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ECONOMIC IMPLICATION OF MILITARY EXPENDITURE ON ECONOMIC GROWTH: EVIDENCE FROM ETHIOPIA

A RESEARCH SUBMITTED TO THE SCHOOL OF BUSINESS AND ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN ECONOMICS (DEVELOPMENT ECONOMICS)

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This is to certify that the thesis prepared by Naol Kebede, entitled: Economic implication of Military Expenditure on Economic growth: Evidence from Ethiopia and submitted in partial fulfillment of the requirement for the degree of Master of Science (Development Economics) compiles with the regulations of the University and meets the accepted standards with the respect to originality and quality

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Lists of acronyms and abbreviations

ADF: Augmented Dickey-Fuller

ETB: Ethiopian Birr

EPLF: Eritrean People's Liberation Front

EPRDF: Ethiopian People's Revolutionary Democratic Front

GDP: Gross Domestic Product

GMM: Generalized Method of Moments

LDCS: Least Developed Countries

MO FED: Ministry of Finance and Economic Development

NBE: National Bank of Ethiopia

NDR: National Democratic Revolution

PA: Peasant Association ship

NATO: North Atlantic Treaty Organization

RGDP: Real Gross Domestic Product

SIPRI: Stockholm International Peace Research Institute

SSA: Sub Saharan Africa

TYPP: Ten-Year Perspective Plan

WDI: World Development Indicator

WPE: Workers Party of Ethiopia

Abstract

This study was carried out to empirically examine the policy implication of military expenditure on economic growth in Ethiopia. Although national defense is an important function of government and security from external and internal threats that contributes to economic development, high military expenditures for defense or civil conflicts burden the economy and may impede growth. Thus, the paper was aimed at investigate the empirical economic implication of military expenditure on economic growth of Ethiopia and the paper also examined moderating effects of inflation and unemployment on the relationship between military expenditure and economic growth. The research employed secondary data for the period 1974/5-2017/18. In analyzing the long run and short run relationship between military expenditure and economic growth, Johansen's co-integration test, VECM, and Granger causality test was applied. Further, forecast Error Variance Decomposition was obtained using the cholesky decomposition of the VECM and used the generalized impulse response function. The study found that military expenditure affect economic growth negatively. The finding showed that there was a unidirectional causality running from economic growth to military expenditure in the long run. From the empirical finding, impulse response function suggested that military expenditure negatively impacts economic growth and Variance Decomposition also revealed that military expenditure has no important impact on future growth rate of output in Ethiopia. The empirical finding also found out that inflation and unemployment have significant moderating effects on the relationship between military expenditure and economic growth in the long run. Finally, this study recommends policy makers to consider the effects of military expenditure and spend more resources on productivity, which is growth enhancing, reducing unemployment, stabilizing inflation as well as foreign exchange market.

Keywords: *Economic Growth, military expenditure, Granger-Causality, Moderator variables, Ethiopia*

CHAPTER ONE

1. INTRODUCTION

1.1Background of the Study

Military expenditures data from SIPRI are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces[1], if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel, including retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country). Excluded are civil defense and current expenditures for previous military activities, such as for veterans' benefits, demobilization, conversion, and destruction of weapons. This definition cannot be applied for all countries, however, since that would require much more detailed information than is available about what is included in military budgets and off-budget military expenditure items. For instance, military budgets might or might not cover civil defense, reserves and auxiliary forces, police and paramilitary forces, dual-purpose forces such as military and civilian police, military grants in kind, pensions for military personnel, and social security contributions paid by one part of government to another (SIPRI, 2018).

Exactly how military spending affects economic growth of a nation remains a contradictory question and a debatable issue among economic managers and policy-makers. Question regarding the nature of relationship between defense expenditures and economic growth in literature is still inconsistent. Since 1970s, advent of debate, there is lack of consensus, whether military expenditures impact growth and, if it so, whether it is direct or inverse (Benoit 1973, 1978; Sandler and Hartley, 2007).

Relationship between defense spending and economic growth has been extensively investigated since the seminal study of Benoit (1973, 1978) that suggested a positive relationship between the

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[1] A paramilitary is a semi-militarized force whose organizational structure, tactics, training, subculture, and function are similar to those of a professional military, but which is not included as part of a state's formal armed forces.

two variables. The simplistic approach and the various problems associated with this study triggered many researchers to re-examine the same relationship using more sophisticated methods, different theoretical underpinnings, longer time series or larger cross sections. Despite all this, and despite the huge amount of empirical work since the Benoit study, there is still no consensus on the impact of military spending on growth. Of course, there is a wide variety of possible reasons that may lead to different results such as different theoretical underpinnings, models and specifications, different estimation methods, different countries, different time periods examined e This lack of consensus combined with continuous developments in econometrics has led researchers in the area to continue with attempts to establish a more robust relationship (Dunne, 2009).

Governments arrange the share they separate for defense spending by taking the welfare of their country into consideration. If they feel a threat, they decrease the investments which will increase the welfare of the country and increase defense spending. The effect of defense spending on the economy is one of the most discussed subjects today. Many countries separate more share to defense spending compared to education, health and infrastructure expenditures (Korkmaz, 2015)

Sub-Saharan African countries spent on average about $8.8 billion annually on the military between 1990 and 1999 (Brempong, 2002). While the absolute amount spent on military in African countries is minute compared to those of developed countries, the defense burden, averaging about 2.3% of GDP, is much higher than the world average. Some of the countries have a very high defense burden. For instance, In the case of Ethiopia, the defense budget was nearly half of the total recurrent expenditure during the Derg regime and the defense burden in reached to 10.7 % in the year 1999 (Kefyalew, 2007).

Given Sustained and equitable economic growth is an important objective of public expenditure policy. Many public policy programs are predominantly aimed at promoting sustained and equitable economic growth. The Society demands for infrastructural facilities such as education, health, defense, to grow and improve on their standards of living. Economically, Ethiopia is one of the fast growing countries. The average economic growth rate for the past decade 2010/11-2014/15 has been at 10.59 percent and consequently 7.7 percent in 2018. However, high military expenditure impeded the economic growth of a given country (NBE, 2018).

The study aims to critically examine the effects of military spending upon national economic growth. It would also explore whether military spending can be utilized to contribute towards the economic progress of Ethiopia.

1.2 Statement of the problem

Large expenditures on weapons occupy resources needed for development. Weapons transfers including both sales and military aid/gifts can be detrimental to developing nations' economies. For instance, debt rose seriously in developing countries because of rising interest rates on loans taken out to finance arms purchases in the most developing nations and Involvement in armed conflict has been a major source of debt in Ethiopia (SIPRI, 2016). Ethiopia military expenditure is increasing from time to time which negatively affects the normal follow of the economy. As data that is received from ministry of finance of Ethiopia reveals, among the outlays of Ethiopian government (economic development expenditure, social service expenditure, military expenditure and other service expenditure) the outlays on military has been the highest starting from 1949 /50 to 2012/13 around for 68 years However, Ethiopia military expenditure contributes 0.7 % as a share of GDP from 2013 to 2016 (MOFED 2017).

The subject of debate is whether or not defense expenditure increases the growth rate of the economy. Thus, the relationship between economic growth and public expenditure on defense is an important subject of analysis or has to be a policy-relevant research topic.

Looking at different economics defense literature; Deger (1986), Deger and Smith (1983), and Lebovic and Ishaq (1987) employ simultaneous equation models which incorporate the demand and supply sides to measure the impact of the military expenditure on growth and found a negative impact of military expenditures on economic growth.

The result of the cross-sectional study over the period of 1960–78 suggests that military expenditure is beneficial to economic growth for the LDCs with rich resource. For the LDCs with limited endowment, there existed no positive relationship between the two variables. Benoit (1973; 1978) found that defense spending has a positive effect on economic development. Applying the Harrod-Domar growth model to 54 LDCs over the period of 1965–73, results by Lim (1983) pointed out huge amount of military spending was harmful to economic growth. Deger (1986), Deger and Smith (1983), Brempong (1989), Dunne and Vougas (1999) found negative relationship between defense burden and economic growth.

Other researchers such as Biswas and Ram (1986) concluded that there exists no relationship at all. Sandler and Hartley (1995) survey vast defense economic literatures and they reported that the literature does not indicate any robust empirical regularity, positive or negative.

