid only.

explanatory variable. Then the policy index will be obtained from the coefficient from the regression result. Therefore the policy index will be derived from the following regression result:

$$Pt = 0.26OPEN + 0.11INF - 0.35BDGDP \dots\dots\dots (4.3)^2$$

Where, Pt = policy index, OPEN = openness to trade, INF = inflation rate, and BDGDP = budget deficit as a ratio of GDP.

In addition aid squared variable is incorporated in the model to assess whether aid inflow has been beyond an absorptive capacity of the country or not.

Thus, the growth function with their expected sign is given by:

$$RGDP = f (INV_o, AID, PA, H, LAB, (A)^2) \dots\dots\dots (4.4)$$

(+) (?) (+) (+) (+) (-)

Where, **RGDP** = GDP growth rate

INV_o = investment level that is not financed by aid

AID = aid as a ratio of GDP

PA = **policy** index times aid

H = human capital proxied by education expenditure

LAB = labor force as a ratio of total population

Accordingly, the model to be estimated can be specified as follows:

² More detail can be found in Appendix D.

$$\ln\text{RGDP} = \beta_0 + \beta_1 \ln\text{INV}_0 + \beta_2 \ln\text{AID} + \beta_3 \ln\text{PA} + \beta_4 \ln\text{H} + \beta_5 \ln\text{LAB} + \beta_6 \ln\text{A}^2 + \varepsilon \dots \dots \dots (4.5)$$

4.1.2. Investment equation

Started from the 1950s, economists in their gap models believed that one of the way through which aid hits growth is investment (private plus public investment). Scholars believed that in the developing country there is a high gap between the target investment level and the available domestic saving therefore foreign aid helps to finance it.

The above theoretical arguments of the gap models are the bases for the formulation of our investment equation. It is identified that domestic saving and foreign aid are the two determinants of investment.

Official development assistance (foreign aid) has a loan component in which it has to be paid in the future with their service interest. If the recipient's payment fails to increase, debt servicing is likely to crowd out investment actively by consuming the available foreign exchange or through raising tax to finance the debt repayment. Therefore debt is one of the determining factors of investment in a given country.

In addition to the above variables, instability, either social or political, is identified as one of a determinant of investment. Social or political instability tends to deter investment by affecting the incentive framework. Serven(1966), as stated by Wondwossen (2002), argued that such instability raises the value of waiting, treating property right and make prediction of investment difficult so they are going to affect investment negatively. One of the factors that induce instability in the given country is war; therefore expenditure on defense is used as a proxy for instability in this paper.

Therefore, the investment equation with their expected sign is identified as

$$I = f(S, A, DF, WGDP) \dots\dots\dots (4.6)$$

(+) (+) (-) (-)

Where, INV = investment as a ratio of GDP

S = domestic saving as a ratio of GDP

AID = aid as a ratio of GDP

WGDP = Defense expenditure as a percentage of GDP

DF = the ratio of debt servicing to GDP

Therefore, the model to be estimated can be specified as follows:

$$\ln INV = \alpha_0 + \alpha_1 \ln S + \alpha_2 \ln AID + \alpha_3 \ln WGDP + \alpha_4 \ln DF + \varepsilon \dots\dots\dots (4.7)$$

4.1.3. Government consumption expenditure

Tylor (1993) and other three gap model advocators argued that it is by assisting government expenditure and financing the fiscal gap in which aid also helps growth. According to them, the government of a given country runs huge projects at initial level of its development, and the finance comes either from the revenue collected of foreign aid. Therefore government revenue (domestic) and foreign aid are identified as determinants of public consumption.

Gross domestic product is also identified as a determining factor of public consumption expenditure in line with Jifar (2002). According to him if the country GDP grows the government is going to spend much expenditure in salary increment and other incentive actions.

Apart from the above variables, inflation is also identified as a determining factor of Government consumption Expenditure, since the increment in the price of goods and services is supposed to reduce consumption expenditure. (Gomanee et al, 2005)

Therefore the impact of foreign aid on government spending can also be analyzed in the following public consumption expenditure function.

$$GCON = f (TR, AID, RGDP, INF) \dots \dots \dots (4.8)$$

(+) (+) (+) (-)

Where, GCON = government consumption expenditure as a ratio of GDP

TR = total domestic revenue as a ratio of GDP

AID = aid as a ratio of GDP

RGDP = real Gross domestic product

INF = inflation

Accordingly, the model to be estimated can be specified as follows:

$$\ln GCON = \gamma_0 + \gamma_1 \ln TR + \gamma_2 \ln AID + \gamma_3 \ln RGDP + \gamma_4 \ln INF + \varepsilon \dots \dots \dots (4.9)^3$$

4.1.4. Import equation

Although the literature on trade and growth tends to focus on export or trade volume of a country, there are various reasons why import themselves are important in contributing to the growth of the country particularly in their relation to the investment.

³ This equation can also help us to identify whether there is aid fungibility.

Bacha (1990) and Tylor (1993, 1994) argues, a major benefit of export is that they generate the foreign exchange required to purchase the import required for growth. According to Gomanee et al (2005) also, the most obvious is imported investment goods.

In order to derive the import function, the paper base itself in the theoretical explanation of the 1950s two gap models and the recent three gap models. Therefore the main issue here is how import is financed.

Export and foreign aid are introduced as a main source of foreign exchange required to pay for import. According to Bacha (1990) it is by financing import and increasing investment goods that foreign aid affect a growth of a country. That is, by financing the gap between import and export.

However, the purchasing power of this financing revenue (export and foreign aid) depends on the exchange rate and terms of trade. Therefore we include Terms of trade and real exchange rate to capture their effect.

The import function is given by:

$$M = f (X, AID, TOT, RER, RGDP) \dots\dots\dots (4.10)$$

(+) (+) (?) (-) (+)

Where, M = Import as a ratio of GDP

X = Export as a ratio of GDP

AID = Aid as ratio of GDP

TOT = terms of trade

RER = Real exchange rate

RGDP = Real gross domestic product

Accordingly, the model to be estimated can be specified as:

$$\ln M = \phi_1 + \phi_2 \ln X + \phi_3 \ln AID + \phi_4 \ln RER + \phi_5 \ln TOT + \phi_6 \ln RGDP + \varepsilon \dots \dots \dots (4.11)$$

4.2. Data type, source and description

As the success of any econometric analysis ultimately depends on the availability and accuracy of data, it is, therefore essential to discuss about the source and nature of data. Regarding the type of data, the study will use a sufficient length (39 years) of secondary time series data. And, such data were collected from different sources. The major data sources for the problem under investigation are publications of National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MOFED) and Central statistics Authority (CSA) of Ethiopia. Besides, IMF CD-ROM, WB CD-ROM, and UNCTAD-CD-Rom were used.

4.3. Estimation technique

The standard estimation and hypothesis testing assumed that all variables, in particular regression, are stationary. A data series is said to be stationary if its error term has zero mean, constant variance and the covariance between any two – time periods depends only on the distance or lag between the two periods and not on the actual time which it is computed (Harris, 1995). However in reality most macroeconomic variables are non stationary. If variables entering into the estimation are non stationary, then the result obtained using Ordinary Least Square (OLS) technique would be spurious in the sense that variables would seem to have promising diagnostic test (high R2 and low DW test) result just because they have common

trend over time rather than actual causation (Harris 1995). Therefore hypothesis testing and inference using such results will be invalid. To avoid such wrong inferences from the non-stationary regressions, the time series property of the data should be checked prior to the estimation of the long run model.

4.3.1. The unit root test

Studies have developed different mechanisms that enable non stationary variables attain stationarity. It has been argued that if a variable has deterministic trend, including trend variable in the regression removes the trend component and makes it stationary. Such process is called trend stationary since the deviation from the trend is stationary. However, most time series data have a characteristic of stochastic trend (that is, the trend is variable which, therefore, cannot be predicted with certainty). In such cases, in order to avoid the problem associated with spurious regression, pre-testing the variables for the existence of unit roots (i.e. non-stationary) becomes compulsory. In general if a variable has stochastic trend, it needs to be differenced in order to obtain stationarity. Such process is called difference stationary process (Gujarati, 1995). The number of unit roots a given variable posses determines how many times that variable should be differenced in order to attain stationarity.

In this regard, the Dickey Fuller (DF) test enables us to assess the existence of stationarity. The simplest DF test starts with the following first order autoregressive model.

$$Y_t = \Phi Y_{t-1} + U_t \dots\dots\dots (4.12)$$

Subtracting Y_{t-1} from both sides gives

$$\Delta Y_t = \gamma Y_{t-1} + U_t \quad \text{Where } \gamma = (\Phi - 1), U_t \sim \text{IID}(0, \sigma^2) \dots\dots\dots (4.13)$$

The test for stationarity is conducted on the parameter γ . If $\gamma = 0$ or $(\Phi = 1)$ it implies that the variable Y is not stationary. The hypothesis is formulated as follows.

$$H_0: \gamma = 0 \text{ or } (\Phi = 1)$$

$$H_1: \gamma < 0 \text{ or } (\Phi < 1) \dots\dots\dots (4.14)$$

Using equation (4.8) is appropriate only when the series Y_t has a zero mean and no trend term (Harris, 1995). If a variable has zero mean, it implies that $Y_t = 0$ when $t = 0$ (i.e., there is no constant term). But, it is impossible to know whether the true value of Y_0 is zero or not. For this reason including a constant (drift) to the regression is suggested. That is,

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + U_t \dots\dots\dots (4.15)$$

Where α is a constant term.

However, if a series contains a deterministic trend, testing for stationarity using equation is invalid. Because if $\gamma = 0$, we accept the null hypothesis that the series contains a stochastic trend when there exists deterministic trend. Therefore, it is important to incorporate time trend in the regression as follows.

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \beta T + U_t \dots\dots\dots (4.16)$$

Where, T is the trend element.

For equations (4.15) and (4.16) as well the parameter γ is used while testing for stationarity where the decision is made using a t-statistics. If the calculated value of t is less than the critical

value (reported by Dickey and Fuller) the null hypothesis is accepted and not if otherwise. Rejecting the null hypothesis implies that there exists stationarity.

However, the DF test has a series limitation in that it suffers from residual autocorrelation. Therefore, it is inappropriate to use DF distribution with the presence of auto correlated errors because the error terms will not be white noise. Autocorrelation of the error terms is the result of failure to adequately specify the dynamic structure of Y_t (Harris, 1995). To amend this weakness, the DF model is augmented with additional lagged first differences of the dependent variable. This is called Augmented Dickey Fuller (ADF).

This regression model avoids autocorrelation among the residuals. Thus, incorporating lagged first differences of the dependent term in DF equation gives the corresponding ADF models.

The general form of the ADF equation where only an intercept is included is as follows:

$$\Delta Y_t = \alpha_o + \gamma Y_{t-1} + \sum_{i=2}^p \beta_i \Delta Y_{t-i+1} + \varepsilon_t \dots\dots\dots (4.17)$$

For the case where the auto regression includes the intercept and a trend, the equation is of the following form:

$$\Delta Y_t = \alpha_o + \gamma_1 T + \gamma Y_{t-1} + \sum_{i=2}^p \beta_i \Delta Y_{t-i+1} + \varepsilon_t \dots\dots\dots (4.18)$$

Where, Y_t is any variable in the model to be tested for stationarity, ε_t is an error term and Δ is the first difference operator.

The null hypothesis of ADF is $\delta = 0$ against alternative hypothesis that $\delta < 0$. Where $\delta = \gamma - 1$. A rejection of this hypothesis means that the time series is stationary or it does not contains a unit root while not rejecting means that the time series is non-stationary (Enders, 1995).

If a variable that is not stationary in levels appears to be stationary after d th difference then the variable is said to be integrated of order d I (d). Once the variables are stationary the regression result will be spurious.

4.3.2. Co integration Test

Most macroeconomic variables are found to be non stationary, according to Harris estimation and hypothesis testing based on such variables is invalid because the result in promising diagnosis tests as a result of their time trend. However, one can difference or de trend the variables in order to make the variables stationary. If variables become stationary either through differencing or de trending, they are in the class of differencing or trend stationary process.

In the case where variables are difference stationary, it is possible to estimate the model by first difference. However, this gives only the short run dynamics in which case valuable information concerning the long run equilibrium properties of the data could be lost (Kennedy, 1992). In order to obtain both the short run and long run relationship one can appeal to what is known as co integration.

Co integration among the variables reflects the presence of long run relationship in the system. We need to test for Co integration because differencing the variables to attain stationarity generates a model that does not show the long run behavior of the variables. Hence, testing for Co integration is the same as testing for long-run relationship. In general, if variables that are integrated of order ' d ' produce a linear combination which is integrated of order less than ' d ' (say

'b') then the variables are co integrated and hence have stable long run equilibrium relationship (Gujarati, 1995).

There are two approaches used in testing for Co integration. They are: (i) the Engle-Granger (Two step algorithm) and: (ii) the Johansen Approach

A. Engle-Granger (two step algorism)

The Engle-Granger (E-G) method requires that for co-integration to exist, all the variables must be integrated of the same order. Hence, once the variables are found to have the same order of integration, the next step is testing for co integration. This needs to generate the residual from the estimated static equation and test its stationarity. By doing so we are testing whether the deviation (captured by the error term) from the long run are stationary or not. If the residuals are found to be stationary it implies that the variables are co integrated. This in turn ensures that the deviation from the long run equilibrium relationship dies out with time (Enders, 1996). Hence, the presence of Co integration makes it possible to model the variables (that are in first difference) through the error correction model. In the model a onetime lagged value of the residual hold the error correction term where its coefficient captures the speed of adjustment to the long run equilibrium.

Although, the Engle-Granger (EG) procedure is easily implemented, it is subject to the following important limitations. First, in tests using three or more variables there may be more than one co-integrating vector. In fact, if there are n variables in a model there may be n co-integrating vector or less. The Engle Granger method has no systematic procedure for separate estimation of the multiple co integrating vectors. This method makes the implicit assumption that the co

integrating vector is unique, which means that we are bound to end with a model that is a linear combination of independent co integrating vectors. Second, the EG approach relies on a two-step estimator. The first step is to generate the error series and the second step uses these generated errors for estimation, thereby carrying over errors obtained from regression using the residuals. Hence any error introduced in the first step is carried in two the second step. Third, co integration test may depend on the variable put in the left side of the co integration. That is, the test is not invariant to the variable used for normalization (Enders, 1995). Finally, the method does not allow the variables in the right hand side to be potentially endogenous (Harris, 1995). (Therefore, this paper chooses to use the Johansen maximum Likelihood Procedure (1988) since it addresses the above stated weakness of the E-G method.

B. Johansen (1988) Maximum Likelihood

The Johansen (1988) procedure enables estimating and testing for the presence of multiple co-integration relationships, in a single step procedure. Moreover, it permits to estimate the model without priory restricting the variables as endogenous and exogenous. Under this procedure, the variables of the model are represented by a vector of potentially endogenous variables.

The starting point in this procedure is formulation of unrestricted vector autoregressive (VAR) model in the following form.

Considering K-lags of Z_t ,

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + \dots + A_k Z_{t-k} + \mu + \varphi D_t + \xi_t \dots\dots\dots (4.19)$$

Where Z_t is a (nx1) vector of stochastic I(1) variables, A_i (i=1,...,k) is (nxn) matrix of parameters, μ is a vector of deterministic component (i.e., a constant and trend), D is a vector of

dummies and $\xi_t \sim IN(O, \Sigma)$ is a vector of error term and $t = 1, \dots, T$ (T is the number of observation).

The above model can be re parameterized to give a vector error correction model (VECM). That is, adding and subtracting $(A_{k-1} \dots A_2 - A_1 - I) Z_{t-k}$ from equation 4.19. (I being the identity matrix) results the following specification.

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots + \Gamma_{k-1} \Delta Z_{t-k+1} + \pi Z_{t-k} + \mu + \phi D_t + \xi_t \dots \dots \dots (4.20)$$

Simplifying equation (4.20) gives

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \pi_j Z_{t-k} + \mu + \phi D_t + \xi_t \dots \dots \dots (4.21)$$

Where, $\Gamma_i = -[I - \sum_{j=1}^i A_j]$ containing information of the short run adjustment to change in Z_t and ($i=1, 2 \dots k-1$).

