ST. MARY'S UNIVERSITY

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THE EFFECT OF EXTERNAL DEBT ON ECON OMIC GROWTH: CASE OF ETHIOPIA

BY: TSIGEREDA MELAKU

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DECLARATION

I Tsigereda Melaku hereby declare that this thesis is an original research undertaken by me under the guidance of my supervisors; and with the exception of references to other people's work which have been dully cited, this thesis has neither in part nor in whole been submitted for another degree elsewhere.

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ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as a university advisor.

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Advisor Signature and Date

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ABSTRACT

External debt is considered as a significant source of income for developing countries. However, a group of sub-Saharan countries classified as HIPCs including Ethiopia, have continued to experience difficulties in managing and serving their huge stock of external debt. This paper estimates empirically the impact of external debt on economic growth in Ethiopia to determine the existence of a 'debt overhang' and/or 'crowding out' effects. This study investigates the effect of external debt on economic growth in Ethiopia using a time series data estimated for 1985 -2015. A vector error correction model has been used to estimate a long run relationship. The empirical findings reveal that real GDP is influenced negatively by the past stock of external debt and debt servicing and, positively by the current external debt inflows. This is indicating the existence of debt overhang problem and in Ethiopian economy. The findings of the study indicate both debt indicators; external debt to GDP ratio and external debt servicing to export ratio have a negative effect on GDP. While the other variables have a positive and significant effect on economic growth. Several policy implications emerge from the study.

ACRONYMS

ADB African Development Bank

ADF Agumented Dicky Fuller

ADLI Agricultural Development Led Industrialization

AIC Akakie Information Criterion

ARDL Autoregressive Distributed Lag

CSA Central Stastics Authority

CV Critical Value

DF Degrees of Freedom

DSA Debt Sustainability Analysis

DW Durbin Watson

ECM Error Correction Model

EAL Ethiopian Airlines Lines

EEA Ethiopian Economic Association

EPRDF Ethiopian People Revolutionary Democratic Front

ETB Ethiopian Birr

GDP Gross Domestic Product

GNP Gross National Product

GTP Growth Transformation Plan

HIPCS Heavily Indebted Poor Countries

IDA International Development Association

IMF International Monetary Fund

LDCs Least Developing Countries

LM Lagrangian Multiplier

MPK Marginal Product of Capital

MOFED Ministry of Finance and Economic Development

NBE National Bank of Ethiopia

NGDP Nominal Gross Domestic Product

OLS Ordinary Least Square

RGDP Real Gross Domestic Product

SAPs Structural adjust Program

SBIC Schwarz Bayesian Information Criterion

SSA Sub Saharan Africa

UN United Nation

UECM Unrestricted Error Correction Model

USD United States Dollar

VAR Vector Autoregression

VECM Vector Error Correction Model

WB World Bank

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The most common beliefs associate external debt with being poor, facing a deficit or war. But the reality is the most advanced and rich countries are the number ones in the list of the most indebted countries of the world. Most counties put themselves in the debt situation before they even face a deficit. In the case of less developed countries, they are obsessed with burgeoning economic growth through large investments. Though they have low per capita income, inadequate saving, low tax base and inefficient tax collection system which causes very big resource gap. They tend to channel all the available resources internal {tax collection, domestic savings and printing money} and external {borrowing from abroad} into investment in order to finance the gap and attain boom in economic growth.

In general we can say one of the greatest problems that the sub- Saharan Africa is facing is the amount of external indebtedness and servicing the debt. The reasons for this external debt can be: First, the size of the debt relative to the size of the economy is enormous and servicing it can lead not only to capital flight but also may discourage private investment. Secondly, debt servicing payments form a significant proportion of the annual export earnings. Meeting debt servicing obligations eats significantly in to whatever other services can be provided to improve the welfare of the citizens and therefore has macroeconomic implications. This raises the question of whether a country can grow fast enough to maintain debt obligations and adequate domestic investment. Thirdly, the burden of debt for a large number of Sub-Saharan African countries threatens not only the execution but also the prospects of success of adjustment programs being embarked up on. Fourth, the current system of debt management has a terrible macroeconomic effect on an economy's output (Ajayi, 1991).

1.2 Statement of the Problem

Because of the need to secure finance from external sources to undertake big infrastructure projects, the external debt for Ethiopia is expected to increase significantly in the immediate future. This external debt will have to be repaid in the future against depreciating Birr. Since devaluation of domestic currency or appreciation of foreign currency means an increase in the real value of debt-service repayments. Therefore, the problem is how economic growth will be affected by the repayment of the external debt in the long run. Since, the external debt may be expected to affect economic growth in two ways: (1) the required debt service payment may create the crowding out effect on investment by transferring resources out of the country in the form of interest and principal repayment: and (2) large debt may overhang and discourage investment especially private investment in that the private sector in the anticipation of increased taxes.

But provided that the country has the capacity to service the debt regularly and not merely wasted on inefficient state enterprises and maintaining artificially high consumption levels, this fund may lead to economic growth. So at the end of this research we ought to know how economic growth is affected by external debt.

The channels through which debt overhang translated in to a drag on growth are multifaceted. First, the burden of principal and interest payments drains the nation's resource and curtails the possible expenditure of resources on other productive ventures. Second, a raising external debt contracted on floating rates leads to a rising debt service. This will have great implications on resource use and hence economic growth. Third, the size of debt relative the size of economy can lead not only to capital flight but also discourage private investors viewing the debt as anticipated foreign tax on future income and returns on investment.

This paper tries to evaluate how external debt affects Ethiopia through both regimes. Revise the then policies and how they contributed to the effect of debt on economic growth. The source, type, magnitude, composition and determinant of Ethiopian external debt through both regimes.

1.3 Research question

The study would attempt to find answers to some pertinent questions regarding external debt and its effect on growth in Ethiopia. The ways through which external debt affects economic growth are vast and varied. For this reason the following questions should be addressed.

- What is the relationship between external debt and economic growth?
- What is the trade-off between external debt and economic growth?

1.4 Objective of the Study

The general objective of the study is to examine the effect of external debt on economic growth in Ethiopian economy. To attain this broad objective the study has the following specific objectives:

- Explain the consequence of the external debt servicing on economic growth
- Emphasize Ethiopia's export performance and external debt servicing capacity
- Investigate the long run relationship between external debt and economic growth in the country.
- Draw policy implications and recommendations based on the findings of the study.

1.5 Hypotheses of the Study

External debt is expected to have positive effect on economic growth. This is the case when there is an expansion of public debt which leads to an increase in public expenditure and an increase in economic growth through the government expenditure multiplier. But an increase in the external debt might indirectly depress the level of GNP by creating debt overhang effect, crowding out effect, discouraging capital formation and encouraging capital flight due to tax increase expectation. Therefore, the researcher will hypothesis that external debt burden and services negatively affect economic growth in Ethiopia Whether the country is poor or not, developed or less developed it will borrow money from external source. It could be to finance its deficit or to stimulate its economy. The question is how deep their indebtedness is and how will that affect the economy. If the debt goes accumulating servicing the debt will drag the economy down.

1.6 Significance of the Study

The effect of debt on economic growth is a controversial and contemporary issue. Due to this many policy makers and researchers contributed a lot to this issue. The significance of adding another document like this study provides more recent and updated data and uses a strong econometric model. Well organized result and recommendations that will give policy makers Perceptive insight about the issue. The study attempts to show the effect of external debt on the economic growth, with

particular focus on Ethiopia. The issue of external debt and analyzing the transmission mechanism of its effect on economic growth is an important issue to study. This study is therefore crucial for the Ethiopia given that it promotes policies that will ensure country's leveraged towards enhancing economic growth through capital accumulation, domestic investment and productivity growth. The study utilized data from various secondary sources including all from Ministry of Finance and Economic Development of Ethiopia (MoFED), publication of National Bank of Ethiopia (NBE) and Central Statistic Authority (CSA) of Ethiopia. The study also employs an econometric model with strong theoretical foundations that relate external debt and economic growth. Moreover, it would be useful to explore the above mentioned issues by updating a data and come up with results that expected to have insightful implications for policy makers.

1.7 Scope and limitation of the Study

This study will examine the effect of external debt on economic growth, in the case of Ethiopia. To realize the objective and address the research gap, the period of 1985-2015 is chosen. Although the research has reached its aims, there were some unavoidable limitations. Since data presented by different sources are inconsistent and distorted. There is also a discrepancy in figure and in concept between institutions. Having said this the researcher put extra effort to minimize the limitation and there potential affecting the research findings and result.

1.8 Organization of the study

This study is grouped under five chapters. Chapter two which is next presented highlights the theoretical and empirical literature review on the relationship between external debt and economic growth. Methodology is presented in chapter three. Estimation, analysis, and discussion of results are captured under chapter four. Finally, conclusion and policy recommendations are offered in chapter five.