Bader and Qarn (2003), using time series analysis, investigated the causal relationship between military expenditure and economic growth for Egypt, Israel and Syria for the last three decades. They report that defense expenditures hinder economic growth for all three countries. On the other hand, Chowdhury (1991), Kollias, Christos and Makrydakis (1997) and Dakurah et al. (2001) empirically supported that causality is not clear cut while Al-Jarrah (2005) examined the causal relationship between defense spending and economic growth for 1970-2003 using time-series procedures. He found evidence of bidirectional causations, wherein higher defense spending lowered economic growth in the long run.

In the literature of defense economics there are various studies that examined the effect of defense expenditure in economic growth in the context of developing countries (Benoit, 1973, 1978; Deger and Smith, 1983; Deger, 1986; Chowdhury, 1991, etc.). However, the scholars found different findings, and hence, there is no common consensus among researchers about the effect of defense spending. Additionally, there is no clear direction of causations.

The above mixed findings; the lack of robust empirical evidence concerning the effect of defense burden and yet the direction of causation of this relationship remains controversial in the defense economics literature motivated the researcher to study at first phase.

About the only thing which can be stated with clarity is that the impact of defense outlays on the economy depends on the particular country, the macro and microeconomic policies pursued by the government, the country's overall economic structure, and a host of other non-economic variables. As Chan (1985:433) so aptly states: "We have probably reached the point of diminishing returns in relying on aggregate cross-national studies to inform us about the economic impact of defense spending future research will profit more from discriminating diachronic studies of individual countries as the search for universal patterns applicable to all places and times is likely to be disappointing."

The majority of the studies mentioned above have used a multi- country approach to examine the relationship between military spending and economic growth in developing countries. While multi-country approaches are useful, a case study approach may be more illustrative. After all, circumstances and policy responses are likely to vary across countries and the nature of the policies pursued is likely to affect the relationship between military spending and economic growth. This paper therefore adopts a case study approach in an attempt to analyze the economic costs of Ethiopian military expenditure on growth more than four decades long. That means it uses longer data series than many previous studies and this has the guarantee to capture the dynamic effects that military expenditure has on economic growth by including variables such as unemployment and inflation as a moderating relationship.

After reviewing available research papers on military spending, it is found that there are no papers which have focused on predicting military spending using moderator variables in Ethiopia. It is also found that some of the researches focused on predicting defense expenditure of different countries have used only direct explanatory variables on dependent variable (RGDP) and completely ignored the relevance of moderator variables. Therefore, the researcher fills the gap of the previous study (add value to the literature) by employing a case study approach, using longer time series and applying the moderating variables to the study.

1.3 Objectives of the Study

The main objective of this study was to investigate empirically the economic implication of military expenditure on economic growth in Ethiopia.

1.3.1The specific objectives were

- To assess the performance of government expenditure on military service in Ethiopia.
- To determine if the relationship between military expenditure and economic growth in Ethiopia is short run and long run phenomena or both.
- To test the direction of causality between the military expenditure and economic growth both in the short run and in the long run in Ethiopia.
- To examine the moderating effect of inflation and unemployment on the relationship between military expenditure and economic growth in Ethiopia.

1.4 Research questions

- What is the performance of government expenditure on military service in Ethiopia?
- What is the relationship between military expenditure and economic growth in short run and long run in Ethiopia?
- What is the direction of the causality between military expenditure and economic growth both in the short run and long run in Ethiopia?
- What is the moderating effect of inflation and unemployment on the relationship between military expenditure and economic growth both in the short run and long run in Ethiopia?

1.5 Hypothesis of the Study

H_{01}: There is no statistically significant short run and long run relationship between military expenditure and economic growth in Ethiopia.

H_{02}: There is no statistically significant causality between the military expenditure and economic growth.

H_{03}: Inflation and unemployment have no significant moderating effect on the relationship between military expenditure and economic growth in Ethiopia.

1.6 Significance of the Study

Clearly, the Sub-Saharan Africa allots high amount of military expenditure in general and Ethiopia in particular. Hence, this study will be helpful for providing information to policy makers during planning of defense spending and other activities such as investment, public expenditure in economic services, social services, and other social works and the study adds to the existing body of knowledge. It is also expected that the findings of the research will be of acute importance since it makes a contribution to both theoretical and empirical literature to researchers who would wish to carry out further research on the effect of military expenditure on economic growth. The findings are of significance to the practice of public financial running specifically policy makers on controlling of public resources and decision making with regards to growth of GDP. If the effect of defense spending is negative, then the government will minimize defense spending to attain the objectives of improvements in the growth of output, reducing poverty and achieving minimum level of per capita income growth. However, if its effect is positive then there is no need to influence its magnitude. Therefore, the study enhances understanding of contributions of military expenditure both in the short run and in long run. Besides, the study augments the effect of inflation and unemployment on moderating the relationship between military expenditure and economic growth.

1.7 Scope of the study

This study was limited to the Ethiopian economy as well as military expenditure that has undertaken countrywide, which covered the time period between 1974/5-2017/18 (Dergue regime and EPRDF regime), which covered forty four years of time-series data on macroeconomic variable that can affect economic growth. This (the beginning of the sample (1974/5)) justifies that the entire economy was geared to the prosecution of war. In every sense, therefore, the economy was a war economy, and the consequences of this were bound to be disastrous. Thus, the main focus of the study was to analyze the influence of military expenditure on economic performance of Ethiopia for the period of 1974/5 to 2017/18.

1.8 Organization of the Study

The research was structured in to six chapters whose sequence was as follows. Chapter two presented literature review that was related with the implication of military expenditure on economic growth in Ethiopia with the moderating effects of inflation and unemployment. Chapter three explored the research methods adopted by the study. Chapter four presented an overview of Ethiopian economy; Chapter five presented study findings and their subsequent interpretations. Finally, a chapter six summarized the entire study, makes conclusions for each objective and derived policy recommendations from the study findings as well as areas for future research.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Concept and Definition

Defense spending is the share separated by states from their national income in order to provide its security against internal and external threats. Defense spending are composed of production (or import from other countries) of tools and vehicles used in defense, repair and maintenance costs for the tools and vehicles, expenditures for R&D activities and the military and civilian staff employed in defense field. Starting from Adam Smith who has an important place for the foundations of economy to be continuing till today, many economists have supported free market economy. Because, it has been accepted that free market economy is a mechanism which best ensures economic growth. Government was requested not to interfere in economy but was requested to fulfill some basic duties one of which is homeland security. While governments regulate the public expenditures, they plan the amount of spend to be spared for the fields which are effective on country development. As the security of the country is the subject, the spared ratio for defense spending change from time to time depending on the conflicts in surrounding countries (Korkmaz,2015)

2.2 Theoretical Literature Review

2.2.1 Theories of Military Expenditure

A major problem that arises in surveying the results of studies of the economic effects of military spending in developing countries is the variety of such studies. They vary in the questions asked, the methods used, the sample of countries, the time period and in their theoretical underpinnings. As a result, in developing the empirical work there are so many auxiliary assumptions that have to be made that tests of particular hypotheses can become tests of the assumptions made and so comparisons of the studies can be at best difficult and at worst meaningless. Given such problems it is useful to consider some of the methodological and theoretical issues involved as prior to a review of the studies. While the main concern of the research we are interested in has been to investigate the relation between military spending and development, in applied work this is usually restricted to economic growth rather than development because of the problems of defining and measuring development. The former is, of course, only a necessary condition for the latter and the starting point for any such analysis should really be some theoretical understanding of the links between the two (Brauer (1993) , Graham *et al* (1986)).

Similarly, it is important to recognize that military spending is only one aspect of militarism in a society and is only a measure of inputs rather than output (Smith, 1983). To interpret the results of any empirical study it is necessary to have a theory, even though this may not of itself be verifiable. For research on the economic effects of military spending this is complicated by the fact that much of economic theory does not have an explicit role for military spending as a distinctive economic activity. However, this has not prevented the development of theoretical analyses, with three basic theoretical positions being adopted in the literature on both developed and developing countries:

Neoclassical: This approach sees the state as a rational actor which balances the opportunity costs and security benefits of military spending in order to maximize a well-defined national interest reflected in a societal welfare function. Military expenditure can be treated as the pure public good and the economic effects on military expenditure will be determined by its opportunity cost, the tradeoff between it and other spending. Game theoretic models representing in a limited way interstate behavior have also become fashionable. This general approach does have the advantage of allowing the development of consistent formal models for the empirical analysis. However, it can be criticized for being a historic, always able to justify observed actions, concentrating on the supply side, ignoring the internal role of the military and military interests, implying a national consensus and requiring extreme knowledge and unrealistic computational abilities of the rational actors. All of which are particularly relevant in the context of developing economies of developing countries. The most influential neoclassical model is Biswas and Ram (1986), developed from Feder (1982). There have been some developments within this approach, with the new classicals are using military expenditure as an important shock to the system, which can have dynamic real effects on output. In addition, there have been attempts to introduce military spending into endogenous growth models (Berthelemy et al, 1994).