$\pi_j = -[I - \sum_{j=1}^k A_j]$, containing information of the short run adjustment to change in Z_t .

The long run relationship among the variables is captured by the term $\pi_j Z_{t-k}$. In the Johansen (1988) procedure, determining the rank of π (i.e., the maximum number of linearly independent stationary columns in π) provides the number of cointegrating vector between the elements in z . In this connection, there are three cases worth mentioning. First, if the rank of π is zero, it points that the matrix is null which means that the variables are not co integrated. In such case the above model (equation 4.21) is used in first difference, void of long run information. Second, if the rank of π equals the number of variables in the system (say n), then π has full rank which implies that the vector process is stationary. Therefore, the VAR can be tested in levels. Finally, if π has a reduced rank [i.e., $1 < r(\pi) < n$] it suggests that there exists $r < (n-1)$ co integrating vector where r is the number of co integration in the system.. Therefore, the matrix π equals to

$-\alpha\beta'$ where α and β are $n \times r$ matrices, β represents the co integration parameters with a showing their corresponding feedback or adjustment mechanism to equilibrium (i.e., it shows the speed with which disequilibrium from the long run path is adjusted). In identifying the number of co integrating vectors, the Johansen procedure provides n Eigen values denoted by λ (also called characteristics roots) whose magnitude measures the extent of correlation of the co integration relations with the stationery elements in the model.

In general, to identify the number of co integrating vectors in the system, the Lambda max (λ_{\max}) and Lambda trace (λ_{trace}) statistics are used. They are obtained from the following formulas.

$$\lambda_{\max} = -T \log (1 - \hat{\lambda}_{r+1}) \quad , r = 0, 1, 2 \dots N-1 \dots \dots \dots (4.22)$$

$$\lambda_{\text{trace}} = -T \sum_{i=r+1}^n \log (1 - \hat{\lambda}_i) \dots \dots \dots (4.23)$$

Where T is the sample size and λ_i is estimated eigenvalues.

λ_{\max} Statistics tests the null hypothesis that there are 'r' co integrating vectors against the alternative of 'r+1'. The trace statistics, on the other hand, tests the hypothesis of less than or equal to 'r' co integrating vectors against the alternative of 'r+ 1'. The distributions of both test statistics follow Chi-square distributions (Enders, 1995). Reimers (1992), cited by Harris, 1995, points that the Johansen approach tends to over reject the null hypothesis when the sample size is small. While testing for co integration, therefore, he suggests adjustment to be made for the degrees of freedom. This is done by substituting 'T-nk' in place of T in equations (4.21) and (4.22), where n is the number of variables and k is the lag length set in the test for co integration.

The other important thing in the co integration analysis is the issue of identifying endogenous and exogenous variables in the system. This is required because the Johansen procedure do not restrict the variables behavior a priori. If a variable is weakly exogenous, it implies that its error correction term (i.e., the corresponding α -coefficient) does not enter in the error correction model. This implies that the dynamic equation for that variable contains no information concerning the long run relationship in the system. Hence, variables that are weakly exogenous should appear in the right hand side of the VECM. This restricts the exogenous variables to be contemporaneous with the dependent variable (Harris, 1995). The first step in the test is formulation of the null hypothesis which states that the variable is weakly exogenous against the general alternate. That is,

$$H_0: \alpha_{ij} = 0 \quad \text{For } j = 1 \dots r \text{ (r being the number of co integrating vectors)}$$

$$H_0: \alpha_{ij} \neq 0 \dots \dots \dots (4.24)$$

The test (for weak exogeneity) is conducted using the following formula.

$$-2 \log(Q) = T \sum_{i=1}^r \log \left(\frac{1-\lambda_i^*}{1-\hat{\lambda}_i} \right) \dots \dots \dots (4.25)$$

$$\text{Where } Q = \frac{(\text{restricted maximized likelihood})}{(\text{unrestricted maximized likelihood})} \dots \dots \dots (4.26)$$

T = the number of observations, r = the number of rank, and $\hat{\lambda}_i$ and λ_i^* represents Eigen values for unrestricted and restricted models respectively. If the result obtained from the above formula is less than the Chi-squared distribution, then the null hypothesis will not be rejected. This implies that the variable is weakly exogenous.

4.3.3. Vector Error Correction Model (VECM)

Economic variables have short run behavior that can be captured through dynamic modeling. If there is long run relationship among the variables, an error correction model can be formulated that portray both the dynamic and long run interaction between the variables. In the previous discussion, we show that if two variables that are non-stationary in levels have a stationary linear combination then the two variables are co integrated. Co integration means the presence of error correcting representation. That is, any deviation from the equilibrium point will revert back to its long run path. Therefore, an ECM depicts both the short run and long run behavior of a system. Engle and Granger (1987) defined ECM as "a particular representation of a vector auto regression appropriate for co integrated results." This means if there exists long run relationship (i.e., co integration among the variables) we can rewrite equation (4.20) to come up with the following VECM specification.

$$\Delta Z_t = \sum_{i=1}^{K-1} \Gamma_i \Delta Z_{t-1} + \alpha(\hat{\beta}'_1 Z_{t-1} + \hat{\beta}'_2 Z_{t-1} + \dots + \hat{\beta}'_n Z_{t-1}) + \mu + \varphi D + \varepsilon \dots \dots \dots (4.27)$$

Where, the figure in the parenthesis represents the error correcting terms.

If there is only one co integrating vector and if the endogenous and exogenous variables are identified in the long run analysis, we can develop the VECM by conditioning on the exogenous variables. In this case, only the error correcting terms of the endogenous variables appear in the error correction model. Thus, assuming that Y_t is endogenously determined in the model and X_{jt} represents weakly exogenous variables, we can model for Y_t . This is performed using the lagged first difference of Y_t , the current and lagged first differences of the explanatory variables as well

as the error correcting term (designed to capture adjustment speed to the long run equilibrium).

That is,

$$\Delta Y_t = \alpha + \sum_{i=1}^K \beta_i \Delta Y_{t-i} + \sum_{i=0}^K \theta \Delta Y_t X_{jt-i} + \gamma ECT_{t-1} \dots \dots \dots (4.28)$$

Where ΔX_{jt-i} and ECT_{t-1} represents a vector of the first differences of the explanatory variables and the error correcting term respectively. To achieve parsimony in the model, insignificant regressors from the general model are removed. In the process the adequacy of the model must be checked to support the reduction approach. This process is called "General to Specific Modeling".

CHAPTER V: ESTIMATION RESULTS AND DISCUSSION

5.1. Time series property of the data

Non stationary of data has often been regarded as a problem in empirical analysis. Working with non stationary variables lead to spurious regression results, from which further inference is meaningless. Hence the first move towards time series analysis is to carry out unit root test on the variables of interest. The test examines that whether the data series is stationary or not. To conduct the test, the conventional Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) test were used with and without a trend. The null hypothesis for the test claims that the data series under investigation has unit root. On the other hand, the alternative hypothesis claims that the series is stationary. The result of the test for the variables at level and at their first difference is presented in table 5.1.1 and 5.1.2 below respectively.

Table 5.1.1 DF and ADF test at level

| Variables | Dickey Fuller test | | Augmented Dickey Fuller test | | | |
|-------------------|--------------------|---------|------------------------------|---------|--------------|--------|
| | Lag length zero | | Lag length 1 | | Lag length 2 | |
| | constant | trend | constant | trend | constant | trend |
| LINV | -2.612 | -2.383 | -1.787 | -2.531 | -2.446 | -2.210 |
| LM | -0.9454 | -1.852 | -0.7479 | -0.7479 | -0.9423 | -1.907 |
| LX | -2.483 | -2.415 | -2.674 | -2.603 | -2.502 | -2.432 |
| LWGDP | -0.7036 | -2.164 | -1.059 | -2.384 | -1.665 | -2.912 |
| LS | -2.728 | -2.465 | -2.857 | -2.793 | -3.705 | -2.621 |
| LDF | -0.8228 | -1.289 | -0.7406 | -1.114 | -0.8772 | -1.087 |
| LGCON | -2.387 | -1.819 | -2.632 | -2.138 | -2.638 | -2.097 |
| LTR | -1.548 | -2.519 | -2.187 | -2.275 | 2.271 | -2.272 |
| LTOT | -1.686 | -2.006 | -1.412 | -2.665 | -1.077 | -2.287 |
| LRER | 0.1675 | -1.878 | -0.2956 | -2.245 | -0.1626 | -2.103 |
| LINV _o | -2.509 | -2.027 | -1.716 | -2.803 | -1.603 | -2.761 |
| LRGDP | 2.581 | -0.0151 | 1.956 | -0.4085 | 2.782 | 0.5983 |
| INF | -1.780 | -1.698 | -2.174 | -2.120 | -1.984 | -1.938 |
| LLAB | 1.365 | 0.1261 | 2.613 | 1.595 | 1.885 | 0.791 |
| LPA | -1.979 | -1.049 | -1.660 | -2.583 | -1.491 | -2.465 |
| LAID | -2.507 | -2.281 | -2.453 | -2.095 | -2.461 | -2.473 |

| | | | | | | |
|----|--------|--------|--------|--------|--------|--------|
| LH | -1.797 | -1.696 | -2.119 | -2.059 | -2.278 | -1.408 |
|----|--------|--------|--------|--------|--------|--------|

Table 5.1.2 DF and ADF test at first difference

| Variables | Dickey Fuller test | | Augmented Dickey Fuller test | | | |
|-----------|--------------------|----------|------------------------------|----------|----------------|----------|
| | Lag Length zero | | Lag length one | | Lag length two | |
| | constant | Trend | Constant | Trend | Constant | Trend |
| DLINV | -8.529** | -8.481** | 3.811** | -3.788** | -3.408* | -3.407* |
| DLM | -6.822** | -6.705** | -3.749** | -3.686** | -3.145* | -3.028* |
| DLX | -5.805** | -5.714** | -4.565** | -4.493** | -4.494** | -4.421** |
| DLWGDP | -4.942** | -5.142** | -3.064* | -3.233* | -3.367* | -3.693** |
| DLS | -8.340** | -8.273** | -4.099** | -4.080** | -3.556* | -3.550** |
| DLDF | -6.080** | -6.516** | -3.937** | -4.421** | -3.096* | -3.655** |
| DLGCON | -4.722** | -5.012** | -3.637** | -3.991** | -3.402* | -3.843** |
| DLTR | -9.928** | -9.784** | -6.446** | -6.355** | -5.318** | -5.246** |
| DLTOT | -6.934** | -6.837** | -5.386** | -5.300** | -3.509* | -3.398* |
| DLRER | -4.049** | -4.055** | -3.650** | -3.686** | -3.157* | -3.213* |
| DLINVo | -8.330** | -8.193** | -4.962** | -4.862** | -3.292* | -3.227* |
| DLRGDP | -4.287** | -5.019** | -3.989** | -5.134** | -2.484 | -3.600* |
| DINF | -8.010** | -7.946** | -7.154** | -7.154** | -3.992* | -3.958** |
| DLLAB | -6.559** | -7.324** | -2.447* | -2.528* | 0.02812 | -0.4871 |
| DLPA | -7.632** | -7.511** | -5.366** | -5.276** | -5.041** | -4.959** |
| DLAID | -6.224** | -6.398** | -3.622* | -3.781** | -3.774* | -3.819** |
| DLH | -4.755** | -4.698** | -3.424* | -3.387* | -2.626 | -2.599 |

Note, ** and * denotes rejection of the null hypothesis at 1% and 5% significance level respectively.

From the table one can conclude that all variables are non stationary at level. That is, the test conducted fails to reject the null hypothesis of unit root both with and without trend. However, the DF and ADF test shows that their first difference is stationary at conventional 1% and 5% level of significance. So the variables are, integrated of order one (I (1)).

5.2. Co integration analysis

5.2.1. Growth equation

In the Johansson maximum likelihood approach, the first step towards the co- integration analysis is the determination of an appropriate lag length that is going to be used in the VAR estimate. There are many tests that can be used to choose a lag length, however AIC and HQ are usual and the efficient ones. According to this criterion, the VAR estimate with the lowest AIC in absolute value is the most efficient one. Therefore, this study used AIC and HQ test to choose the appropriate lag length for the growth model. The model reduction test is also conducted to confirm the result.

Table 5.2.1 model reduction test for growth equation

| Progress to date | | | | | | | |
|--|----|-----|-----|----------------|---------|---------|----------|
| Model | T | p | | log-likelihood | SC | HQ | AIC |
| SYS(4) | 35 | 56 | OLS | 67.498130 | 1.8315 | 0.20201 | -0.65704 |
| SYS(3) | 35 | 105 | OLS | 104.53444 | 4.6926 | 1.6373 | 0.026603 |
| SYS(2) | 35 | 154 | OLS | 180.97100 | 5.3023 | 0.82119 | -1.5412 |
| SYS(1) | 35 | 203 | OLS | 1.000000 | -1.#INF | -1.#INF | -1.#INF |
| Tests of model reduction (please ensure models are nested for test validity) | | | | | | | |
| SYS(3) --> SYS(4): F(49,75) = 0.49689 [0.0308]* | | | | | | | |
| SYS(2) --> SYS(4): F(98,53) = 0.97037 [0.5590] | | | | | | | |
| SYS(1) --> SYS(4): F(147,10)= .NaN [1.0000] | | | | | | | |

According to the AIC the lag length with the lowest AIC value is chosen to be the most appropriate for the model. From the above table the second lag (system 3) is chosen in its value of AIC. This value is also confirmed by the model reduction test, in which a reduction of a model from SYS (3) to SYS (4) is rejected at 5 percent level of significant.

From stationary test of section 5.1, the result showed that all variables are integrated of order one in the growth equation. The existence of the same order of integration, therefore, allows us to test for Co integration among the variables

Table 5.2.2 Co integration test for growth equation

| Ho: r<= | Trace test | Eigen value | p-value |
|---------|------------|-------------|---------|
| 0 | 129.31 | 0.70137 | 0.028 * |
| 1 | 84.592 | 0.57157 | 0.229 |
| 2 | 53.230 | 0.38873 | 0.498 |
| 3 | 35.018 | 0.33045 | 0.452 |
| 4 | 20.176 | 0.30747 | 0.422 |
| 5 | 6.5814 | 0.16277 | 0.632 |
| 6 | 0.0080348 | 0.00021713 | 0.929 |

The trace test from table 5.2.2 confirms that the null of no co integrating vector is rejected at 5% level of significant in favor of at least one co integrating vector for the growth equation. Therefore there is one co integrating vector in this model. The existence of one co integrating vector means the first row of beta co efficient and the first column of alpha coefficient are important for further analysis. The result of alpha and beta coefficient for the growth equation is displayed in the following tables,

Table 5.2.3 the Beta co efficient

| LRGDP | LINVo | LLAB | LASQ | LPA | LAIID | LH |
|----------|-----------|----------|----------|-----------|---------|-----------|
| 1.0000 | -0.60352 | -0.5350 | 0.3400 | -0.20378 | -0.7100 | -2.4641 |
| -5.4347 | 1.0000 | 20.752 | -127.63 | -0.54294 | 257.77 | -1.9355 |
| -0.17068 | 0.0061709 | 1.0000 | 2.8218 | 0.059164 | -5.6520 | 0.0055020 |
| 0.043388 | 0.011128 | -0.69327 | 1.0000 | -0.025891 | -2.0018 | 0.078637 |
| -40.144 | -6.3603 | -15.874 | -992.43 | 1.0000 | 1987.5 | 47.958 |
| 0.10224 | -0.012216 | -1.1326 | -0.47594 | -0.022842 | 1.0000 | 0.028698 |
| 0.50834 | 0.091169 | -31.693 | -5.9170 | 0.27744 | 11.814 | 1.0000 |

Table 5.2.4 Alpha coefficients

| | | | | | | | |
|-------------------|-----------|-----------|-----------|----------|--------------|-----------|--------------|
| LRGD P | -0.028634 | -0.000201 | 0.57823 | 0.074376 | -0.00041775 | -0.080153 | 0.0016629 |
| LINV _o | 0.056533 | -0.056384 | -8.7735 | -3.1724 | 0.0088230 | 11.502 | 0.015180 |
| LLAB | -0.009113 | -0.002930 | -0.030538 | 0.10997 | -5.3413e-005 | 0.001265 | -5.1209e-005 |
| LASQ | -0.094727 | -0.032749 | -3.1837 | 13.084 | 0.0035561 | -1.4311 | 0.012436 |
| LPA | 0.026079 | 0.062545 | -3.4930 | 14.196 | -0.0062844 | -0.39138 | 0.0064595 |
| LAID | 0.050390 | -0.017141 | -1.5416 | 6.5962 | 0.0017114 | -0.69883 | 0.0062354 |
| LH | 0.031394 | -0.024358 | -1.3540 | -1.5319 | -0.0017696 | -0.72582 | 0.0016857 |

The above alpha coefficient table shows that aid squared is a higher tendency to adjust itself to the long run equilibrium. Investment and Aid also adjust themselves to the long run equilibrium faster than the other variables in the model. Its speed of adjustment towards its long run equilibrium is 94%.