CHAPTER TWO: REVIEW OF LITERATURE

2.1 Theoretical Literature

2.1.1 The Theory of External Debt and Economic Growth

External debt is the least argued and popular issue in the early economic schools of thought, but some economists raise the issue in different ways. Adam smith argues about it in its famous book (the wealth of nation) "the Dutch, as well as several other foreign nations, have a very considerable share of our public funds. As Foreigners possess a Share of our national Funds. They render the Public in a Manner tributary to them, and may in Time occasion the Transport of our People, and our Industry" in this statement Adam Smith tries to explain the burden of external debt on the economy and the cost of debt service in an elementary concept of external debt. Through time some scholars raise the concept of external debt ether as their main point or as a side issue. And some ignored the significant influence on a nation's economy.

2.1.2 Motives for External Debt

There are three major sources available for government to raise financial resources towards funding public expenditures: printing of money, taxation and borrowing. Taxation in most developing countries particularly Sub-Saharan Africa has a limited capacity in raising enough revenue necessary for investment in massive infrastructural projects for economic take-off. Printing of money to finance projects puts inflationary pressures in an economy which may jeopardize macroeconomic stability. According to (Gill .I Pinto B, 2005)the issue of equity, stability and smoothing justifies the choice of public debt over taxation and printing of money. They argue that debt allows more equitable use of investment opportunities with long development periods and taxing the current generation to fund projects that will benefit future generations would be inequitable. Over reliance on printing of money could lead to high inflation.

Debt financing also helps in meeting urgent spending needs whilst frequent fluctuations in the tax rate creates economic uncertainty and induce deadweight loss. Furthermore, debt is preferred to the printing of money and taxation on the grounds of political expediency. Government may borrow in order to postpone undertaking urgent structural changes which may be painful in the

short run but beneficial in the long run. The postponement of immediate policy implementation may promote the interest of some well-connected players in the economy. Moreover, the choice of external borrowing can be explained using the dual-gap theory which states that investment is a function of saving, and that the level of domestic saving in developing countries is insufficient for generating the level of investment that is required for growth and development. It is hence prudent to seek additional funds from abroad to complement domestic resources.

(Todaro, P. M., and Smith, S. C, 2006)argue that the phenomenon of external borrowing for developing countries is not uncommon at their early stage of development since domestic capital is inadequate for investment. (Ajayi, S. I., and Khan, M.S, 2000)stated that the principle that should guide debt contractual agreements hinges primarily on the cost and benefit evaluation of economic activities. It requires that a country should borrow from external sources if the rates of returns on such funds are greater than the cost of borrowing them. If foreign borrowing increases the debt service capacity of the borrowing economy more than the addition to debt burden, then such borrowing becomes desirable. Strict compliance with this principle will help countries to expand production with the aid of external savings.

2.1.3 Possible consequences of external debt on economic growth

But this external debt don't always turn out to be as expected.in some economies it boost the growth and in some economies it knocks down the existing growth.

 External debt improve growth:- According to the neo-classical theories, there are three ways where growth takes place, i.e., holding land fixed; increase in the capital stock, labor supply and productivity. Capital increase can take two forms; physical capital and human capital. Physical capital promotes output since it improves the productivity of labor. Human capital increases economic growth since productivity will increase when there are skillful individuals. Larger amount of output will also be produced when more people are employed in a country's production. The neo-classical growth model is frequently attributed to the work of (Solow, 1956) and the Trevor Swan (1956) development of relatively simple growth model. This growth model is so called Solow-Swan growth model.

The Solow growth model is designed to show how growth in the capital stock, growth in the labor force, and advances in technology interact in an economy as well as how they affect a nation's

total output of goods and services. (Solow, 1956)Model assumes that production function exhibits constant returns in labor and capital and labor augmenting technical progress. The model also assumes flexible prices so as to build a model that conciliates full employment of resource with growth. In this model, a reasonable amount of debt inflows are positively linked with growth. Therefore, there is a need to borrow and invest for countries with inadequate capital as marginal product of capital exceeds the world interest rate. Also, as it is implied by Harrod-Domar model the main causes of growth are: growth in saving, investment technical progress and population. In this model only physical capital and labor are included in the production.

Other than the general equilibrium on the goods and labor markets, Harrod-Domar following Keynes give more attention on the equilibrium of goods market. The model implies that economic growth is a direct outcome of capital accumulation obtained through savings and scarcity of capital is the only restriction to production since abundant supply of labor is assumed. In this model capital accumulation is viewed as the engine of development. In order to attain the planned growth rate, developing countries may choose foreign borrowing if the domestic savings are inadequate to attain the desired level of investment. But, according to endogenous growth model, the production function was extended to include human capital. This model was to solve the limitations associated with the neo classical growth models to make clear the sources of economic growth. The augmented Solow model by Romer et al (1992) simply extends the basic production function framework to allow an extra input to enter the production function; Human capital. Lucas (1988) implied that a wide range of endogenous growth models has treated human capital as a critical factor in determining growth rate of output. It is indicated that the rate of return to capital (physical and human) determine growth.

Unlike the neoclassical models, in this model technology is not exogenous rather it is determined by economic activities like innovation. As stated by Romer (1994) economic growth is not the result of forces that impinge from outside rather it is the results of economic activities that create new technological knowledge. It is implied that output can be increased by increasing inputs of resources and productivity of these inputs. The main distinguishing behavior between the neo-classical exogenous and endogenous growth theories is that the earlier assumes constant returns to scale with diminishing marginal productivity of capital per capita (MPK) (Solow, 1956), while the latter assumes constant or increasing returns to scale with non-diminishing marginal productivity

of capital (MPK). On top of supply-driven factors, the growth of output in a nation is influenced by foreign capital through its effect on the productivity of investment. When domestic financial resources are insufficient in the country then external borrowing is anticipated to enhance economic growth through filling the gap.

By theory "reasonable" levels of debt by developing country are expected to bring economic growth since external debt will enhance capital inflow in the economy. As far as, the loans are used for growth linked expenses and macroeconomic instability and shocks are not there then, the rate of economic growth will be accelerated. It will not only provide foreign capital for industrial development but will also give managerial know how, technology, technical expertise as well as access to foreign markets for the mobilization of nations human and material resources for economic growth (Ali and Mustafa, 2011). According to the Keynesians theory, indebtedness does not create charges either on current or future generations due to the investment that it brings. That is, indebtedness stimulates demand and leads to a more proportionate rise in investment via the accelerator principle or effect. Foreign debt is likely to have a favorable effect on total investment in a country because most of the foreign borrowing is done on the claim that domestic savings are not sufficient to finance the planned investment expenditures.

 External debt worsen economic growth:-the relationship between external debt and economic growth can also be negative according to some literatures. This is, at the time when the external debt accumulation exceeds a certain level then economic growth will be negatively affected through its effect on investment. This negative effect of debt on economic growth can be explained in two ways Debt overhang theory and liquidity constraint theory.

 Non-linear relationship:-During the 1970s, where debtor countries were at the initial stage of borrowing a lot of countries faced higher growth rate in foreign borrowing. After some time, during the 1980s these countries incurred a serious challenge to service their debts. Then, the view of negative relationship between external debt and economic growth started which is explained above. Recently, there starts another view which argues as the relationship between external debt and economic growth appears to be non-linear in nature. The non-linear link between debt and growth can be showed using Debt Laffer Curve. As implied in Cohen (1993), the relationship between the face value of debt and investment can be showed using "Debt Laffer Curve" as

outstanding debt increases beyond a threshold level, the expected repayment begins to fall as a result of the adverse effect.

The upward-sloping part of the graph indicates that higher debt is linked with higher debt repayment but the downward sloping part of the curve indicates increase in debt will reduce expected debt repayment. Similarly, it is indicated by Calvo (1998) model the relationship between external debt and growth can be grouped into three parts. Economic growth is positively related to the level of debt in the first part of the graph i.e. growth augmenting section. The second part is in between where an economy can reveal either high or low growth path in the country. The last part is where economic growth is negatively related with debt accumulation i.e. growth hindering section. In the curve the peak showed by A* indicates the optimum level of external debt where the rate of economic growth will be maximized.

2.1.2 Debt overhang, Investment and growth

According to Krguman (1988), Debt overhang is defined as a situation in which the expected repayment on foreign debt falls short of the contractual value of the debt. Similarly, according to Eduardo Borensztein (1990), the debt overhang crisis is defined as a situation in which the debtor country benefits very little from the return to any additional investment because of the debt service obligations. Agenor and Montiel (1996), an approach to this issue of external debt is motivated by several observations. Much policy-oriented discussion of the debt problem centered on the question of whether the crisis was one of solvency or of liquidity problem.