Keynesian: This approach sees a proactive state which uses military spending as one aspect of the state spending to increase output through multiplier effects in the presence of ineffective aggregate demand. In this way increased military spending can lead to increased capacity utilization, increased profits and hence increased investment and growth (Stewart (1991) and Faini et al. (1984)). It has been criticized for its failure to consider supply side issues, leading many researchers to include explicit production functions in their Keynesian models (Deger and Smith, 1983).

Institutionalist: Usually this radical liberal approach (Smith, 1977) is combined with a Keynesian perspective but focuses on the way in which high military spending can lead to industrial inefficiencies and to the development of a powerful interest group composed of individuals, firms and organizations that benefit from defense spending, usually referred to as the military industrial complex (MIC). The MIC increases military expenditure through internal pressure within the state even when there is no threat to justify such expenditures (See Fine, 1993 for a critical review).

Marxist: This approach sees the role of military spending in capitalist development as important though contradictory. There are a number of strands to the approach which differ in their treatment of crisis, the extent to which they see military expenditure as necessary to capitalist development, and the role in class struggle. One offshoot of this approach has provided the only theory in which military spending is both important in itself and an integral component of the theoretical analysis, the under consumptionist approach. Developed from Baran and Sweezy (1966) this sees military expenditure as important in overcoming realization crises, allowing the absorption of surplus without increasing wages and so maintaining profits. No other form of government spending can fulfill this role. While this approach has been extremely influential in the general economic development literature, empirical work within this approach has tended to be limited to developed economies, Smith (1977) and Szymanski (1973). Once we move beyond a broad stroke theoretical understanding towards an empirical analysis it becomes necessary to be more specific about the questions to be addressed and the way in which they are to be analyzed.

There has been some confusion within the literature as a result of not recognizing these differences. For example, there have been criticisms of general studies comprising large numbers of countries, arguing that the variety of countries suggests case studies are more relevant (Kaldor, 1991). While case studies are extremely valuable they are providing different information to general studies and are answering different questions. It is surely a different question to ask if there exists a general relation across all developing countries, than to identify one across groups of countries or individual countries. Also, to ask what the fundamental dynamics of military spending are is different to asking if a sample of countries or individual countries exhibit a particular correlation over a particular period. Indeed, it is possible that military spending may have a different effect at different times, providing a boost to industrialization but in the end providing a drag on further development (Smith, 1977). It is important to emphasize that the empirical results of studies are likely to be very sensitive to the measurement and definition of the variables, to the specification of the estimated equations (especially the other variables included), the type of data used and the estimation method. In addition, the theoretical positions discussed above have generally been developed in the analysis of developed countries and applied to developing countries with some discussion of the nature of developing countries and some adjustments to the empirical model when operationalized. This has been criticized for failing to relate to the specific literature on developing countries. A recent contribution by Park (1993) makes just this point in a study of South Korea. Arguing that literature has failed to consider the competing hypothesis of dependency theory and foreign direct investment, the role of the developmental state with the world system perspective. While a bit unfair on some studies, Smith and Smith (1980) have considerable discussion of development issues, his point is valid. The variety of studies that have resulted from such factors make comparisons very difficult and explain some of the seemingly contradictory findings. Before moving on to consider the empirical analysis it is useful to summarize the particular channels through which military expenditure is expected to influence economic growth. Smith and Smith (1980) categorize these as:

-**Resource allocation and mobilization**: military expenditure can have a direct opportunity cost in diverting resources from investment and other welfare expenditures. It is also possible that a strong state can use military expenditure to improve infrastructure, mobilize resources and create demand. First, Benoit (1973, 1978) has shown that defense spending may stimulate growth through Keynesian-type aggregate demand stimulation. He argued that the additional demand generated by higher defense spending leads to increased utilization of capital stock, lower resource costs, and higher labor employment

-**Organization of production:** A large military sector can have a modernizing effect, through linkages with military industry and training. On the other hand, it can introduce high tech sector divorced from the economy and its needs. -Socio-political structure: The military can be used to provide a strong state, to control opposition, break worker resistance and modernize. On the other hand a military government can be an economic disaster.

-**External relations:** Military expenditure can provide security, provide respect internationally, and allow development. On the other hand it can lead to dependency on aid and might increase the likelihood of conflict. Increasingly it is being recognized that economic security and indeed environmental security may be as important as military security (Gleditsch, 1992). This reduces the apparent value of military capability and also suggests that the concept of development needs to be widened to include environmental issues. Whether or not the overall impact of military spending on development is positive or negative depends upon the relative magnitudes and signs of these channels and in the absence of any theoretical consensus, this can only be determined empirically. In addition, when moving on to consider the economic effects of reductions in military spending (rather than the impact of military spending per se) the theoretical discussion can only guide our understanding, we also need some form of empirical analysis to evaluate the effects and to determine the necessary policy mix for successful disarmament. In considering the empirical analysis of the effects of military expenditure, it is not possible to ignore the interdependence between the demand and supply side. The determinants of military expenditure in a country or group of countries can shape the nature of that expenditure and hence its economic impact. Indeed, in the simultaneous model approaches which try to deal with the indirect effects of military expenditure, one has to include an equation for the determination of military expenditure. The next section deals with the existing literature on the determinants of military expenditure in developing countries.

2.2.2 The Economic effects of Military Spending in Developing countries

Military expenditure comprises an important portion in every nation‘s national budget. In economic terms, military expenditure is the government expenditure on national defense determined in national fiscal policies. The portion of national budget spent on military every year follows a pattern for each nation. There is a recognized pattern of military expenditure in developing countries. There is a tradeoff between production of military goods and civil goods since both use a country‘s factor endowment. As there is a tradeoff it is commonly thought that national income or GDP is inversely related to military expenditure. The pro-growth policy makers and welfare economists suggest a growth in military expenditure should be less than the growth of nonmilitary expenditure. On the other hand, some other experts suggest that there is positive external benefit of military expenditure that enhances production in an economy. Opposing views as such makes the theories relation between military expenditure and economic growth subject to controversies. Benoit (1973) reported that military expenditure exerts a positive external benefit absorbed by the economy. He produced evidence that shows in LDCs military expenditure is positively related to economic growth. The conceptual link that is thought reasonable in this research that military works more efficiently than bureaucracy in nonmilitary welfare activities focusing on poor people. Moreover, in conflict zones, deployment of military forces provides security for agricultural and nonagricultural production in LDCs.

Pessimistic ideas: The economic effects of military spending is an important issue for developing countries, particularly for regions such as Sub Saharan Africa (SSA), has been through considerable turmoil, with high levels of conflict in the region and generally poor economic performance.

It provides a brief review of the empirical literature for developing countries, which suggests that there is little or no evidence for a positive effect on economic growth and that it is more likely to have a negative effect, or at best no significant impact at all. A growth model based on Dunne et al (2006), which includes military sending and overcomes some of the limitations of earlier models, is then estimated on a panel of countries using SIPRI, IFS and World Bank data for 1988-2006 model. (John Paul Dunne, 2010). This finds unequivocal negative impacts of military spending on growth for SSA, consistent with the results for all countries and all non-developed countries.

Optimistic ideas: Evaluating the effects of defense expenditure on economic growth in developing countries has been examined by many empirical studies. On the other hand, there is little consensus on that impact and the variety seems to come from imply of different models and different estimators. The paper aimed at contributing to the literature by utilizing a recently constructed economic growth data set and controlling for defense expenditure, covering a large set of countries and an extended time period, the study reveals further evidence on the relationship between economic growth and military spending. This study integrates the system Generalized Method of Moments (GMM) estimators to analysis the impact of defense expenditure on economic growth between 2002 and 2010 for 67 developing countries. The findings indicate that military spending has a positive and significant effect on economic growth in the sample countries. Our empirical results strongly support the Binoit's who found that government military spending is helpful to economic growth regardless of how we measure the government size and economic growth, when the countries are disaggregated by income levels and the degree of corruption.

Theoretical works have identified a number of channels by which defense spending can influence the economy. These influences can be positive or negative (Sandler and Hartley, 1995; Deger and Smith; 1983). These channels include: resource allocation and mobilization, organization of production, sociopolitical structure and external relations.