Once of the main problem in most econometrics analysis is the identification of a given equation with specified endogenous and exogenous variables. Therefore to identify variables that are endogenously determined and conditional up on the other variables in the VAR, the test for weak exogeneity is conducted. This requires imposition of zero restriction on the first column of α coefficient.

Table 5.2.5 Weak exogeneity test

| Alpha coefficient | LR test of restrictions $\chi^2(1)$ | Probability value |
|-------------------|-------------------------------------|-------------------|
| LRGDP | 5.0564 | 0.0245* |
| LINV _o | 0.048165 | 0.8263 |
| LAID | 0.62431 | 0.4294 |
| LASQ | 0.55293 | 0.4571 |
| LPA | 0.037342 | 0.8468 |
| LH | 0.80159 | 0.3706 |
| LLAB | 7.6338 | 0.2642 |

From the above table, the result using the likelihood ratio test confirms that only the dependent variable real GDP rejects the null hypothesis of weak exogeneity at 5% level of significance. All explanatory variables did not reject, therefore, other than RGDP all explanatory variables are not endogenous to the system.

Once the variables are identified as endogenous and exogenous, the next step is to define the long run relationship of variables in the model and test for the significance of the long run parameters. To identify the significance of the long run parameters, test of zero restriction on the long run β parameters was conducted. Based on such tests the long run equation of growth with their respective diagnostic test is depicted as follows.

$$\begin{array}{rcccccc}
 LRGDP = & 0.6035 & 0.53 & -0.34 & 0.2037 & 0.71 & 2.4641 \\
 & LINVo & LAID & LASQ & LPA & LLAB & LH \\
 & 7.7296 & 9.9923 & 10.063 & 0.39558 & 8.4696 & 3.8609 \\
 & 0.0054^{**} & 0.0016^{**} & 0.0015^{**} & 0.5294 & 0.0036^{**} & 0.0494^*
 \end{array}$$

Vector Normality test: $\chi^2(14) = 44.114 [0.0001]^{**}$

Vector hetero test: $\chi^2(784) = 799.58 [0.3417]$

As shown in the above equation, the long run result depicts that all explanatory variables are significant in affecting growth at one percent level of significance except the policy variable. Moreover the variables from the long run equation show the expected sign.

The result of the diagnostic test⁴ confirms the adequacy of the model. That is, the null of homoscedacity is not rejected at any level of significant; therefore the model is free of hetroscedacity problem. The null of no normality is, however, rejected at 1% level of significance, however Gonzalo (1994) (cited in Nachegea 2001) suggests that the Johansen procedure is robust even with non normal vectors, therefore the Johansson result still holds for growth equation.

Generally, aid has a significant and positive impact on the growth of a country. According to the result a one percent increment in the aid GDP ratio leads to 0.53 percent increment in the RGDP of the country. This result is also consistent with the result reached by Abeba (2002) and Tsegay (2008). The result also confirms that the impact of aid on growth is significant at 1% level of significant. However, the impact of aid assisted by policy even if it is positive it is not significant that shows the impact of aid is not a policy dependent in Ethiopia. Aid squared, which shows positive and significant impact, suggests that the presence of capacity constraint in absorbing foreign aid beyond some level. Similar result is obtained by Wondwossen (2002) for Ethiopia and Burnside and Dollar (1997, 2000) for Developing countries.

Investment, which is independent of aid, has a positive impact on growth. A one percent increment in the investment to GDP ratio, on average, leads to a 0.60 percent increment in the GDP of a country. The above result also confirms that its impact is significant at one percent level of significant.

Labor force ratio and human capital have a significant and positive impact on the growth of a country. Referring to the result, a one percent increment in the labor force ratio results in

⁴ The full result of the diagnostic test can be found in the Appendix A.

increasing the RGDP of a country by 0.0036 percent. And this result is significant at one percent level of significant. And the increase in human expenditure ratio (a proxy to human capital) by one percent leads to a 0.049 percent increment in the RGDP of a country.

5.2.2. Investment equation

Determination of the optimal lag length is the first step towards the estimation of a VAR model (Alemayehu et al (2009)). Akaike information criteria has been used as the efficient way of determination of an optimal lag length for a given regression analysis. Hence, in order to determine an optimal lag length for this study, model reduction test was conducted for each models and the AIC is observed for each lags.

As shown in the following table, a VAR estimate is conducted successively from lag length four to one in the investment equation. Based on the AIC and HQ, the second lag is chosen to be optimal. This is also proven by the model reduction test. All model reduction from all lags to two is accepted.

Table 5.2.6 model reduction test for investment equation

| Progress to date | | | | | | |
|--|----|-----|----------------|---------|-----------|----------|
| Model | T | p | log-likelihood | SC | HQ | AIC |
| SYS(4) | 35 | 30 | OLS 39.113887 | 0.81236 | -0.060588 | -0.52079 |
| SYS(3) | 35 | 55 | OLS 60.952535 | 2.1040 | 0.50356 | -0.04014 |
| SYS(2) | 35 | 80 | OLS 77.657378 | 3.6889 | 1.3611 | 0.13386 |
| SYS(1) | 35 | 105 | OLS 124.54336 | 3.5493 | 0.49395 | -1.1168 |
| Tests of model reduction (please ensure models are nested for test validity) | | | | | | |
| SYS(2) --> SYS(3): F(25,57) = 0.67065 [0.8628] | | | | | | |
| SYS(1) --> SYS(3): F(50,48) = 1.1933 [0.2701] | | | | | | |

The λ trace statistics at the chosen lag length with its Eigen value and P- value confirmed that exist at most one co integrating vector. The test result is reported in table 5.2.7.

Table 5.2.7 Johansson co integration test for investment equation

| Ho: r <= | Trace test | Eigen value | P-value |
|----------|------------|-------------|---------|
| 0 | 78.558 | 0.66025 | 0.007** |
| 1 | 38.615 | 0.39490 | 0.279 |
| 2 | 20.027 | 0.26801 | 0.432 |
| 3 | 8.4839 | 0.19059 | 0.422 |
| 4 | 0.66007 | 0.017681 | 0.417 |

The result showed that the null hypothesis of no-co integrating vector ($r \leq 0$) is rejected at 1% significant level. On the other hand we fail to reject the alternative hypothesis of at most one co integrating vector ($r \leq 1$). The existence of one co integrating vector suggests that the first row of beta and the first column of alpha matrices are important for further investigation. In the following tables we presented α and β matrices of investment equation.

Table 5.2.8 Beta coefficient (scaled on diagonal)

| LINV | LS | LAID | LDF | LWGDP |
|---------|---------|----------|---------|----------|
| 1.0000 | -0.3517 | -0.23535 | 0.42196 | -0.20021 |
| -4.0321 | 1.0000 | 1.8368 | -1.4023 | 0.42848 |
| 13.080 | -17.735 | 1.0000 | -3.9269 | 4.9947 |
| 66.460 | -3.0337 | 14.880 | 1.0000 | 4.5587 |
| 23.971 | -23.423 | -2.8315 | -15.727 | 1.0000 |

Table 5.2.9 Alpha coefficient

| LINV | LS | LAID | LDF | LWGDP |
|------------|-----------|------------|--------------|--------------|
| -0.68404 | 0.033395 | 0.0019566 | -0.0029813 | -0.00044857 |
| -0.97630 | 0.0094828 | -0.0037413 | -0.0030789 | 0.00068605 |
| -0.0094688 | -0.14188 | 0.017471 | -4.3639e-005 | -0.00014300 |
| -0.46876 | 0.024654 | 0.010656 | -0.0076015 | 0.00084046 |
| -0.62958 | -0.069186 | -0.026697 | -0.011703 | -4.4941e-005 |

The value of α obtained from co integration shows strong long run feedback effect on saving and defense expenditure. This can be showed their speed of adjustment towards long run equilibrium

is as high as 97% and 63% respectively. Both variables adjust to their long run equilibrium at the speed of 97% and 63%. Once we identify α and β coefficients the next step is, Therefore, to identify variables that are endogenously determined and conditional up on the other variables in the VAR, and the test for weak exogeneity is conducted. This requires imposition of zero restriction on the first column of α coefficient.

Table 5.2.10 Weak exogeneity test

| Alpha co efficient | LINV | LS | LAID | LDF | LWGDGP |
|------------------------|----------|--------|------------|--------|--------|
| LR test of restriction | 12.550 | 5.182 | 0.00099961 | 1.7999 | 1.2526 |
| Probability value | 0.0004** | 0.0435 | 0.9748 | 0.1797 | 0.2631 |

From the above table, the result using the likelihood ratio test confirms that only the dependent variable investment rejects the null hypothesis of weak exogeneity at 1% level of significant. All explanatory variables did not reject, therefore, other than investment all explanatory variables are not endogenous to the system.

Once the variables are identified as endogenous and exogenous, the next step is to define the long run relationship of variables in the model and test for the significance of the long run parameters. To identify the significance of the long run parameters, test of zero restriction on the long run β parameters was conducted. Based on such tests the long run equation of investment with their respective diagnostic test is depicted as follow.

$$\begin{aligned}
 LINV = & 0.3517LS + 0.23535LAID - 0.4219LDF + 0.2002LWGDGP \\
 & \quad 13.143 \quad 20.786 \quad 8.1109 \quad 15.977 \\
 & \quad (0.0003**) \quad (0.0000**) \quad (0.0044**) \quad (0.0001**)
 \end{aligned}$$

Vector Normality test: $\chi^2(10) = 19.114 [0.0388]^*$

Vector hetero test: $\chi^2(300) = 290.22 [0.6467]$

As shown in the above equation, the long run result depicts that all explanatory variables are significant in affecting investment at one percent level of significance. Moreover the variables from the long run equation show the hypothesized sign except defense expenditure which results in a positive impact on investment.

The result of the diagnostic test confirms the adequacy of the model. That is, the null of homoscedacity is not rejected at any level of significant; therefore the model is free of hetroscedacity problem. The null of no normality is, however, rejected at 5% level of significance.

Generally the result reveals that, all of the explanatory variables included in model are statistically significant in affecting investment at 1% level of significant. As observed from the above equation domestic saving is a major determinant of investment in Ethiopia. A one percent increment in the domestic saving share of GDP results in a 0.35 percent increment in investment of a country. This is consistent with a result revealed by Wondwossen (2002) that domestic saving is a major financing mechanism of investment in Ethiopia.

The impact of official development assistance in the investment of a country is also statistically significant and high. Out of one percent increment in aid GDP ratio, the result shows 0.23 percent goes to investment. This confirms the theoretical argument of the two gap and three gap models which provokes one of the main use of aid is to finance investment saving gap in the developing countries.

The result is also consistent with the result of Tsegay (2009) who proves that aid has a significant impact on both private and public investment of Ethiopia. Abeba (2003) and Jifar (2002) also found this result.

The above equation also reveals a negative long run relationship between investment to GDP ratio and debt servicing in the country. That is when a share of debt servicing of a country increases by 1% a share of investment reduces by 0.42 percent. This may be as result of government resource mobility to such servicing that could have been used for investment or a fear of high tax by private investors that reduces a countries investment.

Government defense expenditure share and investment share are found having a positive relationship in the long run that is an increase in a share of defense expenditure on GDP results in increment in investment. This may look unrealistic from the theoretical point of view since an increment in the defense expenditure is considered as an increment in instability in the country. However, this is not the case in Ethiopia.

5.2.3. Import equation

From table 5.2.11 the AIC and HQ test suggests that the second lag or system three is appropriate for the Johansson co integration test of import equation. This result is also confirmed by the model reduction test that shows reduction from all lags to lag two is appropriate, since we fail to reject the null at any level of significance. However reduction from system two to system four, or from lag 3 to lag one is rejected at 5% level of significance. Therefore the second lag is appropriate for the import equation.

Table 5.2.11 model reduction test for import equation

| Progress to date | | | | | | | |
|--|----|-----|-----|----------------|---------|---------|---------|
| Model | T | p | | log-likelihood | SC | HQ | AIC |
| SYS(4) | 35 | 42 | OLS | 191.21335 | -6.6601 | -7.8822 | -8.5265 |
| SYS(3) | 35 | 78 | OLS | 232.95365 | -5.3883 | -7.6580 | -8.3545 |
| SYS(2) | 35 | 114 | OLS | 290.47303 | -5.0182 | -8.3354 | -10.084 |
| SYS(1) | 35 | 150 | OLS | 353.58486 | -4.9676 | -9.3324 | -11.633 |
| Tests of model reduction (please ensure models are nested for test validity) | | | | | | | |
| SYS(3) --> SYS(4): F(36,77) = 1.5513 [0.0547]* | | | | | | | |
| SYS(2) --> SYS(3): F(36,51) = 1.5799 [0.0658] | | | | | | | |
| SYS(1) --> SYS(3): F(72,33) = 1.1691 [0.3154] | | | | | | | |

Like to that of both investment and growth equations the co integration test from PC give reveals that there is one co integrating vector in the import equation. The trace test from the following table, the null of no Co integrating vector is rejected at 5% level of significance in favor of at most one Co integrating vector in the equation.

The existence of one co integrating vector suggests that the first row of β coefficient and the first column of α coefficient are important for further analysis.

Table 5.2.12 Co integration test for import equation

| Ho: r<= | Trace test | Eigen value | P-value |
|---------|------------|-------------|---------|
| 0 | 102.93 | 0.65340 | 0.013 * |
| 1 | 63.721 | 0.52260 | 0.138 |
| 2 | 36.363 | 0.40312 | 0.383 |
| 3 | 17.270 | 0.28220 | 0.629 |
| 4 | 5.0019 | 0.11408 | 0.807 |
| 5 | 0.52020 | 0.013961 | 0.471 |

Table 5.2.13 beta coefficients (scaled on diagonal)

| LM | LX | LAID | LTOT | LRER | LRGDP |
|------------|----------|-----------|----------|----------|----------|
| 1.0000 | -1.0223 | 0.58385 | -2.0084 | 2.2519 | -1.8314 |
| -0.37526 | 1.0000 | 0.31035 | -1.5594 | 2.6510 | -1.0841 |
| 2.9298 | -1.2461 | 1.0000 | 0.21880 | 1.1522 | -0.36114 |
| -3.6045 | 0.88641 | 2.7881 | 1.0000 | 5.0148 | 3.6617 |
| -0.0013731 | 0.044386 | -0.60486 | 0.079055 | 1.0000 | -0.51492 |
| -0.099853 | 0.15628 | -0.091634 | -0.52739 | -0.47792 | 1.0000 |

Table 5.2.14 Alpha coefficient

| | | | | | | |
|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| LM | 0.19751 | 0.32579 | -0.067509 | -0.018864 | -0.021470 | 0.043783 |
| LX | 0.54904 | -0.059479 | 0.048716 | -0.018435 | -0.30095 | 0.13729 |
| LAID | 0.35015 | 0.11307 | 0.19885 | 0.026016 | 0.43369 | -0.26698 |
| LTOT | 0.20213 | -0.30408 | -0.11189 | -0.041770 | -0.10981 | -0.024122 |
| LRER | 0.0063622 | -0.14878 | -0.092871 | 0.041817 | 0.25951 | -0.050539 |
| LRGDP | 0.017495 | -0.028893 | 0.0073093 | -0.010244 | 0.15054 | 0.039569 |

The alpha coefficient from the above table shows that once a shock is happened, export and Aid have a high tendency to deviate from their long run equilibrium. However, the tendency of RER is very low to deviate from its long run equilibrium is very low.