A liquidity problem refers to the inability of a country to service its debts now in the amount initially contracted. That means lack of liquidity occurs when a county does not have enough cash on hand to pay current obligations. Whilst the solvency issue relates to whether the value of a country's liabilities exceeds the ability to pay at any time; a country is insolvent when it is incapable of servicing its debt in the long run (Ajayi, 1991). According to Kletzer (1988), indebted developing countries were clearly solvent; that is, the present value of their prospective resources (as measured by the discounted value of their real out flows) was many times greater than their debt obligations. If these countries were solvent, it is necessary to explain why they would have been illiquid, that is, why external creditors would have been unwilling to sustain the pace of lending.

One approach to this question is to distinguish between the ability to pay and the willingness to pay. Thus, while indebted countries may have been solvent (able to pay), legal sanctions compel payment of the type that can be applied to domestic debtors are unavailable against sovereign debtors. Debt contracts negotiated with such debtors have to be self-enforcing and must find it in their interest to comply with their payment obligation. In that perspective, the debt crisis can be interpreted as one in which the willingness to pay decline for a variety of reasons. Among many factors there are domestic and external factors that responsible for this outcome (crisis). The domestic factors often cited include wrong macroeconomic policies such as fiscal irresponsibility and Real exchange rate misalignment, policies that deter savings such as negative real interest rates, which in turn reduce investment and encourage capital flight and financing long-run projects with short-term credits. External factors include oil shocks, deterioration in the terms of trade and rising foreign interest rates.

An alternative resolution to the solvency-liquidity problem is, while the debtor countries may have been solvent, debtor governments may not have been. The relevance of this perspective is supported by empirical observation that the overwhelming proportion of external debt outstanding in the heavily indebted developing countries at the time of the outbreak of international debt crisis was owed by the public sector (Agenor and Montiel, 1996). This suggests that approaching the crisis from a fiscal perspective may yield insight that would tend to obscure by treating the debtor country as a single agent in particular, the crisis can be viewed as one of debtor solvency.

As a consequence, at least part of the return to any increase in production would be devoted to debt servicing. This creates a disincentive to invest from the debtor country's point of view. For the same reason, the debt overhang is also likely to discourage government efforts to undertake adjustment policies and, through actual or expected economic policies, it is likely to spread to the private sector discouraging investment. Thus, Borensztein argued that the debt overhang had an adverse effect on private investment, which was strongest when private debt, rather than total debt, was used as a measure of debt overhang. Therefore, debt 'overhang' is a constraining factor in that (i) debt service absorbs profits that otherwise could have been reinvested in capital accumulation. (ii) When the overhang becomes big enough, the source of foreign savings dries up and, if it is not replaced by increased domestic savings, domestic real loan rates of interest rise (Borensztein, 1989). Most empirical evidence shows that there is negative relationship between debt and growth.

For example, in the Philippines a $1.3 billion reduction in international bank debt was calculated to increase the demand for funds for productive investment by 2 percent of GNP. In Argentina, Brazil and Mexico debt service has crowded out investment rather than consumption with private investment being sharply reduced (Hallwood and MacDonald, 1994). The related view of the causes of the slowdown in economic growth in Latin American countries since the early 1980s, is the confidence gap theory in which the sources of foreign saving, domestic saving and domestic demand for investment funds collapse together. The main reason is that poor macroeconomic management and the effect of adverse external events that leads to greater uncertainty throughout a debtor's economy.

Especially in many Latin American countries during the 1980s there developed a general lack of confidence in the economic system as a whole (Ibid.). The second channel is the credit rationing effect (or inability to obtain new financing), which is more indirect and arises from the higher domestic interest rates that prevail in a debtor economy as a consequence of its unfavorable standing in international financial markets. Thus, it refers to the situation where debtor country cannot obtain new loans because it would not be able (or willing) to service them. It may arise from the fact that a highly indebted and non- performing debtor is unlikely to obtain any foreign borrowing beyond the involuntary rollover of interest and amortization payments that are not met. In fact, credit ration is situations where by domestic interest rates exceed the international rate, because of constraints faced by that debtor in international financial markets. Similarly, according to Classens and Diwan, (1990), there are two possible channels through which debt burden can depress capital accumulation and economic growth. The first is that the external debt is expected to hamper the level of investment and hence growth when debt servicing obligation demanded the limited resources of highly indebted countries. The debt burden may affect the current flows of resources available to the country in the present; that is, resources used to service debt may crowd out public investment and hence discourage private investment because of the complementarity between private and public investment. As debt servicing demanded higher resources, the share of public investment will shrink because most governments cannot lower consumption. When there is less public spending on basic infrastructure, private investment will also be discouraged.

2.2 Empirical Literature

S.IbiAjai (1995) looks at capital flight and external debt in the case of Nigeria. He argued that there are two kinds of linkages between external debt and capital flight. The first linkage runs from external debt to capital flight while the second runs from capital flight to external debt.

(1) Debt-driven capital flight: as a consequent of external borrowing, residents of a country are motivated to move their assets to foreign countries, and then we have debt-driven capital flight. Capital flees or leaves the country in response to attendant economic circumstances directly attributable to external debt itself.

The attendant economic circumstances leading to debt-driven capital flight are expectations of Real exchange rate devaluation, or fiscal crisis, possibility of a crowding out domestic capital and avoidance of taxes and ex-production risk.

(2) Flight-driven external borrowing: capital flight drains national foreign exchange resources, forcing the government to borrow abroad. This situation develops as a result of capital that has left the country there is a gap, which needs to be filled in the domestic economy. Consequently, there is a demand for replacement on the part of both the government and the private sector. The reasons why external creditors are willing to meet this demand are attributable to different risks and returns facing resident and non-resident capital.

In Nigeria for the years 1977, 1980 & 1986 capital outflows exceeds foreign debt accumulation indicating the depletion of domestic resources. In the periods of high growth rate in external indebtedness in Nigeria the growth of investment as a percentage of GNP was the highest. Thus, increases in debt accumulation had positive effects on investment (S. Ibi Ajayi, 1995). From this we note that capital outflows should not exceed the accumulation of foreign debt to avoid a slowdown in economic performance.

As he noted also in period of high growth rate in external indebtedness as in the period 1977- 81 in Nigeria, the growth in gross investment as a percentage of GNP was at its highest range of 20-27 percent for the entire period. Thus, increases in debt accumulation had positive effects on investment. But the effect it could have had on growth in GNP was counteracted by capital flight. When the capital flight /change in debt ratio was 69 percent, 36 percent, 352 percent and 122.5

percent, growth rates were negative 6 percent, 4 percent 4 percent and 48 percent, respectively. Thus, these findings will seem to lend credence to the general belief that capital flight has deterrent effects on the growth of the economy. As indicated In the case of Nigeria we have seen that the accumulation has a negative effect on investment.

Regarding the effect of external factors on private investment it can be viewed from two angles: First, a raise in international interest rates on debt will increase the burden of debt and thus, reduce the import capacity, which may have a direct negative effect on the level of private investment (Alemayehu, 1997). Second, the domestic private sector itself holds foreign assets and if the burden of future debt is viewed as a heavy tax burden, this can lead to capital flight.

In Ethiopian case, Befekadu (1992) used a method of eye-balling to test the debt overhang effect on investment. In his conclusion, the debt overhang hypothesis does not seem to hold in Ethiopian case. Using similar methodology Alfred Kebbie Sesay (1998), in his master's thesis concluded that the effect of long-term foreign borrowing on growth had a mixed result. These mixed results can be attributed to a number of factors. First, it is not the volume of external capital that matters but rather how it was used. He indicated that between 1964 to1977 and between 1993 to 1995 external capitals contributed positively to the growth of Ethiopian economy while between 1977 -1992 the contribution was negative. He justified therefore during the Imperial era and under the Transitional Government of Ethiopia (TGE) foreign capital was used in the development of infrastructure whilst the Derg era used a large proportion of

Foreign capital in the procurement of arms. Thus, from this he concluded that the debt crisis is more of a policy problem. This is in close link with Ajay's findings that Nigeria had implemented policies that led to the accumulation of debt in excess of what was sustainable.

During the Derg era the increasing levels of government expenditure was made in defense with noticeable neglect of the social and economic sector development. As a result, health and education standards deteriorated and the rate of economic growth decelerated considerably (Teshome, 1994).

The second aspect of debt relates to the growth in interest rate relative to the growth rate of GDP. During the Imperial era, world interest rate on debt grew at an annual average of -3.6percent whilst GDP grew at an annual average of 6.2 percent. The opposite was observed during the Derg era.

Then world interest rate on debt grew at a higher rate (8.0 percent) relative to that of GDP growth of 1.9 percent. (Eshetu and Makonnen, 1992). This situation was reversed under the TGE. During this period GDP recorded a higher growth over that of interest rate on debt as the result of the ongoing Economic Reform Program.