The LDCs usually suffer from idle capacity, higher unemployment, and under consumption due to lack of aggregate demand. Hence increased utilization of capital stock may lead to increases in the profit rate which, in turn, may lead to higher investment thus generating short-run multiplier effects as well as higher long term rates of economic growth (Deger and Smith, 1983; Deger, 1986; Brempong, 1989; Sandler and Hartley, 1995; Antonakis, 1997).

Military demand for particular products may also induce the development of extra domestic supply, with subsequent back ward linkage effects. In addition, the power provided by a strong military may enable the state to increase the rate of exploitation of available resources as well as in the mobilization of potential resources (Benoit, 1978; Sandler and Hartley, 1995).

However, military expenditure diverts resources from other uses and so has direct opportunity costs in terms of lower levels of public and private investment that are more growth enhancing than defense, health and education spending, infrastructural improvement, consumption, adverse balance of payments in case of arms importing countries, inefficient bureaucracies and excess burdens created by taxes used to finance the military expenditure (Lim, 1983; Mylonids, 2006).

Growth is also inhibited when defense diverts research and development activities and well-educated workforce from the private sector. Though technological spin-offs can come either from the civilian or defense sector, the application of technological breakthroughs to the private sector is often faster and more direct if they originate there.

In addition many research and development findings in the defense sector may not have a useful application in the civilian sector (Deger, 1986; Sandler and Hartley, 1995). Defense can also inhibit growth by diverting resources from the export sector (Feder, 1983; Rothschild, 1973), which is stimulus to growth as it tends to employ advanced technology and efficient management techniques in order to compete abroad.

Defense expenditure can also influence economic growth through inflation **(**Deger, 1986). There can be little doubt that defense spending is inflationary, particularly for aggregate-supply-constrained economies. Starr *et al.*, (1984) mentioned the various ways as to how defense expenditure affects growth through its inflationary pressure.

Firstly, military goods are unproductive unlike other forms of economic activity (including other types of government spending). The problem with military spending is that it adds to the demand for goods without adding to the supply and thus causes demand pull inflation.

Secondly, defense spending increases the demand for labor, machinery, and capital as supplier firms gear up for increased production. In the short-term, a rapid increase in defense spending will cause an increase in wages, prices and rents (causing cost push inflation).

Thirdly, defense spending generates a greater public debt, which is inherently inflationary. As a result of this inflationary consequence, higher defense expenditure may result a spending boom, conspicuous consumption, and investment in low priority sectors that have little growth potential (Starr et al., 1984). However, the appropriateness and adequacy of such technology, infrastructure, training, or specialization to the society may, of course, be open to question, since it is possible that security-related objectives may not be beneficial to civilian needs. Military investment in technology may be restricted to capital intensive modes of production that are of little use to the majority of the population living in the rural hinterlands of LDCs (Starr et al., 1984).

The primary importance of infrastructure such as roads is to bolster defense and security needs, and that may be built in remote areas with little civilian use. In career armies, common to LDCs, soldiers are usually drawn from villages, but they may not return there to disseminate the new technical skills learned in the army (Deger and Smith, 1983, Deger, 1986).

In the context of embodied technical progress, in which new technology is embodied in machines of latest era, an additional and crucial role can be ascribed to saving and investment. Additional saving helps to create new machines, with more efficient technology embodied in them; thus saving will mean not only more capital stock but also better capital stock. The impact of military in reducing investible resources is even stronger from this point of view involving growth through technical change. If an increased defense burden reduces the amount of new capital formation from the level it could have attained, then the economy suffers from a lowering of both quantity and quality of its capital stock **(**Deger, 1986).

2.2.3 Socio-political Structure and External Relations

Security of persons and property from domestic or foreign threats is essential to the operation of markets and the incentives to invest and innovate. To the extent that defense expenditure increases security it may increase output. Adam Smith noted that the first two duties of the state are protecting the society from the violence and invasion of other independent societies and protecting, as far as possible, every member of society from the injustice or oppression of every member of it. In many poor countries, war and lack of security are major obstacles to development. Defense may also be the major link with powerful states and be instrumental in organizing the transfer of technology and the provision of aid, both military and civilian (Dunn et al., 2004).

However, military expenditure may be driven not by security needs but by a rent seeking military industrial complex and it may provoke arms races or damaging wars. In such cases there would not be positive security effects (Dunn et al., 2004). Military establishments, by their very nature, are also often seen as conservative institutions with rigid hierarchical structures, and their concern for stability and maintenance of status quo may inhibit from taking positive steps in the transformation of society. Civil administrations with their longer participation in public life have a more progressive role to play. Even if one accepts that military regimes have played a modernizing role, alternative forms of modernization such as higher education, creation of neutral civil service and the like may be more effective (Deger and Smith, 1983).

2.2.3 Military Spending and Development

In analyzing the relation between military spending and development, applied work is usually restricted to economic growth because of the problems of defining and measuring development. Developing a theoretical model is important for any empirical study, but much of economic theory does not have an explicit role for military spending as a distinctive economic activity. However, this has not prevented the development of theoretical analyses as discussed in Dunne & Coulomb (2008).

In empirical work the fact that there is no agreed theory of growth among economists means that there is no standard framework that military spending can be fitted into. Clearly, in developing countries military spending conflict, economic capacity (education, governance, institutions, natural resources) all interact to influence growth. Indeed, many poor countries, even those with civil wars, spend relatively little on the military. The theoretical work has allowed the identification of a number of channels through which military spending can impact on the economy, through labor, capital, technology, external relations, socio political effects, debt, conflicts etc. (Dunne and Uye, 2009). The relative importance and sign of these effects and the overall impact on growth can only be ascertained by empirical analysis.

Clearly all of the channels mentioned will interact and their influence will vary depending on the countries involved. For example a relatively advanced developing countries, such as one of the Asian 'tigers' will have concerns over the industrial impact of their involvement in arms production, the technology and foreign direct investment benefits versus the opportunity cost, while a poorer African economy may be more concerned with the conflict trap they find themselves in.

2.3 Empirical Literature Review

Alexander (1990) points out that the variables used by Benoit (1978) are not based on any proper theory. Biswas and Ram (1986) also criticized the conclusions drawn by Benoit (1978) by stating that it was just a matter of Military Expenditure and Economic Growth: A Panel Data Analysis 165 coincidence that he found a positive relationship between military expenditure and growth. They further imply that his results depended largely on the sample size and time period under consideration. Had he chosen a different sample, his results could have been much stronger. Another criticism on Benoit's work arises from the study by Landau (1993), who stated that without the inclusion of important variables like human capital, political conditions, technology or natural resources, results cannot be regarded as efficient.

Benoit's (1973) seminal work, which suggests that military expenditure positively affects economic development, the effects of military expenditure on economic growth have been examined extensively. The overwhelming majority of demand side models uncovered a negative impact of defense on growth due to the tradeoff between productive investments, such as health and education expenditures and defense expenditures. However, it was Benoit's work that paved way for future research. This made military expenditure a debatable topic for empirical research among many economists. There are few studies in literature that support the view that there exists a positive relationship between military expenditure and economic growth. Studies like Atesoglu (2002, 2009), Khan (2004) and Yildirim et al. (2005) have made conclusions that are in line with those of Benoit (1978). The channel through which military spending exerts a positive influence on economic growth is explicitly highlighted by Khan (2004) and Yildirim et al. (2005). An increase in the military expenditure stimulates aggregate demand which in turn leads to a higher utilization of capital stock and increased employment.

Due to the higher utilization of capital, profit rate is likely to increase, thus, encouraging investment. This generates short-run multiplier effects which lead to a higher economic growth. Apart from this, military expenditure also improves the quality of human capital through the provision of education and training (Sandler and Hartley, 1995). Dunne and Nikolaidou (2001) provide empirical evidence which supports that defense expenditure enhances growth through Keynesian type aggregate demand effects.

Furthermore, when a supply side approach is employed, defense may have a positive influence through spin-offs and externalities. Atesoglu and Mueller (1990) use a two sector Feder-Ram model for the US over the period 1949 to 1989. They find a positive effect from the military sector to the civilian sector. Stewart (1991) applies a Keynesian demand function to a group of LDCs. He finds that both military and nonmilitary expenditures have positive effects on growth, but that the effect of non-military spending is stronger. Ward, Davis, Penubarti, Rajmaira and Cochran (1991) use a three sector Feder-Ram model with separate externality and productivity effects for India over the period 1950 to 1987. Military expenditure is found to have a positive effect on growth. Mueller and Atesoglu (1993) incorporate technological change into a two sector Feder-Ram model using US data for the period 1948 to 1990. They find a significant relationship from military to growth.