Weak exogeneity test for the import equation results in the logarithm of import (dependent variable) as endogenous. For the import variable, the null hypothesis of weak exogeneity is rejected at 1% level of significance. However, for all variables other than the dependent variable (explanatory variables) the null of weak exogeneity is not rejected at any level of significant that means these variables are endogenous to the model under consideration.

Table 5.2.15 weak exogeneity test for import equation

| Alpha coefficient | LR test of restriction $\chi^2(1)$ | Probability value |
|-------------------|------------------------------------|-------------------|
| LM | 7.0237 | 0.0080** |
| LX | 2.0086 | 0.1564 |
| LAID | 2.7524 | 0.0971 |
| LTOT | 0.070829 | 0.7901 |
| LRER | 3.4278 | 0.0641 |
| LRGDP | 0.23656 | 0.6267 |

Once the variable of interest are identified as endogenous and exogenous, the next task is to specify the long run equation of import and check for the significance of the explanatory variables, this requires making a zero restriction on the beta coefficients. The result of the long run equation and its significance is depicted as follows:

$$LM = 0.7155LX + 0.2429LAID - 0.3097LTOT - 0.1870LRER + 0.8162RGDP$$

| | | | | |
|-----------|-----------|----------|----------|-----------|
| 4.6562 | 4.2724 | 0.90328 | 0.93395 | 4.7605 |
| (0.0309*) | (0.0387*) | (0.3419) | (0.3338) | (0.0291*) |

Vector Normality test: $\chi^2(12) = 34.411 [0.0006] **$

Vector hetero test: $\chi^2(504) = 502.25 [0.5136]$

The long run estimation of the Ethiopian import equation reveals that all the explanatory variables are with their expected sign and the long run restriction on the beta coefficient shows that among the variables included in the model export as a ratio of GDP, AID as a ratio of GDP and real GDP are significant in affecting import in the long run. The diagnostic test for the model also reveals that the model fails to reject the null of no heteroscedasticity, however our model of import suffers from a problem of normality but we are still can accept the import equation since Johansson co integration is robust even with a problem of normality.

From the equation, export is found to be the main determinant of import in the country and its impact is significant in the long run. The null of non significance of export is rejected at 5 percent level of significance. According to the long run result of the model, a 1 percent increment in the export to GDP ratio leads to 0.71 percent increment in the import GDP ratio. This is consistent with a result of Gomanee et al (2005). This result confirms that export earning is a primary source of finance for the import of a country goods and services.

Official Development Assistance (AID) is also found to have a positive and significant impact on import of a country. Like to that of export, the null of non significance of aid is rejected at 5 % level of significance. And a 1% increment in the ratio of aid to GDP leads to 0.25 percent increment in the level of import to GDP ratio. Result is also familiar to that of Gomanee et al (2005) result. From the long run equation one can conclude that in Ethiopia, aid has been used to finance the gap between import and export which is consistent with the theory posed by the gap models.

Real exchange rate and terms of trade, even if they have the hypothesized sign they both have insignificant impact on the import of a country. The result with TOT can be explained in the way that the export of Ethiopia is not price sensitive due to capacity constraint and the lag in agricultural output. The RER result also indicates that the import of our investment goods is exchange rate insensitive in the long run.

Finally, growth of a country proxied by RGDP shows a positive and significant impact on the import of a country. The model reveals that the null non significance at 5% level of significance and a one percent increment in the real gross domestic product leads to a 0.81 percent increment in the ratio of import to GDP.

5.2.4. Government consumption expenditure equation

As long as the first move towards Johansson maximum likelihood estimation is a determination of an appropriate lag length, we have tried also, for the consumption function, to determine the optimal lag length. The summary of the table is displayed as follows,

Table 5.2.16 model reduction test for government consumption expenditure

| Progress to date | | | | | | | |
|--|----|-----|-----|----------------|---------|---------|---------|
| Model | T | p | | log-likelihood | SC | HQ | AIC |
| SYS(3) | 35 | 55 | OLS | 137.99319 | -2.2983 | -3.8988 | -4.7425 |
| SYS(2) | 35 | 80 | OLS | 176.52885 | -1.9609 | -4.2887 | -5.5159 |
| SYS(1) | 35 | 105 | OLS | 227.01016 | -2.3060 | -5.3613 | -6.9720 |
| Tests of model reduction (please ensure models are nested for test validity) | | | | | | | |
| SYS(2) --> SYS(3): F(25,57) = 1.8518 [0.0281]* | | | | | | | |
| SYS(1) --> SYS(3): F(50,48) = 2.0084 [0.0083]** | | | | | | | |

Unrestricted VAR estimation is conducted successively from lag length four to one. even if the model reduction is appropriate from lag length four to lag length three (system 1 to system 2), the reduction from lag length three to two, as well as lag length four to two is not accepted at 5% and 1% level of significant respectively. Therefore, lag length three is chosen to be appropriate for the consumption expenditure function.

We have identified the appropriate lag length, based on this lag length we have to identify how much co integrating vector exists in the consumption expenditure equation. The result is displayed in the following table,

Table 5.2.17 Co integration test for consumption expenditure equation

| Ho<= | Trace test | Eigen value | Probability value |
|------|------------|-------------|-------------------|
| 0 | 100.44 | 0.82669 | 0.000** |
| 1 | 39.098 | 0.40213 | 0.259 |
| 2 | 21.094 | 0.30924 | 0.362 |
| 3 | 8.1458 | 0.19426 | 0.457 |
| 4 | 0.58610 | 0.01606 | 0.444 |

The co integration vector result from the above table shows that, the null of no co integrating vector is rejected at 1 percent level of significant in favor of at most one co integrating vector in the consumption expenditure equation. Therefore we conclude there is one co integrating vector in the model.

The existence of one co integrating vector suggests that only the first row of the beta matrix and the first column of the alpha matrix are important for further analysis. The alpha and the beta matrices are displayed in the following tables,

Table 5.2.18 Beta co efficient

| LGCON | LTR | LAID | INF | LRGDP |
|----------|----------|----------|-----------|----------|
| 1.0000 | -0.54446 | -0.12997 | 0.0064232 | -0.22202 |
| -0.96715 | 1.0000 | -0.53753 | -0.10075 | 0.13850 |
| -3.3060 | 1.3693 | 1.0000 | 0.056036 | -0.51432 |
| 35.527 | -66.187 | 6.5172 | 1.0000 | -11.003 |
| -1.0284 | 1.4363 | -0.50768 | 0.43224 | 1.0000 |

Table 5.2.19 Alpha coefficient

| | | | | | |
|-------|-----------|-----------|-----------|------------|-----------|
| LGCON | -1.0188 | 0.16020 | -0.10146 | 0.00071342 | 0.017317 |
| LTR | -0.42066 | 0.18331 | -0.097865 | 0.0025403 | 0.020135 |
| LAID | -0.018997 | 0.23775 | -0.52057 | -0.0042263 | 0.0081322 |
| INF | -0.312 | -0.050088 | -1.0466 | 0.018613 | -0.26800 |
| LRGDP | -0.038844 | -0.10028 | -0.074531 | 0.0011613 | 0.0068500 |

Once the alpha and the beta coefficients are identified the next step towards the cointegration analysis is to check for the exogeneity of the variables that are included in the model. Weak exogeneity test was conducted for each variable in the consumption expenditure equation and the result is summarized as follows,

Table 5.2.20 Weak exogeneity test for expenditure equation

| Variables | LR test of restriction($\chi^2(1)$) | Probability value |
|-----------|---------------------------------------|-------------------|
| LGCON | 6.7374 | 0.0094** |
| LTR | 0.91463 | 0.3389 |
| LAID | 0.00040111 | 0.9840 |
| INF | 0.8585 | 0.2317 |
| LRGDP | 0.027996 | 0.8671 |

The test for the long run restrictions in the beta coefficient results in the endogeneity of the government consumption expenditure variable. From the above table, the null of weak exogeneity for the government consumption expenditure variable is rejected at 1% level of significance. However, the weak exogeneity for all other variables is not rejected at any level of significance so they are exogenous to the model.

Based on all the above tests the long run relationship between variables for the government consumption expenditure equation is given as follows,

$$\begin{aligned}
 LGCON &= 0.5446LTR + 0.12997LAID - 0.0064INF + 0.222LRGDP \\
 &34.149 \quad 18.054 \quad 1.4156 \quad 39.108 \\
 &0.0000^{**} \quad 0.0000^{**} \quad 0.2341 \quad 0.0000^{**}
 \end{aligned}$$

Vector hetero test: $\chi^2(450) = 457.19 [0.3971]$

Vector Normality test: $\chi^2(10) = 17.803 [0.0584]$

The above long run equation from the regression result shows that all of the variables are with their expected sign and except inflation all of them are significant determinants of the dependent variable. The diagnostic test of the model also confirms that neither normality problem nor heteroscedasticity problem exists in the model of interest.

From the result, Total revenue is found to be the major determinant of government consumption expenditure in the country, which means the expenditure of a country is based up on what the country gets from tax revenue. A one percent increase in the tax revenue ratio leads to a 0.54% increment in the government consumption share from GDP, in Average. Its impact is also significant at 1% level of significant.

The result also confirms the use of some part of aid for the consumption expenditure purpose; aid has a positive and significant impact on the government consumption expenditure. A one percent increment in the aid share leads to a 0.13 % increment in the share of expenditure of a country. This output also suggests that there is some level of aid fungibility in the country. This result is consistent with a result of Abeba (2002) and Gomanee et al (2005). Therefore one of the hypotheses of the gap models is proved to be true, in which aid can affect growth by financing the expenditure revenue gap of a country.

Even if it has an insignificant impact, inflation is found to have a negative impact on the government consumption expenditure. An increase in the price of a good and services force the government to reduce the amount that it spends for consumption purpose. However the real GDP of a country have a positive and highly significant impact on the consumption expenditure.

5.3. Vector error correction models

Vector error correction model captures both the long run and the short run dynamics relationship. While the change in the output from the short run output represents a variation in the short run, the coefficient of the error correction term captures the speed of adjustment towards the long run relationship.

In this study, a vector error correction model was estimated based on the Hendry's general to specific approach. Based on this approach a more general model is first estimated and step by step reduction and testing process is conducted until the parsimonious model is obtained. In each step statistically insignificant regressors were dropped based on the diagnostic test result.

In modeling short run dynamics, all weakly exogenous variables from the long run model with their lag are included by differencing once. This differencing is required to reduce the possibility of multi co linearity problem which could be resulted from correlation between current and lag value of a variable (Alemayehu et al, 2009).

In addition, Error correction term, which is derived from the long run model, was included in the model by lagging one year. The rationality for the lag is, according to Hendry and Juselius (2002), economic agents taking all available information at period $t-1$, they rationally undertake actions at time t , which helps to minimize errors.

5.3.1. Growth short run equation

Based on the error correction term obtained from the long run estimation, a dynamics equation of growth model is reported in the table 5.3.1.

The short run result for the growth equation shows that all variables are with their expected sign. Investment that is not explained by aid has a positive impact on growth however its impact is insignificant in the short run. Labor force and Human capital have also a positive contribution on growth however their impact is not significant in the short run.

Table 5.3.1 Short run dynamics of growth equation

| <i>Variables</i> | Coefficient | Std.Error | t-value | t-prob |
|---|-------------|-----------|---------|---------|
| DLRGDP_1 | 0.611758 | 0.2466 | 2.48 | 0.020* |
| Constant | 0.0109317 | 0.01352 | 0.809 | 0.426 |
| DLINVo_1 | 0.0143693 | 0.009731 | 1.48 | 0.152 |
| DLLAB_2 | 0.0560495 | 1.345 | 0.0417 | 0.967 |
| DLASQ_1 | -0.0504722 | 0.02455 | -2.06 | 0.050* |
| DLPA_1 | 0.0971383 | 0.02576 | 3.77 | 0.001** |
| ECM_1 | -0.535907 | 0.3519 | -1.52 | 0.140 |
| DLAID | 0.0108027 | 0.04110 | 0.263 | 0.795 |
| DLAID_2 | 0.0174679 | 0.03867 | 0.452 | 0.655 |
| DLH | 0.0381518 | 0.08989 | 0.424 | 0.675 |
| R ² = 0.429266 DW = 1.81 F(9,26) = 2.173 [0.059] | | | | |
| AR 1-2 test: F(2,24) = 0.91606 [0.4136] | | | | |
| ARCH 1-1 test: F(1,24) = 1.0665 [0.3120] | | | | |
| Normality test: Chi ² (2) = 3.0422 [0.2185] | | | | |
| hetero test: F(18,7) = 0.34652 [0.9670] | | | | |
| RESET test: F(1,25) = 0.091180 [0.7652] | | | | |

Aid (ODA) has a positive impact on growth like it is expected, however its impact is insignificant also in the short run. The short run model explains that aid will have a positive impact on growth of a country in the short run if and only if it is supplemented by good policy. This is confirmed by the policy variable PA which is positive and significant in the short run. The lagged error correction term (ECM_{t-1}) included in the model to capture the long run dynamics between the co integrating series is negative and between zero and one. The coefficient of this error correction term also implies that in one year the real gross domestic product adjusts itself by 53%.

The diagnostic test of the short run model for growth shows that there is no problem at all. From the Breusch Godfrey LM test for serial correlation the output confirm no indication of serial auto correlation problem. The white test for heteroscedasticity also fails to reject the null of homoscedasticity for the growth equation. The ARCH test also shows no problem with regard to Auto regressive conditional heteroscedasticity errors. The Ramsey and the Jarque Bera test explain no problem of functional misspecification and normality respectively. The Goodness of fit of the model (R^2) shows, 43 percent of a variation in the independent variable (RGDP) is explained by the variation in the explanatory variables included in the model.

5.3.2. Investment short run equation

Once the stationarity of the variables and co integration test is conducted, based on the error correction term saved from the long run estimation the short run dynamics of the investment function is obtained as follows,

Table 5.3.2 short run dynamics of investment equation

| Variables | Coefficient | Std.Error | t-value | t-prob |
|---|-------------|-----------|---------|---------|
| DLINV_1 | 0.0583491 | 0.1612 | 0.362 | 0.720 |
| Constant | 0.00738197 | 0.01992 | 0.371 | 0.714 |
| DLS | 0.597710 | 0.09487 | 6.30 | 0.000** |
| DLWGDP | 0.0482518 | 0.03648 | 1.32 | 0.197 |
| VLINV_1 | -0.286065 | 0.2127 | -1.35 | 0.189 |
| DLDF_2 | -0.0130629 | 0.08971 | -0.146 | 0.885 |
| DLAID_1 | 0.0475176 | 0.08786 | 0.541 | 0.593 |
| DLWGDP_2 | 0.0311679 | 0.05418 | 0.575 | 0.570 |
| $R^2 = 0.712202$ $F(7,28) = 9.899 [0.000]**$ $DW = 2.26$ | | | | |
| AR 1-2 test: $F(2,26) = 1.1703 [0.3261]$ ARCH 1-1 test: $F(1,26) = 0.34254 [0.5634]$ Normality test: $\chi^2(2) = 0.41607 [0.8122]$ hetero test: $F(14,13) = 0.34366 [0.9714]$ RESET test: $F(1,27) = 0.15689 [0.6952]$ | | | | |

All variables included in the model are with their hypothesized sign. However it is only saving, that determines investment significantly in the short run. Aid has a positive but insignificant effect on investment in the short run. Both lags of defense expenditure have a positive impact but insignificant impact on investment like to that of the long run effect. Debt servicing has a negative impact on investment in the short run. The lagged error correcting term is also negative and between zero and one, suggests that in one year the investment adjusts itself to the equilibrium by 28%.

The diagnostic test for the short run investment model shows no problem related with serial autocorrelation, heteroscedasticity, autocorrelation conditional heteroscedasticity, functional misspecification and normality.

The goodness measure R^2 says that, 71% of the variation in the investment in the short run is explained by the variation in the variables included in the model. The all over test of significant F-test also shows that all variables in the model except the constant are jointly significant in affecting investment of the country in the short run.

5.3.3. Import short run equation

Like the growth and the growth equation, the existence of stationary and co integration permits us to conduct the short run dynamics model for import that will capture both the short run and the long run dynamics. Based on the residual saved for the long run estimation the following short run model is obtained for import of Ethiopia.