One basic disadvantage of the eyeballing method is that it does not provide sufficient empirical evidence between the regressed and the explanatory variables (since it only provides trends in economic variables). In addition to this the weakness of this approach is that it does not distinguish between private and public investment.

So, in this study I will give special attention to the effect of external debt stock on economic growth based on Elbadawi's (1996) and for the estimation the Johansen maximum likelihood is used.

2.2.1 External debt in Ethiopia

For much of its history, Ethiopia has quite been an independent nation. The country has in fact been a powerful kingdom that ruled communities in its surrounding area and extending its power beyond the red sea. Early historians and explorers that came from Europe and other part of the world during the middle age have also clearly documented how Ethiopian's society and economic organization were superior and civilized than from their own. Dependence on aid is relatively a recent history in Ethiopia. Before the last century, Ethiopia's request for external assistance was mainly in form of request for armaments and help against outside aggressors. Many of the current nongovernmental organizations come to the country only following the problem of the famine that has occurred in 1973.

External debt is an accumulation of annual loans entered into between one's country government and creditors nation (public external debt), or guaranteed by the government and between private and creditor nation. In our case almost all the external debt is an accumulation of annual loans entered into between the Ethiopian government and creditor nations and lending institutions. The latter include multilateral financial institutions and private lenders. The origin of external debt can be traced to the willingness of the debtor country to borrow and the lenders to lend. From the debtor country's perspective the need for external loan arises from the imbalance between domestic saving and investment, which is referred to as the resource gap. To fill the gap between this two countries have two main options. One is relaying totally on domestic savings to finance

the investment demand while the second option is to borrow externally and close the gap between desired investment and domestic saving. The benefit of long term external credit is to increase investment above and beyond what the country can afford. In this regard the second alternative has been the most popular in countries that experience resource gap (BefekaduDegefe and BerhanuNega, 2000/01).

2.2.2 Determinants of external debt

The determinants of Ethiopia's external debt can be credited to both internal and external factors. The major external factors include: first the 1973/74 oil price increase leads to deterioration in terms of trade leading to BOP deficits. The oil shock also contributed to a marvelous increase in the availability of international credit at very low interest rates and encouraged oil importing developing countries including Ethiopia to borrow (Sach and Larrian, 1995). Second in early 1980s the world interest rates increased sharply as a consequence of anti-inflationary programs in the industrialized countries.

Third as the same time the term of trade deteriorated for the debtor world as raw material price fell which leads to Ethiopia's growth of export earnings declined enormously. Fourth increased protectionism policies by developed countries have tended to discriminate against less developed countries including Ethiopia, thus lowering their earnings. Besides external factors Ethiopia indebtedness can be partly attributed to internal factors. This mainly refers to civil war, continuous policy and program reforms, continuous drought, highly distorted trade policies and the expansionary fiscal policies and budget deficit.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research design, the theoretical framework and the empirical model. It also presents the data type and the data source, definitions, measurements and expected signs of variables, testing techniques for variables and diagnostic test techniques for residuals.

3.1 Research design

In this study, since most of the tasks are with macro variables, the data that are important to achieve the main objective is secondary data, which is time series in nature; because of the nature of the study secondary data are considered better. So this study uses secondary data for examining the effect of external debt on Ethiopia's economic growth.

3.2 Data type and source

The objective of every empirical literature is trying to find out some relation in some way among macroeconomic variables using the available data. Therefore, the accuracy and consistency of data on the variables is very important for the finding to be reliable and meaningful. To keep the reliability of the data therefore, the data is obtained from Ministry of Finance and Economic Development of Ethiopia (MoFED), publication of National Bank of Ethiopia (NBE) and Central Statistic Authority (CSA) of Ethiopia.

3.3 Methods of data analysis

In order to arrive at the intended objectives, this study used secondary time-series data analysis for about 30 years. The selection of this sample size is made given the availability of data for each of the variable included in the model for the entire time horizon. Furthermore, in examining the effect of external debt on economics growth the vector error correction model was used.

3.4 Model specification

The objective of this study is to analyze the effect of debt on economic growth. The key macroeconomic variables or indicators on this study are: GDP, TOT, external debt ratio to GDP, external debt service ratio to export, rate of inflation and Real exchange rate.

For the sake of capturing major relevant external debt burdens the model is specified based on Elbadawi (1996) studies on the debt burden and production function. The functional form of this model is represented as follows:

RGDPt = f (EDGDP, DSE, TOT, ER, RI)……. (3.1)

Where; RGDPt – Real GDP at time t

EDGDP – Stock of external debt to GDP ratio

DSE – The debt service as a ratio of export earnings (reflects crowding out effect)

TOT – Terms of trade (captures external shocks)

RER – Real exchange rate

RI – Rate of inflation (reflects macro-economic stability)

Using equation 3.1 and expressing the variables in natural logarithmic form, an attempt will be made to look at the relative contribution (elasticity) of each variable to the growth process. To pursue this analysis adopting from the Elbadawi (1996) model, growth equation will be specified (to capture all relevant debt burden indicators). Therefore, the model to be estimated is specified as:

$\ln RGDPt = \beta 0+\beta 1 \ln EDGDP+\beta 2 \ln DSE+\beta 34 \ln TOT+\beta 4 \ln RER+\beta 5 \ln RI+\varepsilon t$…… (3.2)

Where; lnRGDPt– natural logarithm of RGDP at time t

lnEDGDP – natural logarithm of stock of external debt to GDP (-)

lnDSE – natural logarithm of debt service as a ratio of export (-)

lnTOT – natural logarithm of term of trade (- or +)

lnRER – Real exchange rate (-)

lnRI – the natural logarithm of Rate of inflation (- or +)

Note: The signs in the bracket shows what is expected

In equation 3.2 above $\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$ and $\beta 6$ are coefficient of elasticity's and εt is the random disturbance term.

3.6 Description of variables

In this section it is attempted to provide a brief discussion of the hypothesized macroeconomic variables that affect the economic growth with a change in the external debt of the country.

Real Gross Domestic Product (GDP): is the explained variable, which refers to the total value of output produced in the country.

The explanatory macro-economic variables that are hypothesized to affect growth when the county's external debt changes, are described below.

External debt to GDP ratio (EDGDP): indicates the extent of indebtedness of the country at any given time and represent external debt indicators of the nation. Gross external debt is the outstanding amount of those actual current and not contingent, liabilities that require payments of interest and/or principal by the debtor at some points in the future and that are owned to non-residents by residents of an economy.

The debt service as a ratio of export earnings (DSE): This ratio is defined as the ratio of external debt-service payments of principal and interest to exports of goods and services. The debt-service-to exports ratio is a possible indicator of debt sustainability because it indicates how much of a country's export revenue will be used up in servicing its debt.in other words movement of this debt-to-exports ratio over time reflects the debt-related risks; how vulnerable the payment of debt service obligations is to an unexpected fall in export earnings.

Terms of trade (TOT): Is the value of a country's export relative to that of its imports. It is calculated by dividing the value of exports by the value of imports. If country's TOT is less than one, there is more capital going out than there is coming in, but greater than one means the country is accumulating capital. It shows the extent of vulnerability of the economy to external factors and consequently to reliance on foreign resource financing. It also shows the extent of credibility of policies and their effect on economic growth.

Real exchange rate(RER): the effect of Real exchange rate on economic growth works through the aggregate supply channel i.e. developing countries are dependent on foreign capital for investment and the demand for their export elasticity is low. Thus, its impact on increasing the costs of imported raw materials is much higher than the positive effect it has on competitiveness.

Hence, Real exchange rate adjustments will have a multiplying cost effect on economic growth in Ethiopia.

Rate of inflation (RI): Inflation is defined as an increase in the overall price level in a country and measured in percent. Inflation can influence the demand for foreign funds through its adverse impact on the trade accounts. That is, inflation would tend to cause export demand to fall and import demand to rise, and the growing trade deficit, in turn, would increase trade-financing requirements.

3.7 Estimation procedure

- Unit root test for stationary of data

In constructing an econometric model between economic variables, time series data on the variables are necessary. Recent development in econometrics has shown that there are problems associated with time series macroeconomic data analysis due to non-stationarity. 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 not on the actual time that is computed (Harris, 1995). Moreover, the classical regression technique, the ordinary least square (OLS), assumes that the variables under considerations are stationary which means they have time independent values. Which means if (Yt) is stationary series then it would have a finite mean, variance and the covariance between any two consecutive periods which are time invariant or constant. As to Gujarati (2004) puts it regression on non-stationary data may lead to a spurious regression and it will be impossible to estimate if the data is non-stationary or random walk. Hence, prior to estimation of the long run model the time series properties of the variables, unit root test should be conducted.