On the other hand, there are a number of studies that provide evidence of the existence of a negative relationship between military expenditure and economic growth. This view is supported by Shahbaz et al. (2013), Dunne (2012), Hou and Chen (2013), Dunne and Tian (2015) and most recently by d'Agostino et al. (2017). Sandler and Hartley (1995) highlight that the more resources diverted towards the military might mean lesser resources available for the public and the private sector. By crowding-out investment in these sectors, it deteriorates economic growth (Sandler and

Hartley, 1995). Shahbaz et al. (2013) contributed to the existing literature by making use of Keynesian hypothesis to conclude that military expenditure proves to be anti-growth for the economic growth of Pakistan. Dunne (2012) also provides an interesting insight into the ongoing debate by suggesting that military expenditure deteriorates the economic growth, especially in case of poor countries. Insight to yet another perspective has been provided by Dunne *et al*. (2005) and Aizenman and Glick (2003),who imply in their respective studies that *Arshad, Syed and Shabbir* military expenditure boosts growth only in the presence of a security threat. According to Aizenman and Glick (2003), an increase in military expenditure instigated by an external threat would eventually lead to increased output. Scheetz (1991) uses pooled cross section time series data for four Latin American countries (Chile, Argentina, Peru and Paraguay) over the period 1969 to 1987. He finds military expenditure has a negative effect on investment. Ward and Davis (1992) use a three sector Feder-Ram model for the US over the period 1948 to 1990. They separate the effects of military spending into productivity and externality effects. Overall, they find military spending has a negative effect on economic growth, with a negative productivity effect but a positive externality effect. Galvi (2003) uses 2SLS and 3SLS to estimate a demand and supply side model for 64 LDCs using cross section data. He concludes that military spending has negative effects for both economic growth and the savings income ratio. Mintz and Huang (1990) using a three-equation model for the US, find military expenditure negatively impacts on investment and therefore growth. However, military expenditure induced by either rent seeking behavior or corruption, is very likely to cause a decline in output. This is why countries with high corruption usually experience a negative growth rate when their military expenditure is raised. Faini et al. (1984) and Rasler and Thomson (1988) employ the single demand-side equations and showed a negative impact of defense spending on growth. However, this relatively new aspect in the defense economics literature has been supported by Dunne et al. (2005).

While critically analyzing different empirical models employed by defense economists in their studies, Dunne et al. (2005) states that the Barro model used by Aizenman and Glick (2003) is quite an effective way of taking into account the effects of security on output. Followed by Aizenman and Glick (2003**),** the study by Goel and Saunoris (2015) is one of the few studies to formally examine the impact military spending might have on corruption. While comparing military spending with non-military spending, the findings reveal that expenditure made for military purposes tends to give a rise to corruption, whereas expenditure for the non-military sectors helps diminish the corrupt activities. This suggests that all expenditures by government do not have similar impacts on corruption. Hence, countries with high military burdens need to strengthen their institutions in order to tackle the issue of corruption.

There are also a number of studies that provide evidence of no impact on the relationship between military expenditure and economic growth. Huang and Mintz (1990) estimate a three sector Feder-Ram model using ridge regression techniques to overcome multicollinearity problems using annual data for the US over the period 1952 to 1988. They do not find any relationship between military and growth. Again, Huang and Mintz (1991) extend their earlier model by separating the military effect into productivity and externality effects. The same data and estimation technique is used. Once again, they find no relationship. Alexander (1990) uses a four sector Feder-Ram model for nine developed countries over the period 1974 to 1985 using cross section time series data. He finds no effect of military spending on economic growth. Adams, Behrman and Boldin (1991) use a three sector model (military, nonmilitary and export) with cross section and time series data for a group of LDCs over the period 1974 to 1986. They find military spending has no effect on growth, whereas exports have a positive effect. Gerace (2002) uses a spectral analysis type methodology to investigate movements in US military expenditure, US non-military expenditure and US GDP. He finds evidence that non-military expenditure is used as a counter-cyclical stabilization tool, but that military expenditure is not.

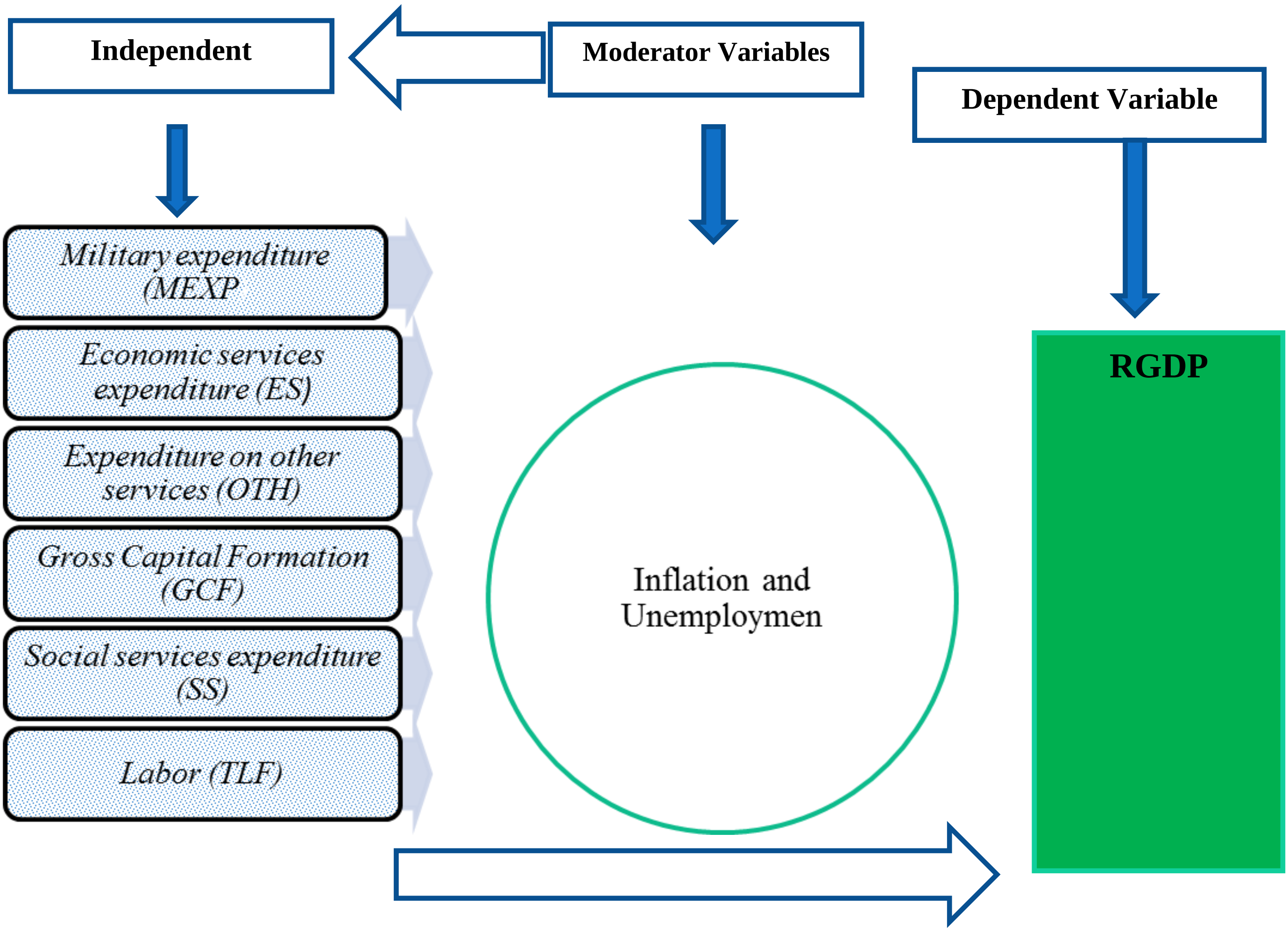
Eventually, Chowdhury (1991) undertakes Granger causality testing using military burden time series for 55 LDCs. He finds positive causality from military to growth for seven countries, negative causality for 15 countries, no causality for 30 countries and bi-directional causality for three countries.