Almost all of the variables are with their expected sign. Like to that of the long run impact, export is a significant determinant of import in the short run. Aid does not have a significant

impact in the short run even if it has positive impact. Terms of trade has a negative impact on the import of a country in the short run in its level and in its lag however they are insignificant. RGDP has a positive impact but insignificant effect on the import. Regarding the real exchange, according to the output it has a significant negative impact however its lag has a positive significant impact on import.

The error correcting term for import is negative and between zero and one, and it is also significant. The coefficient of the error correcting term implies that in one year import adjusts itself to equilibrium by 39 percent.

Table 5.3.3 short run dynamics of import equation

| variable | Coefficient | Std.Error | t-value | t-prob |
|--|-------------|-----------|---------|---------|
| DLM_2 | 0.388618 | 0.1338 | 2.90 | 0.008** |
| Constant | 0.0163098 | 0.02326 | 0.701 | 0.490 |
| DLX_1 | 0.242485 | 0.09181 | 2.64 | 0.014* |
| DLTOT | -0.161651 | 0.1432 | -1.1 | 0.270 |
| DLRGDP | 0.229338 | 0.3086 | 0.743 | 0.464 |
| DLAID_1 | 0.0906853 | 0.07202 | 1.26 | 0.220 |
| ECM_1 | -0.395788 | 0.1393 | -2.84 | 0.009** |
| DLTOT_1 | -0.172943 | 0.1415 | -1.22 | 0.233 |
| DLRGDP_1 | -0.985914 | 0.3326 | -2.96 | 0.007** |
| DLRER | -0.352161 | 0.1504 | -2.34 | 0.028* |
| DLRER_1 | 0.803336 | 0.1396 | 5.75 | 0.000** |
| R ² = 0.728326 F(10,25) = 6.702 [0.000]** DW = 2.13 | | | | |
| AR 1-2 test: F(2,23) = 0.20185 [0.8186] | | | | |
| ARCH 1-1 test: F(1,23) = 0.38836 [0.5393] | | | | |
| Normality test: Chi ² (2) = 1.4263 [0.4901] | | | | |
| hetero test: F(20,4) = 0.15224 [0.9985] | | | | |
| RESET test: F(1,24) = 5.2662 [0.3308] | | | | |

The diagnostic term for the import equation in the short run shows no problem related with serial autocorrelation, heteroscedasticity, autocorrelation conditional heteroscedasticity, functional misspecification and normality.

The goodness measure R^2 says that, 73% of the variation in the import in the short run is explained by the variation in the variables included in the model. The all over test of significant F-test also shows that all variables in the model except the constant are jointly significant in affecting import of the country in the short run.

5.3.4. Government consumption expenditure short run equation

The short run model for government expenditure as depicted in table 5.3.4 Shows that all variables are with their expected sign. And the adjustment co efficient (error correcting term) is negative, between zero and one, and significant. The coefficient for this error correction term explains that in one year period government consumption expenditure adjusts itself to the long run equilibrium by 44%.

Table 5.3.4 short run dynamics of government consumption expenditure

| Variables | Coefficient | Std.error | t-value | t-probability |
|--|-------------|-----------|---------|---------------|
| DLGCON_1 | 0.161255 | 0.1553 | 1.04 | 0.309 |
| Constant | -0.0243419 | 0.009212 | -2.64 | 0.014* |
| DLTR_1 | 0.143187 | 0.1675 | 0.855 | 0.401 |
| DLAID | 0.0771175 | 0.03329 | 2.32 | 0.029* |
| DLINF_3 | -0.00719631 | 0.005704 | -1.26 | 0.219 |
| DLRGDP_3 | 0.607502 | 0.1592 | 3.82 | 0.001** |
| ECG_1 | -0.443189 | 0.1546 | -2.87 | 0.008** |
| DLAID_2 | 0.104003 | 0.03354 | 3.10 | 0.005** |
| DLTR | 0.809978 | 0.06431 | 12.6 | 0.000** |
| $R^2 = 0.933599$ $F(8,25) = 43.94 [0.000]**$ $DW = 1.85$ | | | | |
| AR 1-2 test: $F(2,23) = 0.097503 [0.9075]$ ARCH 1-1 test: $F(1,23) = 1.2015 [0.2844]$ Normality test: $\chi^2(2) = 2.2588 [0.3232]$ hetero test: $F(16,8) = 0.37628 [0.9542]$ RESET test: $F(1,24) = 0.0021623 [0.9633]$ | | | | |

From the output lag one of tax revenue is found to have a positive significant impact on Consumption expenditure. Therefore tax revenue is the significant determinant of consumption expenditure both in the short run and long run.

Aid has a positive and a significant impact on expenditure of the government in the short run. This result is consistent with a result of Gomanee et al (2005) in which aid is somewhat fungible in sub-Saharan countries. Even if inflation have a significant impact on consumption expenditure on the long run its impact on the short run is insignificant.

The diagnostic test for the government consumption expenditure, like the other equations, confirms no problem related with serial autocorrelation, heteroscedasticity, autocorrelation conditional heteroscedasticity, functional misspecification and normality.

The goodness measure R^2 says that, 93% of the variation in the government consumption expenditure in the short run is explained by the variation in the variables included in the model. The all over test of significant F-test also shows that all variables in the model except the constant are jointly significant in affecting government consumption of the country in the short run.

CHAPTER VI: CONCLUSION AND POLICY IMPLICATION

6.1. Conclusion

Most developing countries are characterized by low level of domestic saving which is insufficient to finance the investment, huge level of trade deficit and high level of budget deficit. These problems therefore necessitate the country to depend on external assistance from developed countries and downer organizations. However, there has been a great debate on the contribution of this foreign assistance to the economic growth and how this impact transmitted. Therefore, the main focus of this study is to examine the impact of foreign aid on economic growth through its transmission mechanisms (i.e. investment, import and government consumption expenditure) of Ethiopia using annual time series data from 1970/1 to 2008/9.

In this study, based on theories and literatures, the equations for growth, investment, and import and government consumption expenditure have been identified and estimated using the Johansson maximum likelihood estimation technique. However, before looking to their co integration relationship, each variables were tested for their time series property using DF and ADF test of stationary and all variables are identified as $I(1)$. The lambda trace test conducted for each model resulted in the null hypothesis of zero co integrating vector is rejected in favor of one co integrating relationship.

In line with our main objective first we tested a relationship between foreign aid and economic growth. The result showed that all explanatory variables are with their expected signs. Labor force, investment and human capital have a positive contribution on the real GDP both in the short and long run. However, since it takes time to see the outcome of education and physical

investment, they are insignificant in the short run. On the other hand, Aid squared variable has significant and negative impact on growth showing absorptive capacity constraint of the economy. The long run estimated equation of economic growth reveals that aid has significant and positive impact on growth, but insignificant in the short run indicating that most of the aid has been used to finance investment which has a long gestation period. However when it is assisted by policy it has a positive and significant impact in the short run only.

Investment is identified as one of the transmission mechanism through which aid affects growth; therefore investment equation is estimated to examine its interaction with aid. The result confirms that saving is a main determinant of investment both in the long run and short runs however debt servicing has a negative and significant impact on investment which confirms the existence of debt overhang problem with the loan component of aid. Aid has significant and positive contribution on investment in the long run indicating Foreign aid to be used to finance the gap between saving and investment.

The empirical result on import equation confirms that export is a main determinant of import both in the long run and short run like it is expected. Real GDP, even if it is insignificant in the short run, has a significant and positive impact on import both in the long run and short run. Real exchange rate and terms of trade have a negative and insignificant impact on import in the long run, however RER have a significant impact on import in the short run. Aid has a positive contribution on import both in the long run and short run but it is insignificant in the short run, this justifies the importance of aid in financing the gap between export and import like it is hypothesized.

Government consumption expenditure function, which is identified to test whether aid has an impact on government consumption expenditure, is identified and estimated. The result reveals that government revenue is a main financing method of government expenditure. Apart from that Aid has a significant contribution both in the short run and the long run; this verifies our hypothesis of one of the use of aid in bridging the gap between government consumption expenditure and revenue. Real GDP is found to have a positive and significant impact on Government consumption expenditure both in the long run and short run. However, Inflation ends having a negative but insignificant impact in the long run.

6.2. Policy implication

Based on the empirical conclusions, the following plausible policy implications are drawn by the researcher that are recommended to be taken by the government of Ethiopia,

The Ethiopia economy is characterized by low level of saving, huge trade deficit and Budget deficit, therefore foreign aid can be used to finance these problems and enhance economic growth if it is supplemented by good monetary, fiscal and trade policies. For Foreign aid to have a significant impact on economic growth in the long run, it has to be invested on the selective and productive investment areas including basic infrastructural development that facilitate the productivity of other sectors of the economy.

However, most of the investment of a country is based on the import of capital and intermediate goods. The government can use the foreign exchange, from foreign assistance, to import intermediate and investment goods instead of consumable goods and services.

From the empirical result we have identified the problem of aid fungibility in the short run, therefore for foreign aid to have a positive and significant impact on growth in the short run it has to be assisted by good policy.

Foreign aid are composed of grants and loans, however the debt servicing associated with loan component of aid erodes the investment of a country which leads a larger loss in the present and future output of the country. Hence, external borrowing decision must be linked to a general policy framework that will guarantee profitability of invested funds and generation of foreign exchange earnings for external debt servicing.

REFERENCES

- Abeba S. (2002), "Macroeconomic impact of external Assistance in Ethiopia", Unpublished M.Sc. thesis, AAU
- Alemayehu G. and Befekadu D. (1999), "Management Transition from Aid Dependence in Ethiopia", in Lancaster, C. and S.Wange, eds., *Managing Transition from Aid in SSA* Macmillan.
- Alemayehu G., Daniel Z and Ndung'u N. (2009), "Applied time series Econometrics: A practical Guide for Macroeconomic researches with a focus on Africa", Addis Ababa University, Central Bank of Kenya and African Research consortium.
- Bacha E. (1983), "Growth with limited supplies of foreign exchange: A reappraisal of the two gap model", *Departmenta de economica*.
- Bacha E. (1990), "A three gap model of Transfer and the GDP growth rate in Developing countries", *Journal of development economics*, 32(2):279-296.
- Barro R.J. and Lee W. (1993), "International comparisons of Education Attainment", *Journal of monetary economics*, 32, pp. 363-394.
- Befekadu D and Birhanu N. (1999/2000), *Annual Report on the Ethiopian Economy*, Addis Ababa, EEA.
- Benjamin N., Devareyan S. and Weiner (1989), "The Dutch Disease in Developing Country: Oil Revenues in Cameroon" *Journal of Development Economics*; Vol.30: 71-92.
- Burnside C. and Dollar D. (1997), "Aid, Policies and Growth", *macroeconomics and growth Division policy research department*, World Bank.
- Burnside C. and Dollar D. (2000), "Aid, Policies and Growth", *American Economic Review* 90(4), 847-868.

- Chenery H. and Strout A. (1966), “foreign Assistance and Economic Development”, *American Economic Review*, 4 September, 679-733.
- Dalgaard C. and Hansen H. (2000), “Aid, Growth and Good Policies”, credit research paper 00/17, Center for Research in Economic Development and International Trade University of Nottingham.
- Dawit W. and Yemisrach T. (2001), “The Impact of Foreign Financing on Economic Performance in Ethiopia”. Paper Presented at the 11th Annual Conference on the Ethiopian Economy.
- Devrarajan S., Rajkumar S. and Swaroop V. (1999), “What Does Aid to Africa Finances?” Development research Group, The World Bank
- Dowling J. and Hiemenz U (1983), “Aid, Saving and Growth in the Asian Region”, the *Journal of Institute of developing Economics*, 21(1):3-13.
- Easterly W. (2001), Debt Relief, *Foreign Policy* No.127 ((Nov-Dec, 2001)): p.20-26.
- Easterly W. (2009), “Can the west save Africa?” *Journal of Economic Literature*.
- Enders W. (1995), “Applied Econometric Time Series”, John Wiley and Sons, New York
- Engle R. and granger C. (1987), “Co integration and Error Correction: Representation, Estimation and Testing”, *Econometrica*, 55: 251-278.
- Gomanee K., Girma S. and Morrissey O. (2001), “Aid and Growth: Accounting for Transmission Mechanism in Sub-Sahara Africa”
- Gomanee K., Girma S. and Morrissey O. (2005), “Aid and Growth in Sub Saharan Africa: Accounting for Transmission Mechanisms”, Research paper No. 2005/60, United Nation University.

- Griffin K. (1970), "Foreign Capital, Domestic Savings and Economic Development", Bulletin of the Oxford University, Institute of Economics and Statistics, Vol. 32(2): 99-112.
- Griffin K. and J. Enos (1970), "Foreign Assistance: Objectives and Consequences," Economic Development and Cultural Change, Vol. 18: 313-327.
- Gujarati D. (1995), "Basic Econometrics", Mc Graw-Hill, Inc. 3rd edition.
- Haile K. and Alemayehu G. (2000) "Savings, Foreign aid and Economic Growth: A Review of the Theory and the Existing Evidence", Paper Presented at the Tenth Annual Conference on the Ethiopian Economy.
- Hailemariam A. (2010), "The impact of external debt on economic growth and private investment", Unpublished M.Sc. thesis, AAU.
- Hansen H. and Tarp F. (2001), "Aid and Growth Regressions", Journal of Development Economics, 64(2): 547-570.
- Hansen, H. (2001), "The Impact of Aid and External Debt on Growth and Investment: Insight from Cross-Country Regression Analysis", Wider Conference on Debt Relief, Helsinki, 17-18 August 2001.
- Harris R. (1995), "Using Co integration Analysis in Econometric Modeling", Prentice Hall/Harvester Wheat Sheaf.
- Hendry D. (1997), "Dynamic Econometrics", Oxford University Press
- Hjertholm P., Laursen J. and White H. (2000), "Macroeconomic issue in foreign aid", DREG, University of Copenhagen.
- Jiffar T. (2002), "The Impact of Foreign Aid on Public Spending: The Ethiopian Case", Unpublished M.Sc. Thesis, AAU.

- Johansen S. (1988), “Statistical Analysis of Co integration Vectors”, *Journal of economic dynamics and control*, 12(2/3): 231-254.
- Johansen S. (1991), “Estimation and Hypothesis Testing of Co integration Vectors in Gaussian vector Autoregressive model”, *Econometrica*, 1551-1580
- Lensink R. and Morrissey O. (2000), “Aid Instability as a Measure of Uncertainty and the Positive Impact of Aid on Growth”, *Journal of Development Studies*,
- Levy, V. (1987), “Anticipated Development Assistance, Temporary Relief Aid and Consumption Behavior of Low-Income Countries”, *the Economic Journal*, 97, 446-458.
- Lloyd T., Morrissey O. and Osei R. (2001), “Aid, Exports and Growth in Ghana”, *Center for Research in Economic Development and International Trade, University of Nottingham*.
- Lucas, R.E. (1988), “On the Mechanics of Economic Development”, *Journal of Monetary Economics*, 22(1), pp. 3-42.
- MEDaC (1999), “Survey of the Ethiopian Economy: Review of Post Reform Developments, 1992/93 - 1997/98”
- Mosley P., Hudson J., Horrell S. (1987), “Aid the Public Sector and the Market in Less Developed Countries”, *the Economic Journal*, 97, 616-641.
- MoFED (2005), *Bulletin of External Economic Cooperation*, Addis Ababa.
- Morrissey O. (2001), “Does Aid Increase Growth”, *Progress in Development Studies*, 1, 37-50.
- National Bank of Ethiopia (2005), *Annual report on the Ethiopian Economy*.
- National Bank of Ethiopia (2009), *Annual report on the Ethiopian Economy*.