Several tests are usually employed to test whether time series variables are stationary or non-stationary: the Augmented Dickey- fuller (ADF) test, Phillips- Peron test and Auto- correlation function (ACF) test. In this study the ADF test is applied to determine the existence of a unit root. This test has been chosen for its consistency, accuracy, and it took care of possible serial correlation in the error terms by including the lagged difference of the dependent variable.

The Augmented dickey-fuller (ADF) test

The fulfillment of stationary condition is conducted by the use of the following hypothesis.

Ho: Unit root, random walk, non-stationary ($\delta=0$)

H1: Stationary ($\delta\neq0$)

The general form of ADF is estimated by using the following models:

$$Y_t = \gamma Y_{t-1} + \varepsilon_t \quad (3a)$$

If $\gamma=1$, in equation (3a) becomes a random walk, that is, a non-stationary process. As a result, there tends to be the so-called unit root problem, which means there is a situation of non-stationarity in the series. However, if $\gamma<1$, this means that the series Yt is stationary. However, the unit root problem can be eliminated or stationarity can be achieved by differencing the data set (Wei 2006). The basic idea behind the ADF unit root test for non-stationarity is to simply regress Yt on its (one period) lagged value Yt-1 and find out if the estimated α is statistically equal to one or not. In this case, equation (4a) can be further manipulated by subtracting Yt-1 from both sides and obtain:

$$Y_t - Y_{t-1} = (\gamma - 1)Y_{t-1} + \varepsilon_t \quad (3b)$$

If equation (4b) is rewritten as following:

$$\Delta Y_{t-1} = \delta Y_{t-1} + \varepsilon_t \quad (3c)$$

Where $\delta= (\gamma-1)$, and Δ is the difference operator. Practically, instead of estimating equation (3a), the study estimated equation (3c) and tested for the null hypothesis of $\delta= 0$against the alternative hypothesis of $\delta\neq 0$.The ADF is also conducted with trend and constant. Since, the actual data generating process is not known a priori, the test of determining the orders of integration of the variables has conducted first by including a constant only and then both a constant and a trend. The ADF test is based on the regressions run in the following forms.

$$\Delta Y_t = \alpha_t + Y_{t-1} + \varepsilon_t \quad (3d)$$

$$\Delta Y_t = \alpha_t + \alpha_{t-1} + \delta Y_{t-1} + \varepsilon_t \quad (3e)$$

Where, t is the time or trend variable. In each case the null hypothesis is that, there is a unit root. The null hypothesis (H0) is thus a series contains a unit-root (non-stationary) against the alternative hypothesis (H1) stationary (deterministic trend).

- Co-integration test

Co-integration test determines the validity of long run linear equilibrium relationship of the variables when all variables are found to be non-stationary at level (that is, have a unit roots). If there is co-integration, it means that even if the variables are non-stationary at level there is a long run relationship between variables. In order to make this happen, the residual of a linear combination of non- stationary variables need to be stationary. In this study the Johansen (1998) approach was selected for co-integration test. Therefore, if we have n-numbers of variables there could be n-1 co-integrating vectors. The numbers of co-integrating vectors are determined with the help of two statistics: the trace statistics and the maximum Eigen value. If we have n-numbers of variables there could be n-1 co-integrating vectors. The numbers of co-integrating vectors are determined with the help of two statistics: the trace statistics and the maximum Eigen value.

- The Trace Statistic

The null hypothesis of the trace statistic is that there are no more than r cointegrating relations. Restricting the number of cointegrating equations to be r or less implies that the remaining 2-r eigenvalues are zero. Johansen derives the distribution of the trace statistic

$$-T\sum_{i=r+1}^{2}\ln(1-\lambda_i) \qquad (3f)$$

Where, T is the number of observations and the $\hat{\pi}_i$ is the estimated eigenvalues used in computing the log likelihood. For any given value of r, large values of the trace statistic are evidence against the null hypothesis that there is r or fewer co integrating relations in the VEC model.

- The Maximum Eigenvalue Statistic

The alternative hypothesis of the trace statistic is that the number of cointegrating equations is strictly larger than the number r assumed under the null hypothesis. Instead, in the maximum eigenvalue test statistic, we could assume a given r under the null hypothesis and test this against the alternative that there are r+1 cointegrating equations. Johansen derives an LR test of the null

of r co-integrating relations against the alternative of r+1cointegrating relations. Johansen derives the distribution of the trace statistic

$$-\mathrm{Tln}(1-\lambda_{r+1}) \qquad (3g)$$

Where, T is the number of observations and the $\hat{\pi}_i$ is the estimated eigenvalues used in computing the log likelihood.

CHAPTER FOUR: RESULT AND DISCUSSION

4.1 Unit root test results

Stationary of the data is checked using the Augmented Dickey-Fuller (ADF) test.

Table 4.1 Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	**Computed ADF**	
	At level	At 1st diff
lnRGDP	0.259421	-2.989444
lnEDGDP	-1.380477	-4.061042
lnDSE	-1.424527	-6.085629
lnTOT	-2.272223	-5.467356
lnOER	-0.866941	-3.746744
lnRI	-1.648877	-5.922600
Critical values		
At 1%	-3.679322	-3.699871
At 5%	-2.971853	-2.976263
At 10%	-2.622989	-2.627420

Reject the null hypothesis at 1% significance level
Reject the null hypothesis at 5% significance level
Reject the null hypothesis at 10% significance level

Results from stationery rest on the level of the variables indicate that: All variables are non-stationery at all significant levels when ADF is computed at level. Since all the variable need to be stationary the ADF is conducted on difference of the variables. When the variables are difference, as the above table shows, all variables reject the null hypothesis (the presence of a unit root). Therefore all variables are stationary on the first difference (integrated order one). Integrated order (I (1)) one means all variables are needed to be differenced once before they become stationary.

4.2 Test for co-integration

Before proceeding to estimate the growth model, the first task is to check whether the variables are co-integrated. If the variables are co-integrated of the same order, then there is a long run relationship between the variables. Table 4.2 below shows the result of co-integration test using Johansen (1988) trace statistic and maximum eigenvalue statistic.

Table 4.2. Johansen test for co-integration

Hypothesized No. of CE(s)	**Eigen values**	**Trace Statistics (λ trace)**	
		Johansen's Test statistics	Critical Value (5%)
None *	0.842105	127.0449	95.75366
At most 1	0.693162	69.36191	69.81889
At most 2	0.484756	42.28174	47.85613
At most 3	0.337276	23.71455	29.79707
At most 4	0.279203	12.19546	15.49471
At most 5	0.102511	3.028324	3.841466

* denotes rejection of the null hypothesis at 5% level of significance

The Johansen test statistics was greater than critical value at zero co-integrating vector (r =0) for trace test. This indicated the existence of one co-integrating relationship. Thus the above table shows that the null hypothesis of no co-integration is rejected at the conventional level (5%) and the study conclude the existence of a relationship among the proposed variables in the long run. Trace test indicates that there are one co-integrating vector. All the variables are co-integrated of order one having the long run relationship.

4.3 Estimation of the growth model

The result of Johansen approach co-integration test confirmed the existence of single long run equilibrium equation. The long run equation is estimated by VECM the regression result on the first difference of the variables is presented below.

Table. 4.3. The long-run VECM estimation result

Variables	Coefficients	Standard error	t-value
Constant	-33.33174	-	-
LNRGDP	1.000000	-	-
lNEDGDP	3.243533	0.26420	12.2766*
lnDSE	1.587398	0.18166	-8.73830*
lnTOT	-4.082765	0.50494	8.08565*
lnER	-2.726547	0.20196	-13.5007*
lnRI	-0.041513	0.01213	3.42128*

* indicates significance at 5%

Result can be put in an equation form as

LnRGDP=33.33174-3.243533lnEDGDP-1.587398lnDSE+4.082765lnTOT+2.726547lnER

+0.041513lnRI

Since all variables are used in the logarithmic form, the estimated coefficients can directly be interpreted as long term elasticity. Coefficients of all variables are significant at 5% level of significance. The coefficient of the dependent variable (GDP) at zero level of the explanatory or independent variable is given as 33.33174. This indicates a positive relationship between the constant parameter and GDP. The long run elasticity of external debt as ratio of GDP is -3.243533 indicating GDP is sensitive to the change in external debt: a 1% increase in the level of external debt to GDP ratio leads to 3.243533 percent contraction in GDP. This effect is because of the debt overhang effect.

The coefficient of debt-service payments to export ratio (DSE) shows that there is a negative relationship between GDP and DSE. Which means each export earning that should be invested in the country is now paid to the creditors. In other words a large capital outflow will eventually affect the economic growth in a negative way.