In general, the above reviewed showed that there was the lack of robust empirical evidence concerning the effect of defense burden and yet the direction of causation of this relationship remains controversial in the defense economics literature motivate study at first phase. About the only thing which can be stated with clarity is that the impact of defense outlays on the economy depends on the particular country, the macro and microeconomic policies pursued by the government, the country's overall economic structure, and a host of other non-economic variables. As Chan (1985:433) so aptly states: "We have probably reached the point of diminishing returns in relying on aggregate cross-national studies to inform us about the economic impact of defense spending, future research will profit more from discriminating diachronic studies of individual countries, as the search for universal patterns applicable to all places and times is likely to be disappointing."

The majority of the studies mentioned above have used a multi- country approach to examine the relationship between military spending and economic growth in developing countries. While multi-country approaches are useful, a case study approach may be more illustrative. After all, circumstances and policy responses are likely to vary across countries and the nature of the policies pursued is likely to affect the relationship between military spending and economic growth. This paper therefore adopts a case study approach in an attempt to analyze the economic costs of Ethiopian military expenditure more than four decades long. That means it used longer time series than many previous studies and it has the guarantee to capture the dynamic effects that military expenditure has on economic growth by including variables such as inflation and unemployment as a moderating relationship.

After reviewing available research paper on military spending, it is found that there are no papers which have focused on predicting military spending using moderator variables. It is also found that some of the researches focused on predicting defense expenditure of different countries have used only direct explanatory variables on dependent variable (GDP) and completely ignored the relevance of moderator variables. Therefore, the researcher fills the gap of the previous study (add value to the literature) by employing a case study approach, using longer data series and applying the moderator variables to the study.

2.3 Conceptual Framework



Source: Own Design (2019)

Military expenditure is theorized to have an effect on economic growth. The independent variable such as military expenditure, economic services expenditure, expenditure on other service, gross capital formation, social services expenditure and labor force are considered. Further, the researcher conceptualized that there are variables that are not part of the study interest although they needed to be controlled throughout the study because their effect on economic growth could not be overlooked. The study therefore controlled inflation rate and unemployment. The study tests mainly focused on the effect of military expenditure on economic growth even though each component of government expenditure as well as gross capital formation and labor force was tested on the dependent variable that is, GDP growth. In addition to these unique effects, the researcher conceptualized that the variation in economic growth is also explained by the interaction between all explanatory variables and inflation and unemployment. The interaction between variables is represented by their product term as specified by Whisman and McClelland (2005). The interaction terms included the product of; military expenditure and inflation military expenditure and unemployment, economic services expenditure and inflation, economic services expenditure and unemployment, expenditure on other service and inflation, expenditure on other service and unemployment, gross capital formation and inflation, gross capital formation and unemployment, social services expenditure and inflation, social services expenditure and unemployment ,labor force and inflation, labor force and inflation. Thus, Inflation and unemployment moderate the relationship between military expenditure and GDP growth.

CHAPTER THREE

3.0 DATA SOURCE AND METHODOLOGY

3.1 Sources of Data

The researcher used the annual time series data covering the period from 1974/75 to 2017/18 for Ethiopia regarding 2010/11 as a base year and the data from 2015 to 2017 was based on 2015 as a base year. The data was sourced from the National Bank of Ethiopia, Ministry of Finance and Economic Development-MoFED (2017/18), and Stockholm International Peace Research Institute (SIPRI 2017/2018).

3.2 Empirical Model

In order to analyze the economic implication of military expenditure on economic growth of Ethiopia, the study adapted the following linear model

$Y_t = \beta0+\beta1Xt+\mu t$…………………………………………………………………….… (1)

Where

Y_t is (Economic growth) at time t proxy of RGDP

(X_t) is the vector of independent variables,

β_1 are the coefficients of the explanatory variables to be estimated

β_0 is the intercept

t is the time period from 1974/5-2017/8

μt is the error term in time t

All the series were then transformed into natural log-form in order to reduce sharpness in the data, provide elasticity's and more reliable results (shahbaz *et al.,* 2015).

In addition, log-linear specification performs better compared to the simple linear model (shahbaz *et al.,* 2013) and makes results more favorable Ehrlich (1977) and Layson (1983). All variables were transformed into their natural logarithm so that their first differences approximate their growth rates. On the other hand, to eliminate the impact of heteroscedasticity for economic variables time series data, all variables were in natural logarithm. To investigate the empirical relationship between military expenditure and output growth the researcher used the modern economic growth theory based on the conventional neo-classical one sector aggregate production technology where it was treated military expenditure as separate input. That is

$$RGDP_t = F(ES_t, SS_t, MEXP_t, OTH_t, GCF_t, TLF_t) \quad \text{.......(2)}$$

$$LNRGDP_t = F(LNES_t, LNSS_t, LNME_t, LNOTH_t, LNGCF_t, LNTLF_t) \quad \text{.......(3)}$$

The growth rate of a variable refers to its proportional rate of change. That is, the growth of rate of GCF refers to the quantity of $\frac{\dot{GCF_t}}{GCF_t}$. A key fact about growth rates is that the growth rate of a variable equals the rate of change of its natural log. That is, $\frac{\dot{GCF_t}}{GCF_t}$ equals $\frac{d \ln GCF(t)}{dt}$ by using Euler's theorem implies that a function that is homogenous degree of one can be decomposed as:

$$F(ME_t, OTH_t, ES_t, SS_t, TLF_t, GCF_t) = F_{me}ME_t + F_{oth}OTH_t + F_{es}ES_t + F_{ss}SS_t + F_{tlf}TLF_t + F_{gcf}GCF_t \quad \text{.......(4)}$$

Taking the total derivative of equation 1, it gives:

$$\frac{dRGDP_t}{dt} = F_{me}\frac{dME_t}{dt} + F_{oth}\frac{dOTH_t}{dt} + F_{es}\frac{dES_t}{dt} + F_{ss}\frac{dSS_t}{dt} + F_{tlf}\frac{dTLF_t}{dt} + F_{gcf}\frac{dGCF_t}{dt}$$

$$\dot{RGDP_t} = F_{me}\dot{ME_t} + F_{oth}\dot{OTH_t} + F_{es}\dot{ES_t} + F_{ss}\dot{SS_t} + F_{tlf}\dot{TLF_t} + F_{gcf}\dot{GCF_t}$$

$$= F_{me}ME_t \frac{\dot{ME_t}}{ME_t} + F_{oth}OTH_t \frac{\dot{OTH}}{OTH_t} t + F_{es}ES_t \frac{\dot{ES}}{ES_t} t + F_{ss}SS_t \frac{\dot{SS_t}}{SS_t} + FtlftTLF_t \frac{\dot{TLFt}}{TLFt} + F_{gcf}GCF_t \frac{\dot{GCF_t}}{GCF_t} \text{...........(5)}$$

Dividing equ. (5) by RGDP to get growth equation and rearranging the resulting expression, it gives the following growth equation.

$$\frac{\dot{RGDP_t}}{RGDP_t} = F_{me} \frac{ME_t}{RGDP_t} \frac{\dot{ME_t}}{ME_t} + F_{oth} \frac{OTHt}{RGDP_t} \frac{\dot{OTH}}{OTH_t} t + F_{es} \frac{ESt}{RGDP_t} \frac{\dot{ES}}{ES_t} t + F_{ss} \frac{SS}{RGDP_t} t \frac{\dot{SS_t}}{SS_t} + Ftlf_t \frac{TLF_t}{RGDP_t} \frac{\dot{TLF_t}}{TLF_t}$$
$$+ F_{gcf} \frac{GCFt}{RGDP_t} \frac{\dot{GCF_t}}{GCF_t} \text{...(6)}$$

$$\dot{rgdp_t} = \beta \dot{me}_t + \varphi \dot{oth}_t + \mu \dot{es}_t \text{...(7)}$$

$$\dot{rgdp_t} = \beta \dot{me}_t + \varphi \dot{oth}_t + \mu \dot{es}_t + \theta \dot{ss}_t + \eta t \dot{lf}_t + \varsigma \dot{gcf}_t$$

Where a dot on the top of a variable means that the variable is now in a growth rate form. The constant parameters $\beta, \varphi, \mu, \theta, \eta$ and ς are the elasticity's of output with respect to military expenditure, other service expenditure, economic service expenditure, social service expenditure, total labor force and gross capital formation respectively.