- Nalo D. (1993) "Constraints to Growth in Developing Countries and the Three-Gap Model"
Eastern Africa Economic Review (9)2:247-264.
- Ngange J.B. (2008), "The impact of foreign aid on economic growth and development in
Cameroon", Master Degree project, University of Skevde.
- Obstfeld M. (1999). "Foreign resource inflows, saving, and growth", Cambridge, UK:
Cambridge University Press.
- Opeskin B. (1996), "The Moral Foundations of Foreign Aid", World Development, 24(1): 21-44
- Papanek G. (1973), "Aid, Foreign Private Investment, savings, and Growth in Less Developed
Countries", Journal of Political Economy 81(1): 120-130.
- Rana P. and Dowling J. (1988), "The Impact of Foreign Capital on Growth: Evidence from
Asian Developing Countries", the Journal of Institute of Developing Economics.
- Rosenstein Rodan, P.N (1961), "International Aid for Underdeveloped Countries," Review
Economics and Statistics, Vol. 43(May): 107-38.
- Serven L. (1996), "Irreversibility, Uncertainty, and private investment, Analytical issue and
some lessons for Africa", The World Bank.
- Sewasew P. (2002), "The Relationship between Import and GDP Growth in Ethiopia: An
Empirical Analysis", Unpublished M.Sc. Thesis, AAU.
- Taylor L. (1994), "Gap Models", Journal of Development Economics, 45(1)17-34.
- Taylor L. (1993), "The rocky road to reform: trade, industrial, financial and Agricultural
strategies", World Bank, Volume 21.
- Todaro M. (1994), "Economic Development", Longman Publishing Ltd., London and New
York.

- Tolessa A. (2001), "The Impact of Foreign Aid on Domestic Saving, Investment and Economic Growth: The Case of Ethiopia", Unpublished M.Sc. Thesis, AAU.
- Tsegay G. (2008), "Foreign aid, investment and Growth in Ethiopia", M.Sc. Thesis, University of Copenhagen.
- Weisskopf, T. (1972), "The Impact of Foreign Capital Inflow on Domestic Savings in Underdeveloped Countries", *Journal of International Economics*, 2, 25-38.
- White H. (1992a), "The Macroeconomic impact of development aid: A critical Survey," *Journal Of Development Studies*, 28(2): 163-240.
- Wondwossen T. (2003), "An empirical investigation of the Aid-growth relationship in Ethiopia." Unpublished M.Sc. thesis, AAU
- World Bank (1992, 2002, 2006 and 2008), *World Development Indicators*, Washington DC: The World Bank.

APPENDICES

APPENDIX A: DIAGONSTIC TESTS

i. Growth equation

| | |
|---------|---|
| LRGDP | : Portmanteau(5): 0.373934 |
| LINVo | : Portmanteau(5): 2.23793 |
| LAID | : Portmanteau(5): 2.40688 |
| LPA | : Portmanteau(5): 2.80648 |
| LASQ | : Portmanteau(5): 2.37426 |
| LEDU | : Portmanteau(5): 1.76678 |
| LLabour | : Portmanteau(5): 2.58288 |
| LRGDP | : Normality test: $\text{Chi}^2(2) = 0.96824$ [0.6162] |
| LINVo | : Normality test: $\text{Chi}^2(2) = 1.4310$ [0.4889] |
| LAID | : Normality test: $\text{Chi}^2(2) = 0.38651$ [0.8243] |
| LPA | : Normality test: $\text{Chi}^2(2) = 12.399$ [0.0020]** |
| LASQ | : Normality test: $\text{Chi}^2(2) = 0.39143$ [0.8222] |
| LEDU | : Normality test: $\text{Chi}^2(2) = 10.378$ [0.0056]** |
| LLabour | : Normality test: $\text{Chi}^2(2) = 12.138$ [0.0023]** |
| LRGDP | : ARCH 1-1 test: $F(1,26) = 0.00074062$ [0.9785] |
| LINVo | : ARCH 1-1 test: $F(1,26) = 0.43300$ [0.5163] |
| LAID | : ARCH 1-1 test: $F(1,26) = 0.38828$ [0.5386] |
| LPA | : ARCH 1-1 test: $F(1,26) = 0.0020826$ [0.9639] |
| LASQ | : ARCH 1-1 test: $F(1,26) = 0.38453$ [0.5406] |
| LEDU | : ARCH 1-1 test: $F(1,26) = 0.12858$ [0.7228] |
| LLabour | : ARCH 1-1 test: $F(1,26) = 0.16336$ [0.6894] |
| LRGDP | : hetero test: $\text{Chi}^2(28) = 17.461$ [0.9389] |
| LINVo | : hetero test: $\text{Chi}^2(28) = 26.427$ [0.5496] |
| LAID | : hetero test: $\text{Chi}^2(28) = 28.892$ [0.4180] |

| | | |
|---------|----------------|--|
| LPA | : hetero test: | Chi ² (28)= 18.116 [0.9232] |
| LASQ | : hetero test: | Chi ² (28)= 28.942 [0.4155] |
| LEDU | : hetero test: | Chi ² (28)= 23.178 [0.7241] |
| LLabour | : hetero test: | Chi ² (28)= 32.896 [0.2396] |

ii. Investment equation

| | | |
|-------|--------------------|--|
| Linvt | : Portmanteau(5): | 2.18539 |
| LS | : Portmanteau(5): | 1.92229 |
| LAID | : Portmanteau(5): | 3.09872 |
| LDF | : Portmanteau(5): | 1.94128 |
| LWAR | : Portmanteau(5): | 1.94183 |
| Linvt | : Normality test: | Chi ² (2) = 2.5848 [0.2746] |
| LS | : Normality test: | Chi ² (2) = 0.49504 [0.7807] |
| LAID | : Normality test: | Chi ² (2) = 0.74751 [0.6881] |
| LDF | : Normality test: | Chi ² (2) = 14.198 [0.0008]** |
| LWAR | : Normality test: | Chi ² (2) = 9.8695 [0.0072]** |
| Linvt | : ARCH 1-1 test: | F(1,28) = 0.33013 [0.5702] |
| LS | : ARCH 1-1 test: | F(1,28) = 0.043914 [0.8355] |
| LAID | : ARCH 1-1 test: | F(1,28) = 0.77347 [0.3866] |
| LDF | : ARCH 1-1 test: | F(1,28) = 0.14029 [0.7108] |
| LWAR | : ARCH 1-1 test: | F(1,28) =7.0028e-005 [0.9934] |
| Linvt | : hetero test: | F(20,4) = 0.37601 [0.9372] |
| LS | : hetero test: | F(20,4) = 0.35110 [0.9490] |
| LAID | : hetero test: | F(20,4) = 0.13218 [0.9993] |
| LDF | : hetero test: | F(20,4) = 0.35034 [0.9494] |
| LWAR | : hetero test: | F(20,4) = 0.20607 [0.9933] |

iii. Import equation

| | |
|-------|---|
| LIMP | : Portmanteau(5): 3.77722 |
| LEXP | : Portmanteau(5): 10.5371 |
| LAID | : Portmanteau(5): 3.16765 |
| LTOT | : Portmanteau(5): 4.49975 |
| LRER | : Portmanteau(5): 2.21198 |
| LRGDP | : Portmanteau(5): 3.40462 |
| LIMP | : Normality test: $\text{Chi}^2(2) = 0.039407$ [0.9805] |
| LEXP | : Normality test: $\text{Chi}^2(2) = 0.59541$ [0.7425] |
| LAID | : Normality test: $\text{Chi}^2(2) = 1.1748$ [0.5558] |
| LTOT | : Normality test: $\text{Chi}^2(2) = 3.7074$ [0.1567] |
| LRER | : Normality test: $\text{Chi}^2(2) = 62.493$ [0.0000]** |
| LRGDP | : Normality test: $\text{Chi}^2(2) = 0.44346$ [0.8011] |
| LIMP | : ARCH 1-1 test: $F(1,27) = 0.30460$ [0.5856] |
| LEXP | : ARCH 1-1 test: $F(1,27) = 1.2103$ [0.2810] |
| LAID | : ARCH 1-1 test: $F(1,27) = 1.4396$ [0.2406] |
| LTOT | : ARCH 1-1 test: $F(1,27) = 0.029502$ [0.8649] |
| LRER | : ARCH 1-1 test: $F(1,27) = 0.0049984$ [0.9442] |
| LRGDP | : ARCH 1-1 test: $F(1,27) = 5.6042$ [0.0253]* |
| LIMP | : hetero test: $\text{Chi}^2(24) = 19.132$ [0.7449] |

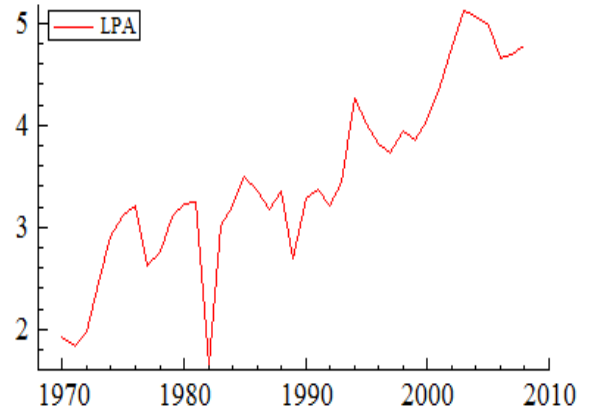
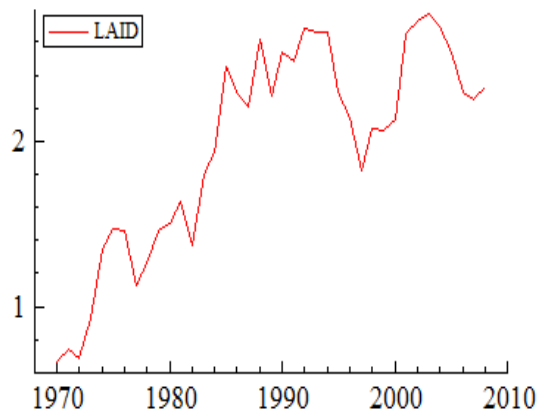
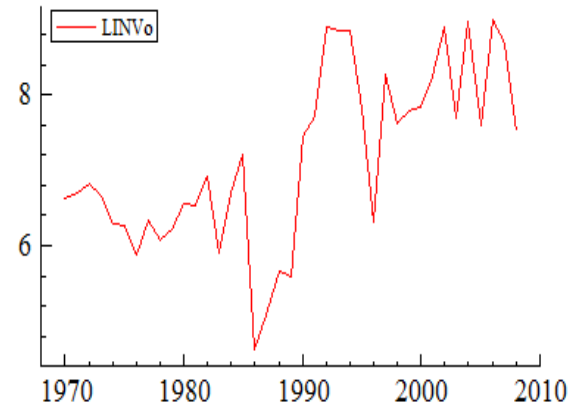
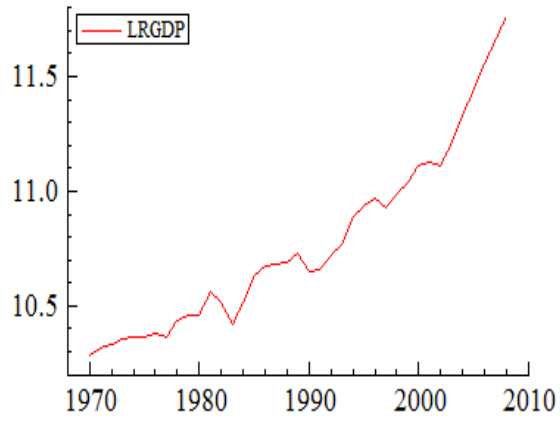
| | | | |
|-------|----------------|------------------------|-----------------|
| LEXP | : hetero test: | Chi ² (24)= | 30.523 [0.1680] |
| L Aid | : hetero test: | Chi ² (24)= | 25.166 [0.3968] |
| LTOT | : hetero test: | Chi ² (24)= | 24.212 [0.4496] |
| LRER | : hetero test: | Chi ² (24)= | 34.613 [0.0743] |
| LRGDP | : hetero test: | Chi ² (24)= | 21.668 [0.5991] |

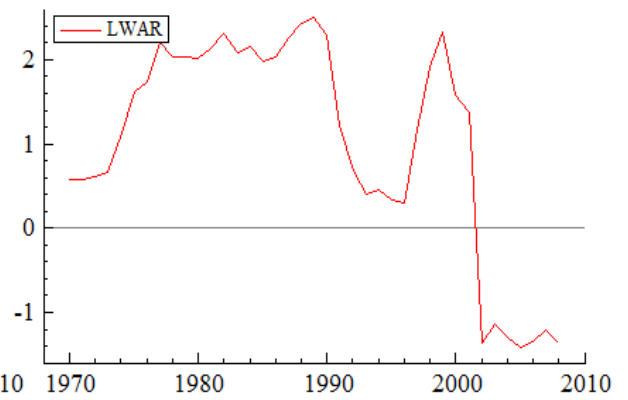
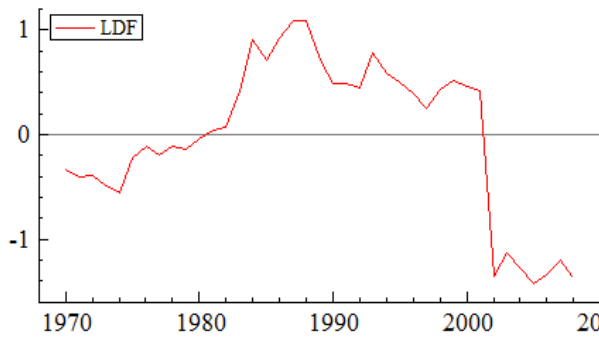
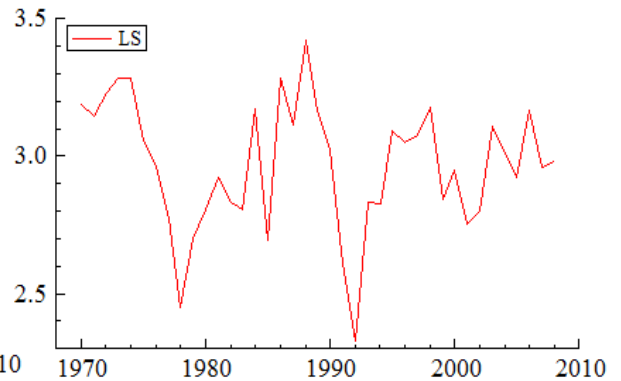
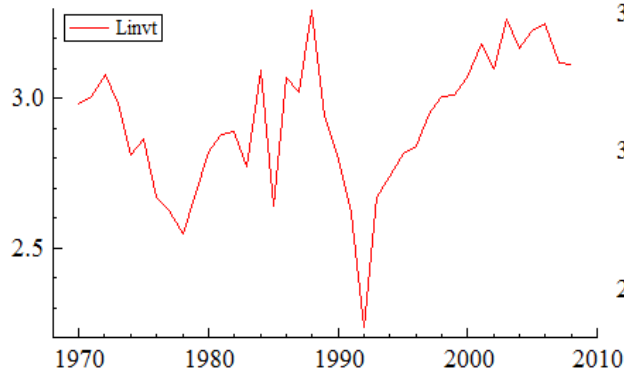
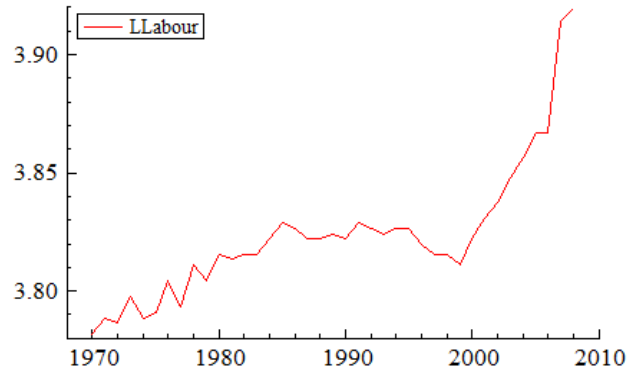
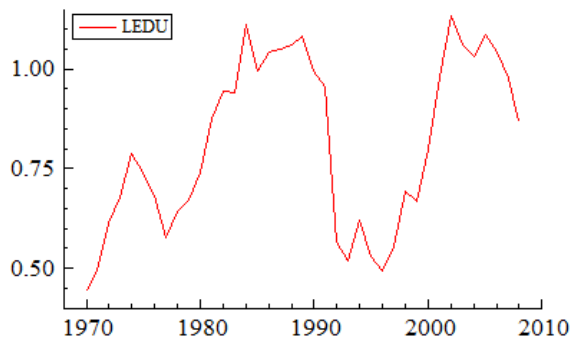
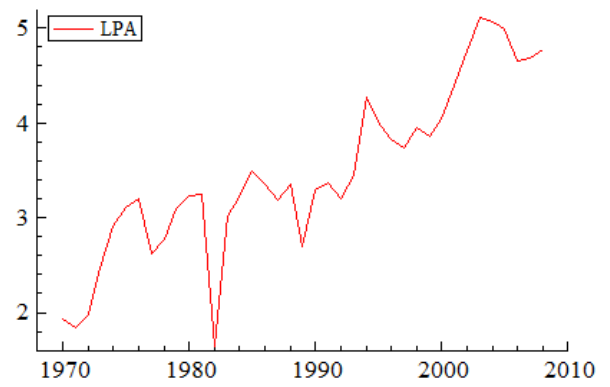
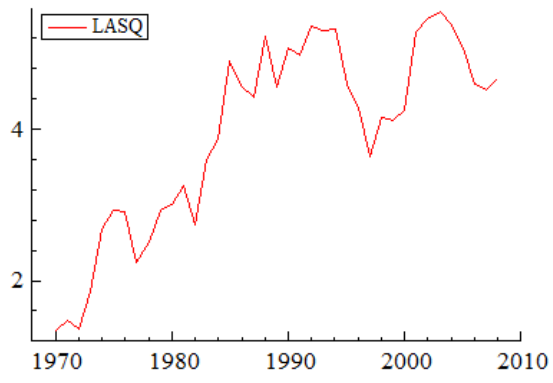
iv. Government consumption expenditure equation