The result also shows that there is a positive relationship between economics growth and term of trade. Which is a 1% increase in terms of trade (TOT), will increase GDP by 4.082765 percent. Growth in the export of the country, will contributed much to capital accumulation and due to generating foreign currency to import capital goods that are vital for economic growth. The other variable Real exchange rate (RER) also have a positive relationship with a significant t-value. A

1% increase in the Real exchange rate increases the GDP by 2.726547percent. Unfortunately, unlike the hypothesis the result was quite unexpected: having a positive relationship is that the deterioration in the Real exchange rate will favor export expansion and contract import trough higher import prices; as a result, the GDP is enhanced through improved net export component of aggregate demand.

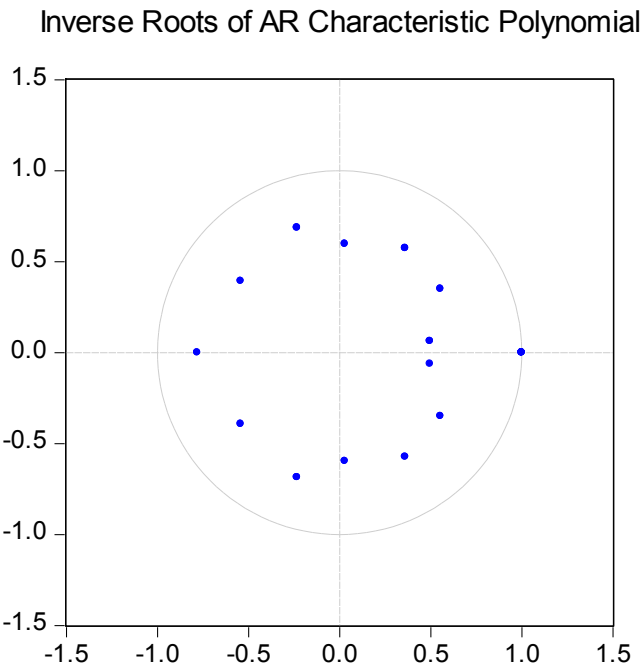
The last variable estimated: rate of inflation was found to have a direct relationship and a 1% increase in the rate of inflation will raise GDP by 0.041513percent. Contrary to the theory of inflation where it causes contraction of the economic growth, in this study, the rate of inflation prevailed was desirable and favorable by initiating the economic activity. Even though it requires additional research to identify its impact on economic growth; in this study however, it is found that rate of inflation does not have an adverse effects on economic growth.

4.4 Diagnostic Tests on the Residual of VECM

Tests of serial correlation, normality, and hetroskedasticity on the residuals of the vector error correction models are conducted with the help of Lagrange-multiplier test, Jarque-Beta test, White-heteroskedasticity test respectively.

4.4.1 Stability test

The very important test in econometric research analysis is checking stability of the model. Stability test for residuals is employed to test the validity of VECM. In this study VECM stability test is conducted by using method of inverse roots of characteristic polynomial. As we seen from the following graph the values are inside the circle except two on the line. it is tolerable in VECM, the values are less than a unity.



4.4.2 Normality Test

By using annual data from 1977 to 2015 the VEC residual normality test employed Orthogonalization method of Cholesky of covariance. As we seen from the following table, the test has low p-value (0.0434). Therefore, the null hypothesis of residuals are multivariate normal is rejected and accept the alternative.

4.4.3 Heteroskedasticity test

The vector error correction model residual test results shows absence of Heteroskedasticity. VEC residual Heteroskedasticity test has p-value of (0.4921) and statistically insignificant at 10 percent. Therefore, the test is failed to reject no Heteroskedasticity problem showing the variance of error terms are constant.

4.4.4 Autocorrelation test

Serial correlation test for residuals of vector error correction models used a method of langrage multiplies (LM) test. Since most of p-values are greater than 10 percent critical values, we failed to reject the null-hypothesis. Generally, the model is free from the problem of autocorrelation

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

The main objective of this study is to analyze the effect of external debt on economic growth in Ethiopia during the specified period. To determine the long run relationship among the variables. Vector error correction model was applied. Before applying VECM model, all the variables are tested for their time series properties stationary properties using the ADF. An also all the diagnostic tests on the residual.to examine the long run relationship the study uses VECM.as the result indicates the heavy dependence on external debt for deficit financing brings an outcome of debt burden problem which is reflected by a rising level of stock of external debt and debt servicing. .The debt burden problem is a great concern because it imposes a number of constraints on the economic growth rather than causing economic growth.

The empirical evidence revealed that external debt has a significant negative relationship with economic growth. This clearly shows that higher external debt discourages economic growth. Therefore, it is verifies the existence of debt overhang situation in Ethiopia during the period under the study. The other debt burden indicator debt service as a percentage of export is found to be negative as well.

In line with the conventional growth theories, the regression result indicates that term of trade have positive contribution to real GDP.

In addition to the above growth equation indicates the positive and significant relationship between Real exchange rate and inflation rate with economic growth.

5.2. Recommendation

The government of Ethiopia should increase domestic saving. This includes increase saving mobilization like selling of government Bonds, expanding financial institutions and by strengthening existing saving tools (strengthening both private and government workers social security scheme, strengthening saving for housing program, saving for investment equipment scheme).

As debt affects the economic growth of Ethiopia negatively, allocating resources on selected productive investment areas, which used to return back the debt burden and together with basic infrastructure construction that facilities productive of other sector is crucial.

In addition there should be close monitoring and consistent debt management strategies, which is used to avoid misallocation and mismanagement of external debt problem.

Since exchange rate have a positive effect on economic growth by encouraging export. Diversifying export sector by an export-led growth strategy is one of the solutions to reduce the debt problem. Means by lowering the external debt service to export ratio he government can service its debt without affecting the economic growth; at least not in a big way.

Proper macroeconomic management of the economy as a whole is also important, since it has effect on the volume and servicing of external debt Payment stability.

Inflation have a positive significant effect on GDP but still the government should sustain the existing inflation rate by tight fiscal and monetary policies, financing of budget deficit from non-inflationary sources and implementation of price stabilization program by subsiding basic food items.

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1. UNIT ROOT TEST

1. A

Null Hypothesis: LNDSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.424527	0.5565
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNDSE)
Method: Least Squares
Date: 05/31/17 Time: 15:51
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDSE(-1)	-0.129888	0.091180	-1.424527	0.1658
C	0.362673	0.282423	1.284148	0.2100

R-squared	0.069905	Mean dependent var	-0.021860
Adjusted R-squared	0.035457	S.D. dependent var	0.455360
S.E. of regression	0.447214	Akaike info criterion	1.294913
Sum squared resid	5.400008	Schwarz criterion	1.389209
Log likelihood	-16.77623	Hannan-Quinn criter.	1.324445
F-statistic	2.029278	Durbin-Watson stat	2.205523
Prob(F-statistic)	0.165751		

B.

Null Hypothesis: D(LNDSE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.085629	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNDSE,2)
Method: Least Squares
Date: 05/31/17 Time: 15:57
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDSE(-1))	-1.172395	0.192650	-6.085629	0.0000
C	-0.032272	0.087826	-0.367456	0.7163

R-squared	0.587530	Mean dependent var	-0.004773
Adjusted R-squared	0.571666	S.D. dependent var	0.709142
S.E. of regression	0.464114	Akaike info criterion	1.371376
Sum squared resid	5.600445	Schwarz criterion	1.466533
Log likelihood	-17.19926	Hannan-Quinn criter.	1.400466
F-statistic	37.03487	Durbin-Watson stat	1.973107
Prob(F-statistic)	0.000002		

2.

A

Null Hypothesis: LNEDGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.380477	0.5778
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNEDGDP)
Method: Least Squares
Date: 05/31/17 Time: 16:02
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEDGDP(-1)	-0.136925	0.099187	-1.380477	0.1788
C	0.494770	0.370591	1.335084	0.1930

R-squared	0.065929	Mean dependent var	-0.009863
Adjusted R-squared	0.031333	S.D. dependent var	0.333312
S.E. of regression	0.328048	Akaike info criterion	0.675161
Sum squared resid	2.905626	Schwarz criterion	0.769457
Log likelihood	-7.789835	Hannan-Quinn criter.	0.704693
F-statistic	1.905715	Durbin-Watson stat	1.447180
Prob(F-statistic)	0.178763		

B.

Null Hypothesis: D(LNEDGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.061042	0.0041
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNEDGDP,2)
Method: Least Squares
Date: 05/31/17 Time: 16:03
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNEDGDP(-1))	-0.774392	0.190688	-4.061042	0.0004
C	-0.011303	0.063586	-0.177761	0.8603

R-squared	0.388121	Mean dependent var	-0.003095
Adjusted R-squared	0.364587	S.D. dependent var	0.421885
S.E. of regression	0.336297	Akaike info criterion	0.727103
Sum squared resid	2.940481	Schwarz criterion	0.822260
Log likelihood	-8.179442	Hannan-Quinn criter.	0.756194
F-statistic	16.49207	Durbin-Watson stat	1.977878
Prob(F-statistic)	0.000399		

3.