Hence replacing the specific variables in equation (1) then equation 8 obtained: $\ln RGDP_t = \beta_0 + \beta_1 \ln ES + \beta_2 \ln ME + \beta_3 \ln OTH + \beta_4 LNSS + \beta_5 \ln GCF + \beta_6 \ln TLF + \varepsilon$ ………
……………………………………………………………………………..…………… (8)

Where;

$\ln RGDP_t$ is a natural log of real aggregate output at time t

$\ln ME_t$ is military service expenditure at time t

$\ln ES_t$ is natural log of economic services expenditure at time t

$lnSS_t$ is natural log of social services expenditure at time t

lnOTHt is natural log of other services expenditure at time t

$lnGCF_t$ is natural log of gross capital formation at time t

$lnTLF_t$ i s natural log of total labor force at time t and the subscript t denotes the time period.

ε_t=error term.

β_{1-6}=coefficients of the explanatory variables.

β_0 is the intercept

3.3 Definitions of the Variables

The variables that this study uses are described as the following:

Real GDP (RGDP)**:** Real Gross Product is a macroeconomic measure of the value of economic output adjusted for price changes (i.e., inflation or deflation). This adjustment transforms the money-value measure, nominal GDP, into an index for quantity of total output. GDP is the sum of consumer spending, Investment made by industry, Excess of Exports over Imports and Government Spending. Due to inflation GDP increases and does not actually reflect the true growth in economy. That is why inflation rate must be subtracted from the GDP to get the real growth percentage called the real GDP. Most of the studies conducted on the relationship of economic growth with any variables (Colombage, 2009, Koch et al., 2005) used gross domestic product (GDP) as the measurement of economic growth. Hence, this study was used the growth form of real GDP as a proxy to represent economic growth.

Economic services expenditure (ES): It includes the current and capital expenditures that the government spent on agriculture, natural resources, industry, mining and energy, trade and tourism, transportation and communication and construction. Since expending on one of the above services contributes for the economic growth of the country, the researcher expected positive sign.

Social services expenditure (SS): It includes the current and capital expenditure that the government spent on education and training, culture and sport, public health, labor and social welfare, and housing. Expending on these variables will increase the productivity of a given individuals, and hence economic growth. Thus, the researcher expected positive sign.

Military expenditure (ME): It is the current and capital expenditure that the government spent on general government, Internal Order and national defense, justice, public order and security, and others. Since these services are non-productive, they discourage the economic growth of a given country, and hence the researcher expected negative sign.

Expenditure on other services (OTH): It is the current expenditure that the government spent on Pension Payment, Debt servicing, internal debt, principal, interest, miscellaneous, and subsidies. These services have no additional values on output of a given country and hence, economic growth. Thus, the researcher expected a negative sign.

Gross capital formation (GCF): It is the gross capital formation and in line with many researchers, in the absence of capital stock for all African countries, gross capital formation has been used as proxy for the stock of physical capital. However, getting such a readymade time series data in Ethiopia is difficult. The capital stock series is constructed from real gross capital formation using the perpetual inventory assumption with depreciation rate set equal to 5 percent (Wang and Yao, 2003). As a result, in this study, gross investment was used as proxy of physical capital accumulation and have been expected a positive impact on economic growth.

Labor (TLF)**:** It is the labor inputs, and labor force 15+ years and below 60 years. it is one of the key inputs in production of output yet. Thus, the researcher expected the positive relationship between economic growth and labor force

3.4 Data Collection Procedure

The study used secondary time series data for Military expenditure, economic service expenditure, social service expenditure, other service expenditure, gross capital formation, labor force and economic growth as well as moderator variables such as inflation and unemployment for the years 1974/5-2017/18. The choice of this type of model was that first it determines trends and pattern of future using graphs and other tools, secondly, it uses extensively for forecasting based on historical trend and patterns, thirdly, to study cross correlation/ relationship between two time series and their dependency on another. Furthermore, the biggest advantage of using time series analysis is that it can be uses to understand the past as well as predict the future.

3.5 Data Collection Instrument

Data extraction tool must be critically examined to check the extent to which it is likely to yield the expected results (Godfred, 2016). Construct validity is achieved in secondary data through literatures reviewed as proposed by Zikmund, Babin and Griffin (2009). Consequently, the measurement and operationalization of variables and development of data extraction tool were informed by various literatures reviewed.

The data was converted from nominal values to real values using GDP deflators with 2010 as the base year and 2015 for the recent data. This was achieved by dividing nominal expenditure values by GDP deflators. The justification for conversation of nominal values to real values is that real values should be more considered rather than inflationary changes in the variables (Kumaranayake, 2000). Data on GDP used 2011 as base year. This is because, 2011 is the most recent revision that catapulted Ethiopia to position. Besides that, these values measures aggregate production that eliminates the effects of inflation (Maingi, 2010).

3.6 Data Analysis and Presentation

This section presented how the model that was used to estimate the effect of military expenditure on economic growth in Ethiopia. Particularly, it provided the process of systematic application of statistical and logical techniques to describe, illustrate, condense and evaluate data. Finally, the section highlights how the analyzed data was presented. Data that used for analysis composed of macro variables from a time component of 44 years. The analysis began with the identification of the nature of time series data. The data was composed of different explanatory macro variables. After that, descriptive statistics analysis will be conducted to determine measures of central tendencies that is (the mean) and measures of dispersion (standard deviation, minimum and maximum values).

This study employed an Autoregressive VEC model developed by Sims (1980) to the following merits. The vector error correction mechanism (VECM) has been very influential in this respect as it enables the researcher to make use of the procedure devised by Johansen (1988) to test for the number of co-integrating relationships. This method developed by Johansen (1988) is undoubtedly the most widely used method in applied work. Models using this approach are known as vector error correction (VECM) or cointegrating VAR (CIVAR) models. VECM can be seen as scaled down VAR model in which the structural coefficients are identified. The justification for the VECM approach is that identification and testing for the significance of the structural coefficients, underlying the theoretical relationships, is important. The simple VAR models do not identify structural coefficients nor do they take seriously the relevance of unit root tests. When both series are deemed I(0), a VAR model in levels is used. When one of the series is found I(0) and the other one I(1), VAR is specified in the level of the I(0) variable and in the first difference of the I(1) variable. When both series are determined I (1) but not cointegrated, the proper model is VAR in terms of the first differences. Finally, when the series are cointegrated, we can use a vector error correction (VECM) model or, for a bivariate system, a VAR model in levels. Estimation of the parameters of the VAR requires that the variables in y_t and x_t are covariance stationary, with their first two moments finite and time-invariant. If the variables in y_t are not covariance stationary, but their first differences are, they may be modeled with a vector error correction model, or VECM. It has nice interpretation with long term and short term equations.

3.7Moderating Effect of Inflation on the Relationship between military Expenditure and Economic Growth in Ethiopia

The study adopted Whisman and McClelland (2005) to test the moderating effect of inflation and unemployment on the relationship between military expenditure and economic growth in Ethiopia. Moderation refers to a change in the relationship between an independent variable and a dependent variable, depending on the level of a third variable, termed the moderator variable. Moderating effects are also referred to as interaction and conditioning effects. For two continuous variables, moderation means that the slope of the relationship between the independent and dependent variable varies (i.e., increases or decreases) according to the level of the moderator variable. According to the model, there are two main stages. First, inflation and unemployment in a particular year is introduced in model 10 and 12 as a variable as below then the coefficients of the interaction term was tested.

The product ME*INF or UNEM is often highly correlated with ME and INF or UNEM, as while both ME and INF or UNEM take only positive values. This phenomenon represents non-essential ill conditioning and can be reduced by rescaling ME and INF or UNEM such that they are centered near zero (this is often accomplished by centering ME and INF (UNEM) at their means).