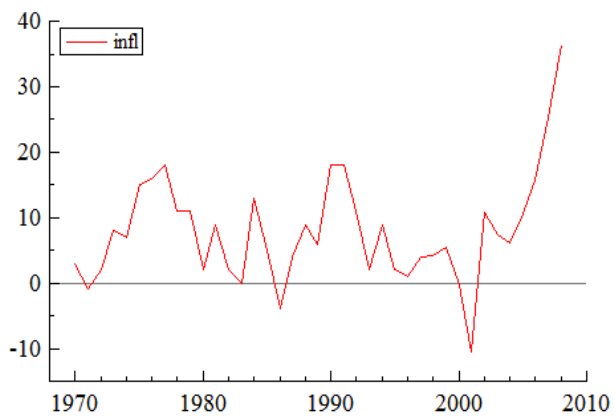
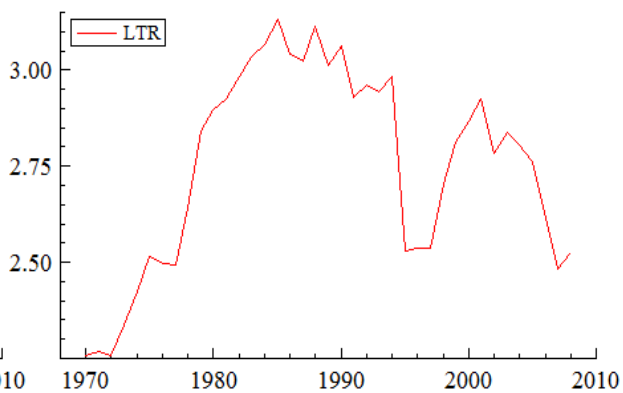
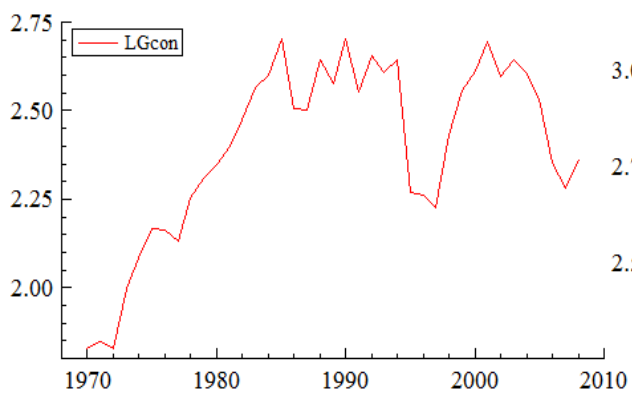
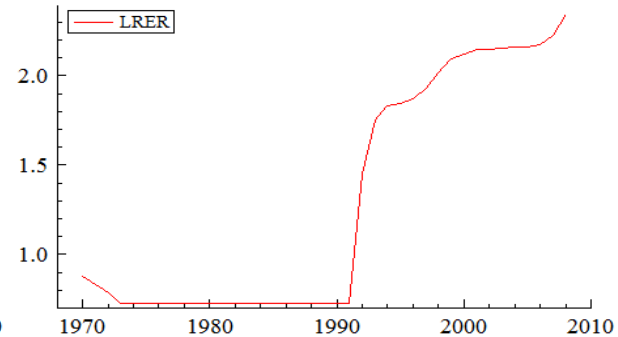
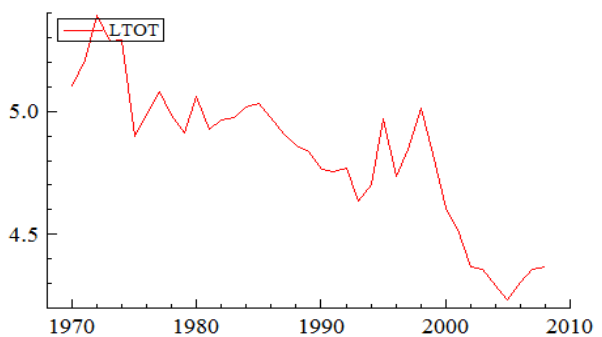
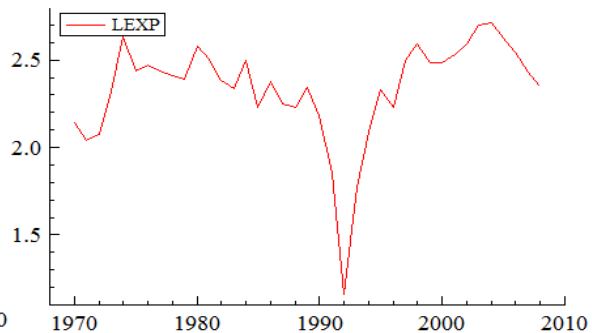
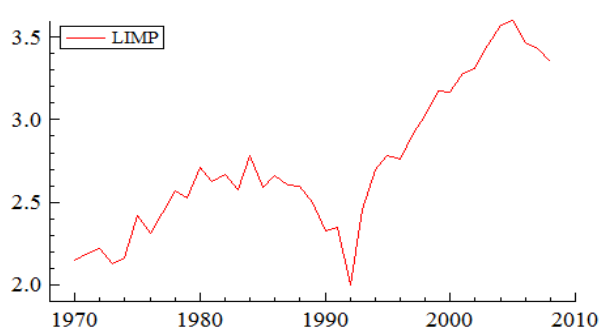
LGcon : Portmanteau(5) : 1.96293
 LTR : Portmanteau(5) : 1.17957
 LAID : Portmanteau(5) : 4.8435
 Infl : Portmanteau(5) : 2.93682
 LRGDP : Portmanteau(5) : 2.1734
 LGcon : Normality test: $\text{Chi}^2(2) = 7.1093$ [0.0286]*
 LTR : Normality test: $\text{Chi}^2(2) = 11.030$ [0.0040]**
 LAID : Normality test: $\text{Chi}^2(2) = 0.80526$ [0.6686]
 Infl : Normality test: $\text{Chi}^2(2) = 3.6223$ [0.1635]
 LRGDP : Normality test: $\text{Chi}^2(2) = 0.078676$ [0.9614]
 LGcon : ARCH 1-1 test: $F(1,22) = 0.20035$ [0.6588]
 LTR : ARCH 1-1 test: $F(1,22) = 0.13308$ [0.7187]
 LAID : ARCH 1-1 test: $F(1,22) = 0.46430$ [0.5027]
 Infl : ARCH 1-1 test: $F(1,22) = 0.72393$ [0.4040]
 LRGDP : ARCH 1-1 test: $F(1,22) = 0.15116$ [0.7012]
 LGcon : hetero test: $\text{Chi}^2(30) = 32.664$ [0.3373]
 LTR : hetero test: $\text{Chi}^2(30) = 32.047$ [0.3653]
 LAID : hetero test: $\text{Chi}^2(30) = 32.530$ [0.3433]
 Infl : hetero test: $\text{Chi}^2(30) = 32.302$ [0.3536]
 LRGDP : hetero test: $\text{Chi}^2(30) = 32.571$ [0.3415]

APPENDIX B: PLOTS OF VARIABLES USED IN THE STUDY

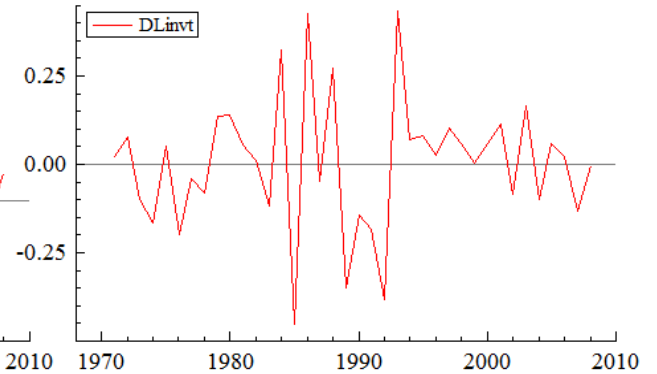
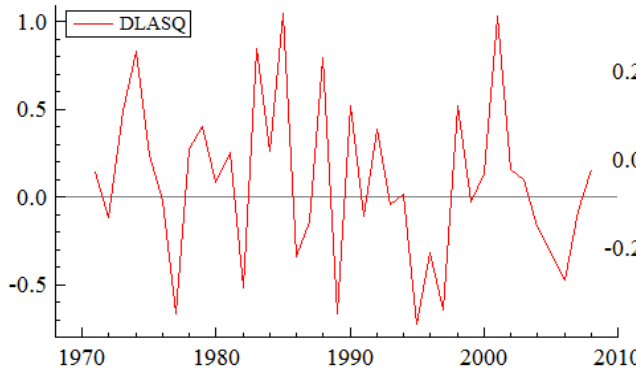
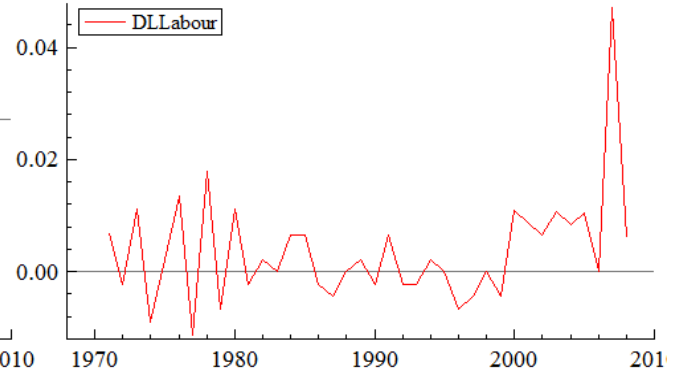
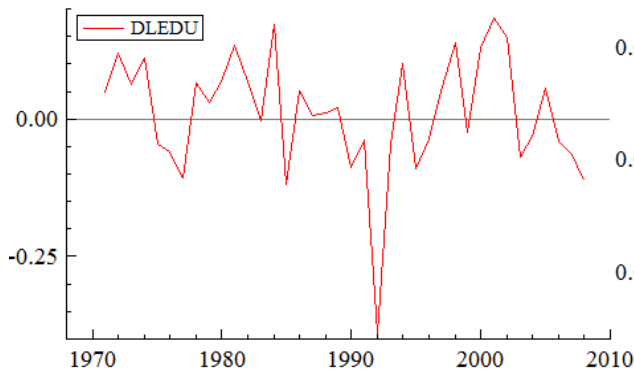
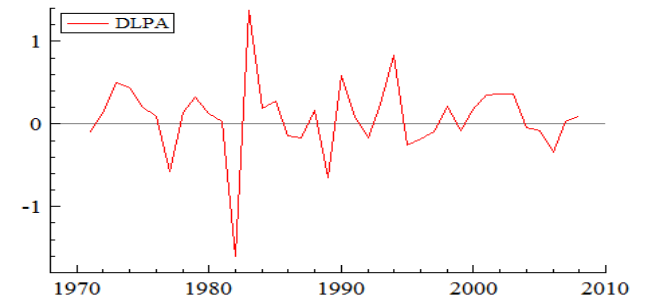
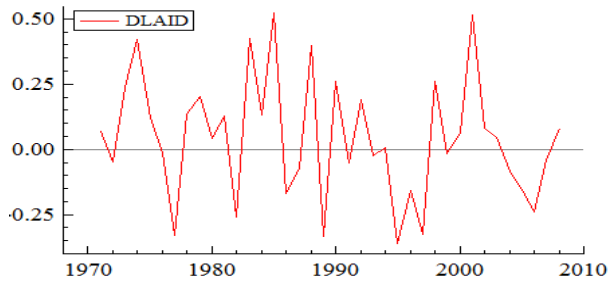
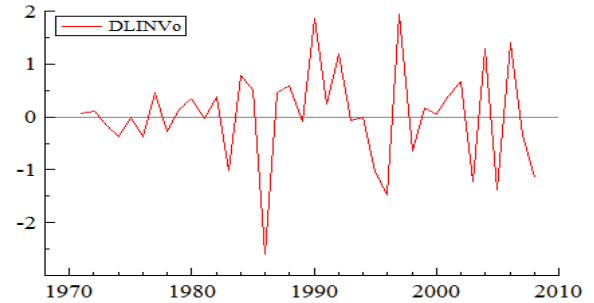
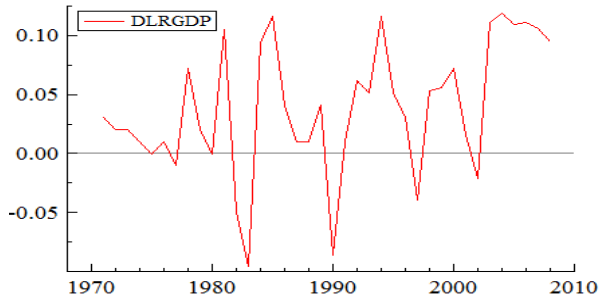
i. Graphs of all variables at level