A.

Null Hypothesis: LNOER has a unit root
Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.866941	0.7842
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNOER)
Method: Least Squares
Date: 05/31/17 Time: 16:07
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNOER(-1)	-0.032285	0.037241	-0.866941	0.3936
C	0.139874	0.076071	1.838727	0.0770

R-squared	0.027083	Mean dependent var	0.078210
Adjusted R-squared	-0.008951	S.D. dependent var	0.144610
S.E. of regression	0.145256	Akaike info criterion	-0.954172
Sum squared resid	0.569678	Schwarz criterion	-0.859876
Log likelihood	15.83550	Hannan-Quinn criter.	-0.924640
F-statistic	0.751587	Durbin-Watson stat	1.244073
Prob(F-statistic)	0.393614		

B.

Null Hypothesis: D(LNOER) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.746744	0.0090
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNOER,2)
Method: Least Squares
Date: 05/31/17 Time: 16:09
Sample (adjusted): 1990 2016
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNOER(-1))	-0.822345	0.219482	-3.746744	0.0010
D(LNOER(-1),2)	0.290505	0.194519	1.493453	0.1484
C	0.068745	0.032154	2.137988	0.0429

R-squared	0.377825	Mean dependent var	0.000371
Adjusted R-squared	0.325977	S.D. dependent var	0.167738
S.E. of regression	0.137711	Akaike info criterion	-1.022879
Sum squared resid	0.455144	Schwarz criterion	-0.878897
Log likelihood	16.80887	Hannan-Quinn criter.	-0.980066
F-statistic	7.287178	Durbin-Watson stat	2.009479
Prob(F-statistic)	0.003365		

4.

A.

Null Hypothesis: LNRGDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.259421	0.9716
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRGDP)
Method: Least Squares
Date: 05/31/17 Time: 16:11
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRGDP(-1)	0.004258	0.016415	0.259421	0.7974
D(LNRGDP(-1))	0.509511	0.201740	2.525581	0.0183
C	0.023602	0.175323	0.134618	0.8940

R-squared	0.289075	Mean dependent var	0.148436
Adjusted R-squared	0.232201	S.D. dependent var	0.104687
S.E. of regression	0.091731	Akaike info criterion	-1.838950
Sum squared resid	0.210366	Schwarz criterion	-1.696214
Log likelihood	28.74530	Hannan-Quinn criter.	-1.795314
F-statistic	5.082731	Durbin-Watson stat	2.110545
Prob(F-statistic)	0.014054		

B.

Null Hypothesis: D(LNRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.989444	0.0741
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRGDP,2)
Method: Least Squares
Date: 05/31/17 Time: 16:12
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRGDP(-1))	-0.462025	0.166229	-2.779444	0.0100
C	0.068387	0.030025	2.277636	0.0312

R-squared	0.229066	Mean dependent var	-0.000361
Adjusted R-squared	0.199414	S.D. dependent var	0.100665
S.E. of regression	0.090071	Akaike info criterion	-1.907690
Sum squared resid	0.210932	Schwarz criterion	-1.812533
Log likelihood	28.70766	Hannan-Quinn criter.	-1.878600
F-statistic	7.725308	Durbin-Watson stat	2.160636
Prob(F-statistic)	0.009983		

5.

A.

Null Hypothesis: LNRI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.648877	0.4457
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	

10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRI)
Method: Least Squares
Date: 05/31/17 Time: 16:14
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRI(-1)	-0.244002	0.147981	-1.648877	0.1108
C	3.049975	2.210814	1.379571	0.1790

R-squared	0.091484	Mean dependent var	0.656389
Adjusted R-squared	0.057835	S.D. dependent var	9.251051
S.E. of regression	8.979548	Akaike info criterion	7.294248
Sum squared resid	2177.072	Schwarz criterion	7.388545
Log likelihood	-103.7666	Hannan-Quinn criter.	7.323781
F-statistic	2.718796	Durbin-Watson stat	1.887234
Prob(F-statistic)	0.110762		

B.

Null Hypothesis: D(LNRI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.922600	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRI,2)
Method: Least Squares
Date: 05/31/17 Time: 16:15
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRI(-1))	-1.124354	0.189841	-5.922600	0.0000
C	1.117418	1.760790	0.634612	0.5312

R-squared	0.574309	Mean dependent var	0.345016

Adjusted R-squared	0.557936	S.D. dependent var	13.97493
S.E. of regression	9.291634	Akaike info criterion	7.364855
Sum squared resid	2244.696	Schwarz criterion	7.460013
Log likelihood	-101.1080	Hannan-Quinn criter.	7.393946
F-statistic	35.07719	Durbin-Watson stat	2.122417
Prob(F-statistic)	0.000003		

6.

A.

Null Hypothesis: LNTOT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.272223	0.1871
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNTOT)
Method: Least Squares
Date: 05/31/17 Time: 16:17
Sample (adjusted): 1988 2016
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNTOT(-1)	-0.355878	0.156621	-2.272223	0.0313
C	1.702459	0.746994	2.279081	0.0308

R-squared	0.160526	Mean dependent var	0.005711
Adjusted R-squared	0.129434	S.D. dependent var	0.113492
S.E. of regression	0.105893	Akaike info criterion	-1.586311
Sum squared resid	0.302758	Schwarz criterion	-1.492014
Log likelihood	25.00151	Hannan-Quinn criter.	-1.556778
F-statistic	5.162999	Durbin-Watson stat	1.919119
Prob(F-statistic)	0.031252		

B.

Null Hypothesis: D(LNTOT) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.467356	0.0001
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNTOT,2)
Method: Least Squares
Date: 05/31/17 Time: 16:20
Sample (adjusted): 1990 2016
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNTOT(-1))	-1.592884	0.291344	-5.467356	0.0000
D(LNTOT(-1),2)	0.382098	0.193594	1.973710	0.0600
C	0.007757	0.021656	0.358216	0.7233

R-squared	0.635284	Mean dependent var	0.000370
Adjusted R-squared	0.604891	S.D. dependent var	0.178768
S.E. of regression	0.112370	Akaike info criterion	-1.429609
Sum squared resid	0.303046	Schwarz criterion	-1.285627
Log likelihood	22.29972	Hannan-Quinn criter.	-1.386796
F-statistic	20.90228	Durbin-Watson stat	1.820004
Prob(F-statistic)	0.000006		

2. CO-INTEGRATION

Date: 05/31/17 Time: 16:45
Sample (adjusted): 1989 2016
Included observations: 28 after adjustments
Trend assumption: Linear deterministic trend
Series: LNRGDP LNDSE LNEDGDP LNOER LNRI LNTOT
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.842105	127.0449	95.75366	0.0001
At most 1 *	0.693162	75.36191	69.81889	0.0169
At most 2	0.484756	42.28174	47.85613	0.1510
At most 3	0.337276	23.71455	29.79707	0.2128
At most 4	0.279203	12.19546	15.49471	0.1478
At most 5	0.102511	3.028324	3.841466	0.0818

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.842105	51.68303	40.07757	0.0016
At most 1	0.693162	33.08017	33.87687	0.0620
At most 2	0.484756	18.56720	27.58434	0.4487
At most 3	0.337276	11.51909	21.13162	0.5955
At most 4	0.279203	9.167133	14.26460	0.2725
At most 5	0.102511	3.028324	3.841466	0.0818

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

3

A. VCM MODEL

Vector Error Correction Estimates
Date: 05/31/17 Time: 16:56
Sample (adjusted): 1990 2016
Included observations: 27 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNRGDP(-1)	1.000000
LNDSE(-1)	1.587398 (0.18166) [-8.73830]
LNEDGDP(-1)	3.243533 (0.26420) [12.2766]
LNER(-1)	-2.726547 (0.20196) [-13.5007]
LNRI(-1)	-0.041513 (0.01213) [3.42128]
LNTOT(-1)	-4.082765 (0.50494) [8.08565]