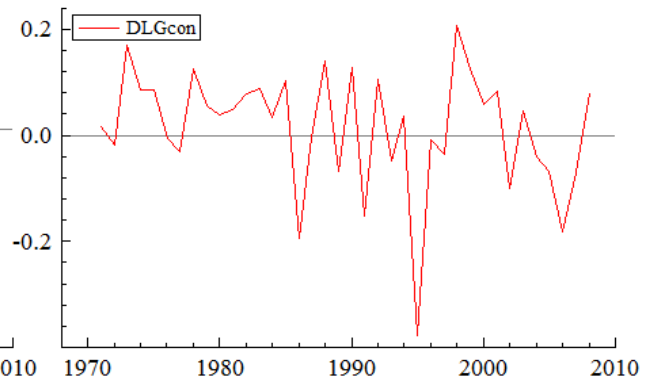
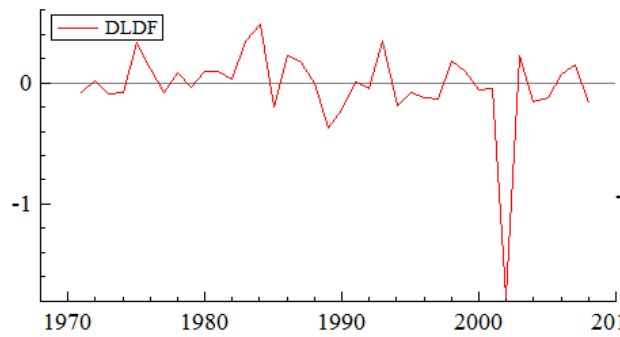
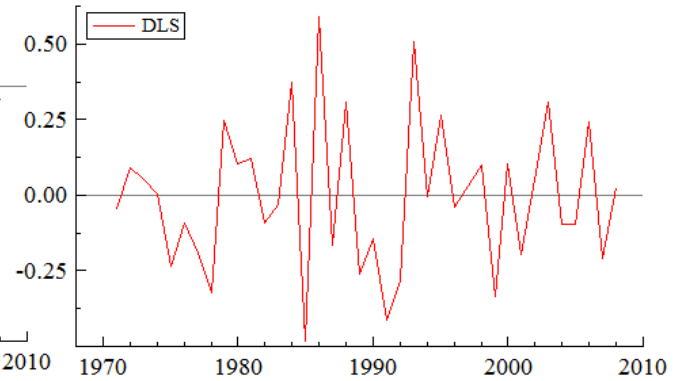
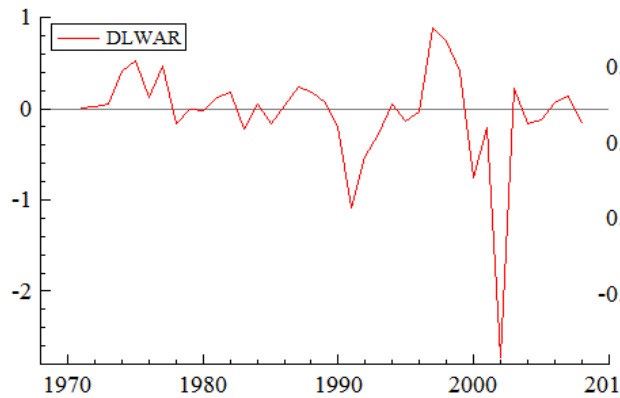
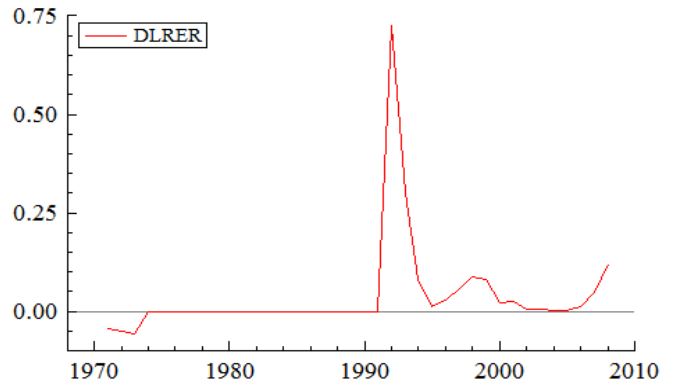
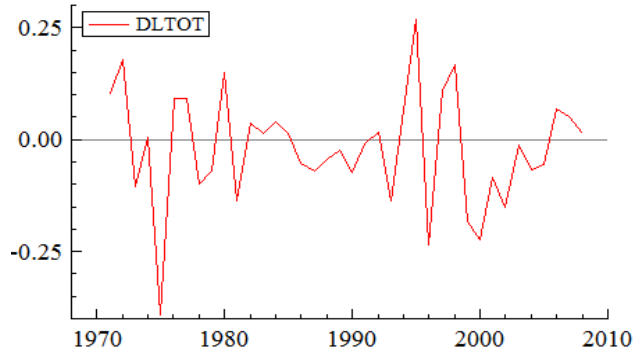
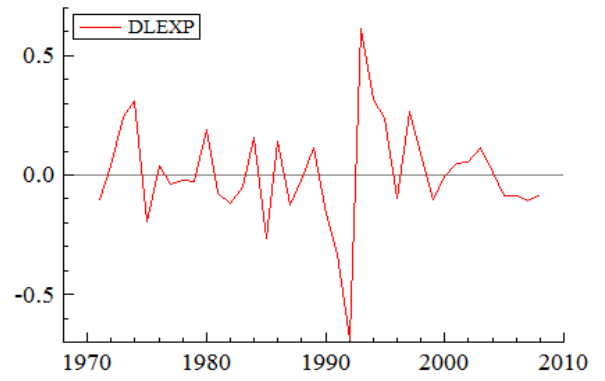
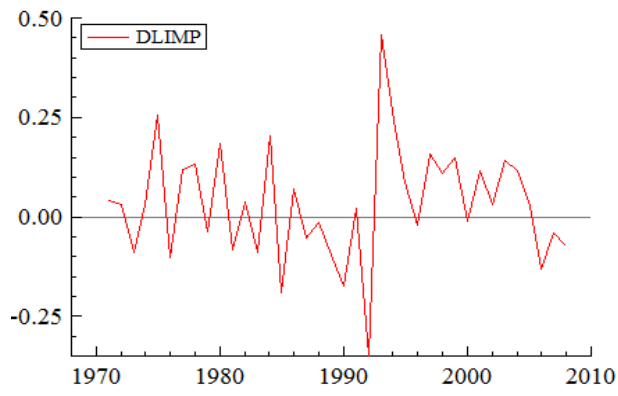


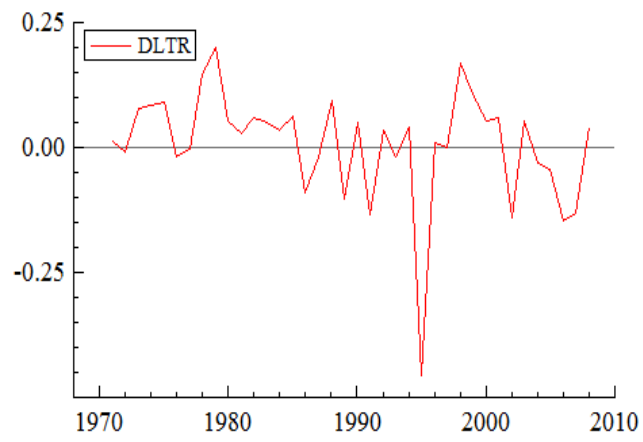
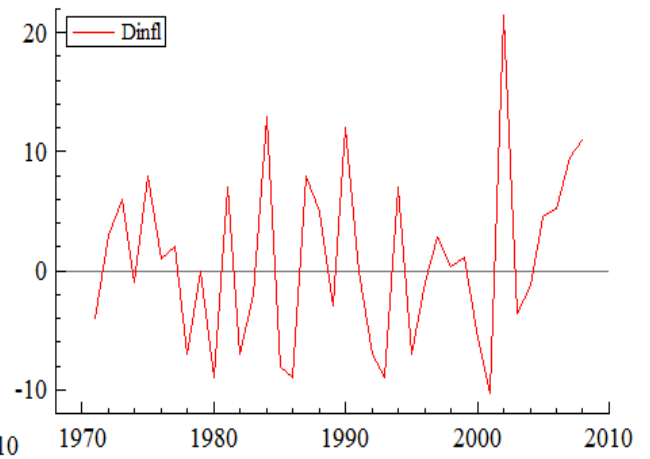
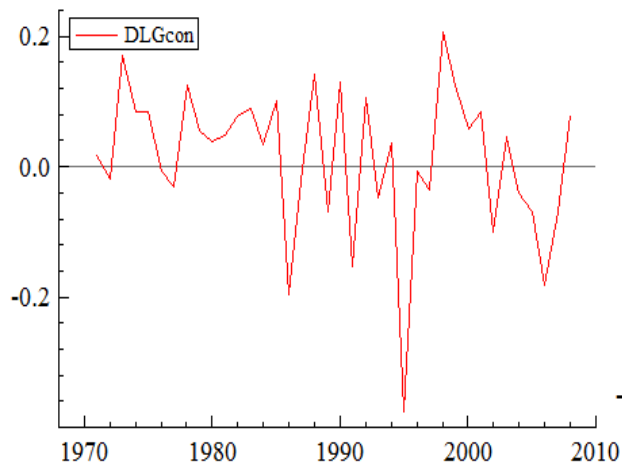




ii. Graphs of all variables at first difference

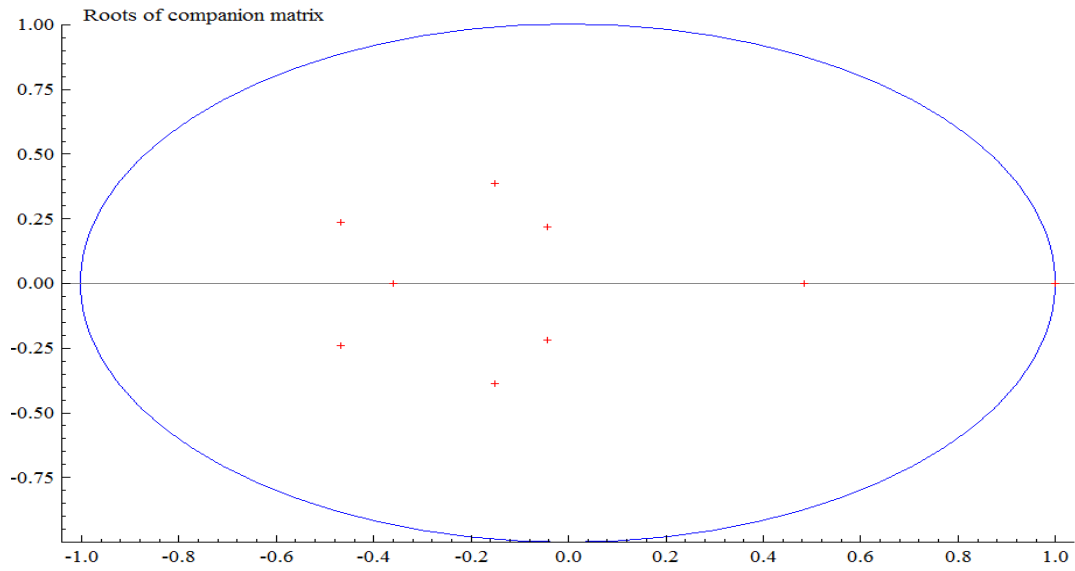




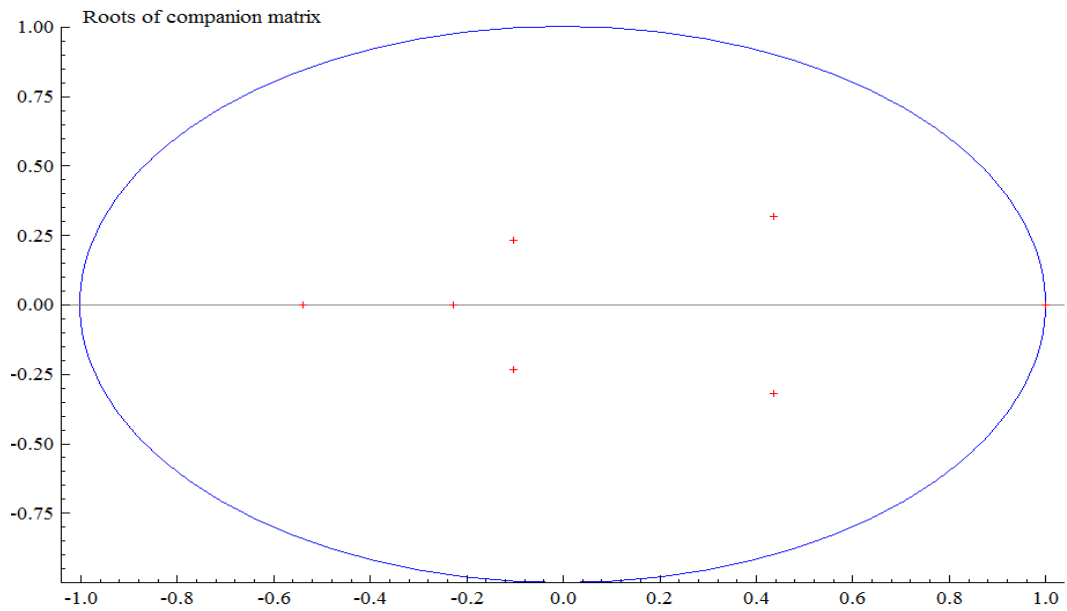


APPENDIX C. VAR STABILITY TEST

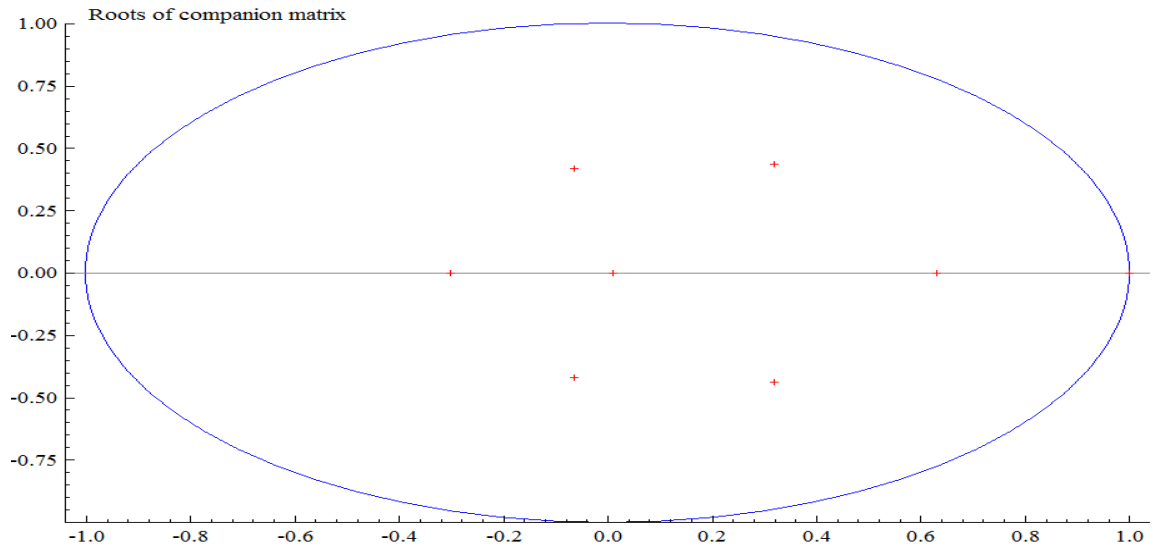
i. Roots of companion matrix for Growth equation



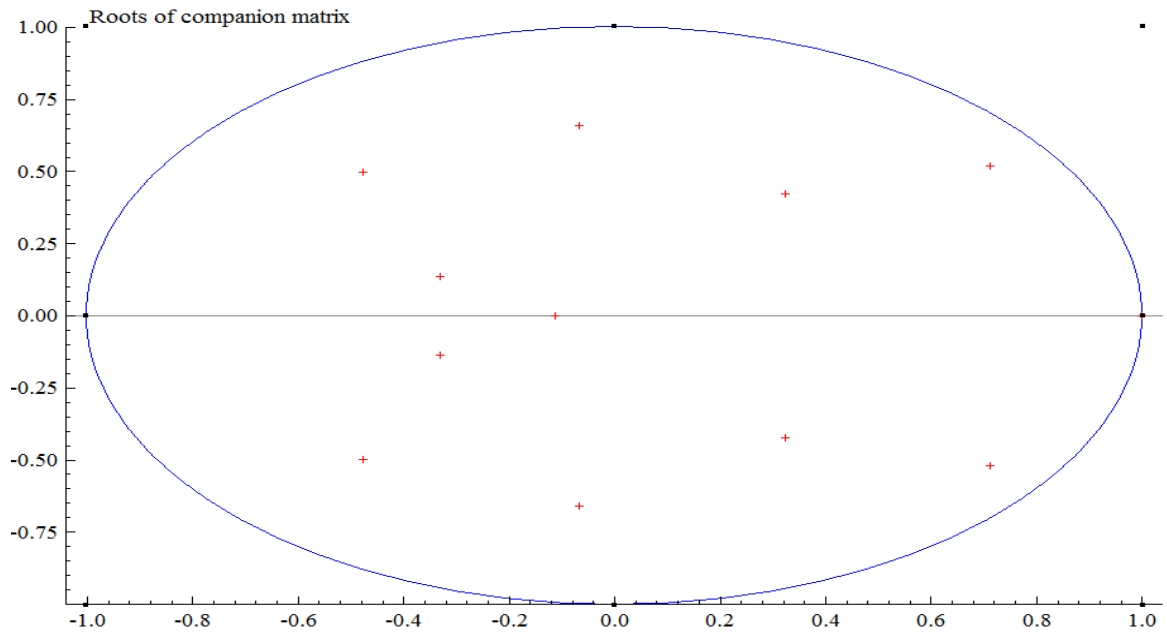
ii. Root of companion matrix for Investment equation



iii. Roots of companion matrix for Import equation



iv. Roots of companion matrix for Government consumption expenditure function



APPENDIX D. Derivation of Policy variable

To construct the policy index, the first step is developing growth equation where budget deficit, openness to trade and monetary policy (Approximated by inflation of the country) are the explanatory variables. The result obtained from the growth regression reported below.

$$\ln GDP_{gr} = 0.916 - 0.35 (\text{budget deficit}) + 0.26(\text{openness}) + 0.11 (\text{inflation})$$

By taking the coefficients of the policy variables, the policy index corresponding to each period is constructed as follows.

$$P_t = -0.35 (\text{budget deficit})_t + 0.26(\text{openness})_t + 0.11(\text{inflation})_t$$