C	-33.33174					

Error Correction:	D(LNRGDP)	D(LNDSE)	D(LNEDGDP)	D(LNOER)	D(LNRI)	D(LNTOT)
CointEq1	-0.026135	-0.557084	-0.706008	-0.090302	-0.015643	-0.150253
	(0.06554)	(0.24519)	(0.18831)	(0.07684)	(4.60982)	(0.06165)
	[-0.39875]	[-2.27207]	[-3.74928]	[-1.17525]	[-0.00339]	[-2.43720]
D(LNRGDP(-1))	0.424124	1.309667	-0.458396	0.371020	-7.074917	0.009469
	(0.32919)	(1.23151)	(0.94580)	(0.38593)	(23.1539)	(0.30965)
	[1.28838]	[1.06346]	[-0.48466]	[0.96138]	[-0.30556]	[0.03058]
D(LNRGDP(-2))	0.048100	-0.831079	-1.733983	-0.653123	40.35772	-0.558882
	(0.36101)	(1.35054)	(1.03722)	(0.42323)	(25.3917)	(0.33958)
	[0.13324]	[-0.61537]	[-1.67176]	[-1.54320]	[1.58941]	[-1.64582]
D(LNDSE(-1))	-0.009925	-0.814363	-0.806760	-0.232024	4.279673	-0.224528
	(0.12024)	(0.44984)	(0.34548)	(0.14097)	(8.45746)	(0.11311)
	[-0.08254]	[-1.81035]	[-2.33521]	[-1.64593]	[0.50602]	[-1.98511]
D(LNDSE(-2))	-0.077415	-0.391461	-0.170581	0.026540	-0.161781	-0.039894
	(0.09451)	(0.35357)	(0.27154)	(0.11080)	(6.64747)	(0.08890)
	[-0.81911]	[-1.10718]	[-0.62820]	[0.23953]	[-0.02434]	[-0.44875]
D(LNEDGDP(-1))	-0.078170	1.060857	1.396397	0.382562	2.061260	0.191284
	(0.17475)	(0.65375)	(0.50208)	(0.20487)	(12.2913)	(0.16438)
	[-0.44732]	[1.62272]	[2.78121]	[1.86734]	[0.16770]	[1.16368]
D(LNEDGDP(-2))	0.079661	1.394639	0.529829	-0.134262	-4.253800	0.097285
	(0.14489)	(0.54205)	(0.41630)	(0.16987)	(10.1912)	(0.13629)
	[0.54979]	[2.57290]	[1.27272]	[-0.79040]	[-0.41740]	[0.71380]
D(LNOER(-1))	0.112566	-0.831619	-0.070383	0.463141	-13.74442	-0.108942
	(0.33278)	(1.24493)	(0.95611)	(0.39013)	(23.4062)	(0.31302)
	[0.33826]	[-0.66800]	[-0.07361]	[1.18714]	[-0.58721]	[-0.34803]
D(LNOER(-2))	-0.090774	-0.423001	-0.202757	-0.133373	-14.11513	0.340034
	(0.19019)	(0.71150)	(0.54644)	(0.22297)	(13.3771)	(0.17890)
	[-0.47728]	[-0.59452]	[-0.37105]	[-0.59817]	[-1.05517]	[1.90071]
D(LNRI(-1))	0.002317	0.012794	0.005140	0.000624	-0.361578	0.003951
	(0.00304)	(0.01139)	(0.00874)	(0.00357)	(0.21407)	(0.00286)
	[0.76113]	[1.12371]	[0.58778]	[0.17491]	[-1.68910]	[1.38020]
D(LNRI(-2))	0.000182	-0.023358	-0.007698	0.000312	-0.328754	0.004244
	(0.00274)	(0.01026)	(0.00788)	(0.00322)	(0.19292)	(0.00258)
	[0.06631]	[-2.27636]	[-0.97689]	[0.09694]	[-1.70410]	[1.64490]
D(LNTOT(-1))	0.144321	2.819639	1.664455	0.342639	3.398829	0.247628
	(0.29873)	(1.11754)	(0.85828)	(0.35021)	(21.0111)	(0.28099)
	[0.48312]	[2.52307]	[1.93930]	[0.97838]	[0.16176]	[0.88126]
D(LNTOT(-2))	-0.044553	-0.547173	0.976404	0.426428	-16.86654	0.184789
	(0.32612)	(1.22002)	(0.93698)	(0.38233)	(22.9379)	(0.30676)
	[-0.13661]	[-0.44849]	[1.04207]	[1.11535]	[-0.73531]	[0.60239]
C	0.072470	-0.008845	0.328279	0.092034	-0.335362	0.057967

	(0.06188) [1.17122]	(0.23148) [-0.03821]	(0.17778) [1.84659]	(0.07254) [1.26874]	(4.35206) [-0.07706]	(0.05820) [0.99596]
R-squared	0.497187	0.651131	0.617025	0.654821	0.640386	0.647248
Adj. R-squared	-0.005627	0.302262	0.234050	0.309642	0.280772	0.294496
Sum sq. resids	0.143758	2.011917	1.186689	0.197579	711.1816	0.127196
S.E. equation	0.105159	0.393399	0.302132	0.123282	7.396369	0.098916
F-statistic	0.988810	1.866404	1.611137	1.897046	1.780759	1.834855
Log likelihood	32.36734	-3.255228	3.871704	28.07428	-82.47107	34.01984
Akaike AIC	-1.360544	1.278165	0.750244	-1.042539	7.146005	-1.482951
Schwarz SC	-0.688628	1.950080	1.422160	-0.370624	7.817921	-0.811035
Mean dependent	0.152072	-0.025419	-0.014187	0.084003	1.666238	0.006134
S.D. dependent	0.104864	0.470963	0.345220	0.148375	8.721381	0.117765

Determinant resid covariance (dof adj.)	4.48E-08
Determinant resid covariance	5.58E-10
Log likelihood	57.76296
Akaike information criterion	2.387929
Schwarz criterion	6.707385

4. STABILITY

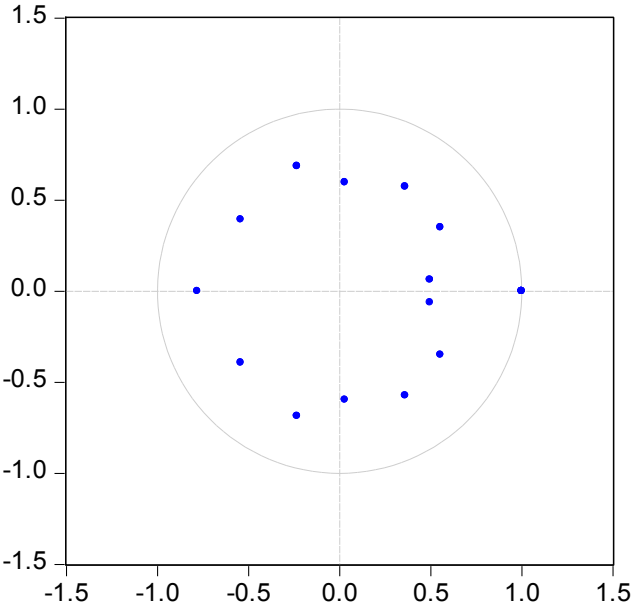
A.

Roots of Characteristic Polynomial
Endogenous variables: LNRGDP LNDSE LNEDGDP LNOER LNRI LNTOT
Exogenous variables:
Lag specification: 1 2
Date: 05/31/17 Time: 17:24

Root	Modulus
1.000000 - 2.08e-15i	1.000000
1.000000 + 2.08e-15i	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.779412	0.779412
-0.232649 + 0.686238i	0.724602
-0.232649 - 0.686238i	0.724602
0.360761 + 0.574138i	0.678073
0.360761 - 0.574138i	0.678073
-0.541982 - 0.393062i	0.669509
-0.541982 + 0.393062i	0.669509
0.554856 + 0.349587i	0.655802
0.554856 - 0.349587i	0.655802
0.029567 - 0.597769i	0.598500
0.029567 + 0.597769i	0.598500
0.496994 + 0.061465i	0.500781
0.496994 - 0.061465i	0.500781

VEC specification imposes 5 unit root(s).

Inverse Roots of AR Characteristic Polynomial



5. Normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 05/31/17 Time: 17:46
Sample: 1987 2016
Included observations: 27

Component	Skewness	Chi-sq	df	Prob.
1	0.620342	1.731709	1	0.1882
2	0.618604	1.722018	1	0.1894
3	0.960340	4.150138	1	0.0416
4	-0.451954	0.919182	1	0.3377
5	-0.149078	0.100009	1	0.7518
6	0.464002	0.968841	1	0.3250
Joint		9.591898	6	0.1429

Component	Kurtosis	Chi-sq	df	Prob.

1	2.723015	0.086311	1	0.7689
2	2.798024	0.045894	1	0.8304
3	4.460060	2.398246	1	0.1215
4	2.795544	0.047028	1	0.8283
5	2.927336	0.005940	1	0.9386
6	2.944393	0.003479	1	0.9530
Joint		2.586896	6	0.8586

Component	Jarque-Bera	df	Prob.
1	1.818020	2	0.4029
2	1.767912	2	0.4131
3	6.548384	2	0.0378
4	0.966210	2	0.6169
5	0.105949	2	0.9484
6	0.972320	2	0.6150
Joint	12.17879	12	0.0434