Note that rescaling ME and INF (UNEM) has no effect on tests of β_8, but it changes the interpretation of β_2 and β_7, such that they represent the slopes of RGDP on ME and INF or UNEM at the rescaled zero points of INF and ME, respectively. Rescaling ME and INF or UNEM might facilitate interpretation, but there is little reason to rescale them to reduce multi-collinearity, because substantive interpretation is unaffected by the scaling of ME and INF.

$$\ln RGDP_t = \beta_0 + \beta_1 \ln ES_t + \beta_2 \ln ME_t + \beta_3 \ln OTH_t + \beta_4 \ln SS_t + \beta_5 \ln GCF_t + \beta_6 \ln TLF_t + \beta_7 IF_t + \beta_8 \ln IF_t * \ln ME_t + \beta_9 IF_t * \ln ES_t + \beta_{10} IF_t * \ln OTH_t + \beta_{11} IF_t * \ln SS_t + \beta_{12} IF_t * \ln GCF_t + \beta_{13} IF_t * \ln TLF_t + \varepsilon_t \text{.......}(9)$$

However; the researcher focused only on the coefficients of

$$\ln RGDP_t = \beta_0 + \beta_1 \ln ME_t + \beta_2 \ln IFl_t + \beta_3 \ln TLF_t + \beta_4 \ln GCF_t + \beta_5 IF_t * \ln ME_t + \beta_6 \ln IF_t * \ln GCF_t + \beta_8 IF_t * \ln TLF_t + \varepsilon_t \text{.......}(10)$$

3.8 Moderating Effect of Unemployment on the Relationship between military Expenditure and Economic Growth in Ethiopia

$$\ln RGDP_t = \beta_0 + \beta_1 \ln ES_t + \beta_2 \ln ME_t + \beta_3 \ln OTH_t + \beta_4 \ln SS_t + \beta_5 \ln GCF_t + \beta_6 \ln TLF_t + \beta_7 UNEM_t + \beta_8 UNEM_t * \ln ME_t + \beta_9 UNEM_t * \ln ES_t + \beta_{10} UNEM_t * \ln OTH_t + \beta_{11} UNEM_t * \ln SS_t + \beta_{12} UNEM_t * \ln GCF_t + \beta_{13} UNEM_t * \ln TLF_t + \varepsilon_t \text{.......}(11)$$

Again, the researcher emphasized on the coefficients of UNEM and ME*UNEM by including the gross capital and total labor force variables.

$$\ln RGDP_t = \beta_0 + \beta_1 \ln ME_t + \beta_2 UNEM_t + \beta_3 \ln TLF_t + \beta_4 \ln GCF_t + \beta_5 UNEM_t * \ln ME_t + \beta_6 UNEM_t * \ln GCF_t + \beta_7 UNEM_t * \ln TLF_t + \varepsilon_t \text{.......}(12)$$

The data for Unemployment was taken from 1978 to 2018 because there was no data registered for unemployment before 1978 in Ethiopia.

3.9 Unit Root Test

The classical time series regression model is based on the assumption that the data generating processes are stationary, i.e., the moments of the variables under consideration are time invariant. However, as the economy grows and evolves over time, most macroeconomic variables are likely to grow over time rendering them non-stationary (Granger, 1974). Regression using non-stationary variables will only reveal a relationship that is not real, and accordingly such regression it is termed as "spurious regression."

The precondition of co-integration test is the stationarity of each individual time series over the sample period. From the time when the seminal paper by Engle and Granger (1987), co integration analysis has increasingly become the favored methodological approach for analyzing time series data containing stochastic trends. Thus, before turning to the analysis of the long run relationships between the variables we check for the unit root properties of the single series, as non-stationary behavior is a precondition for including them in the co integration analysis.

There are several tests of stationary. These tests are Dickey-Fuller unit root tests, Augmented Dickey-Fuller (ADF) unit root tests and Phillips Perron (PP) unit root tests. This study used a test which became popular over the past years. Thus, unit root tests for stationary was examined on the levels and first differences for all variables using the most common unit root tests, which is the Augmented Dickey-Fuller (ADF).

The regression model of the ADF unit root test is given by the following equations.

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \varepsilon_t \text{ .... (13)}$$

Where Y_t denotes the variables RGDP and explanatory variables are ES, SS, OTH, MEXP, labor and capital. All variables are in logarithm form. Δ is the difference operator; β_0 and β_1 are parameters to be estimated; ε_t is white noise.

The regression models of the ADF unit root test below:

$$\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{q} \zeta_i \Delta Y_{t-1} + \varepsilon_t \text{ .... (14)}$$

The hypotheses of the above equation form are:

$H_0 : \delta = 0;$ there is a unit root, i.e., the time series is non stationary
$H_1 : \delta \neq 0;$ there is no unit root, i.e., the time series is stationary (level stationary)

The Null hypothesis (Ho): Y_t is not I(0), if the calculated ADF statistics are less than their critical values from Fuller's table, then the null hypothesis (Ho) is rejected and the series are stationary or integrated or order one i.e, I(1). If the coefficient of the lag of Y_{t-1}, δ is significantly different from zero, then the null hypothesis is rejected.

To allow for the various possibilities, the ADF test is estimated in three different forms, that is, under three different null hypotheses.

1st possibility: Y_t is a random walk without drift: $\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{q} \zeta_i \Delta Y_{t-1} + \varepsilon_t$

2nd possibility: Y_t is a random walk with drift: $\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum_{i=1}^{q} \zeta_i \Delta Y_{t-1} + \varepsilon_t$

3rd possibility: Y_t is a random walk with drift around a stochastic trend: $\Delta Y_t = \beta_0 + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{q} \zeta_i \Delta Y_{t-1} + \varepsilon_t$

β_0 is intercept, t is linear time trend, q is the number of lagged first differences, and (i=1,2,3,…q) q is the number of lagged terms chosen by Akaike Information Criterion (AIC) to ensure that ε_t is white noise.

3.10 Optimal Lag Length Selection

The determination of autoregressive lag length for a time series is especially important in economics studies. Various lag length selection criteria such as the Aikaike's information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quinn criterion (HQC), Final prediction error (FPE) and Bayesian information criterion (BIC) have been employed. As the outcomes of these criteria may influence the ultimate findings of a study, a throughout understanding on the empirical performance of these criteria is necessary. .

Thus, the ability to correctly locating the true lag order depends on IC the ordinary least Squares regression model is run starting with lag zero upwards, since according to Engle *et al* (1995) it is the mostly used and recommended methodology was used to determine the lag length. Accordingly, lag that provides the minimum value is chosen as the optimal lag length, in other words, among the IC that provides majority lag is chosen as optimal lag length. On the basis of one or more of these criteria this paper was used a model that is the highest $\bar{R}^2$ or the lowest value of AIC or SIC or BIC.

3.11 Co-integration test

Granger causality tests are sensitive to the stationarity of the series. This is why we first study the stationarity properties of the variables. Having, discuss a variety of unit root tests, in order to proceed with co-integration and VEC analyses one needs to be confident as to the order of integration of the series used.

In the second step we estimate co-integration regression using variables having the same order of integration. Co-integration among the variables means that two or more variables are said to be co-integrated if they share common trends that is they have long run equilibrium relationships. More, co-integration is the necessary criteria for stationary among non-stationary variables. The series are linked by some long-run equilibrium relationship from which they can deviate in the short run but they must return to in the long-run that is they exhibit the same stochastic trend. Co-integration can be considered as an exception to the general rule which establishes that, if two series are both I(1), then any linear combination of them will yield a series which is also I(1). The exception is when a linear combination of two or more series is integrated of a lower order: In this case, in fact, the common stochastic trend is cancelled out, leading to something that is not spurious but that has some significance in economic terms (Amirat and Bourimun dated).

If the series are integrated of the same order one can proceed with the co-integration tests.

$$\Delta RGDP_t = \beta_0 + \sum_{q=1}^{N} \beta_1 \Delta RGDP_{t-q} + \sum_{q=1}^{N} \beta_2 \Delta ME_{t-q} + \sum_{q=1}^{N} \beta_3 \Delta ES_{t-q} + \sum_{q=1}^{N} \beta_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{N} \beta_5 \Delta OTH_{t-q} + \sum_{q-1}^{N} \beta_6 \Delta GCF_t + \sum_{q-}^{N} \beta_7 \Delta TLF_{t-q} + \varepsilon_{1t} \text{...}(15)$$

$$\Delta ME_t = \alpha_0 + \sum_{q=1}^{M} \alpha_1 \Delta RGDP_{t-q} + \sum_{q=1}^{M} \alpha_2 \Delta ME_{t-q} + \sum_{q=1}^{M} \alpha_3 \Delta ES_{t-q} + \sum_{q=1}^{M} \alpha_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{M} \alpha_5 \Delta OTH_{t-q} + \sum_{q-1}^{M} \alpha_6 \Delta GCF_{t-q} + \sum_{q-1}^{M} \alpha_7 \Delta TLF_{t-q} + \varepsilon_{2t} \text{...}(16)$$

$$\Delta ES_t = \mu_0 + \sum_{q=1}^{o} \mu_1 \Delta RGDP_{t-q} + \sum_{q=1}^{o} \mu_2 \Delta ME_{t-q} + \sum_{q=1}^{o} \mu_3 \Delta ES_{t-q} + \sum_{q=1}^{o} \mu_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{o} \mu_5 \Delta OTH_{t-q} + \sum_{q-1}^{o} \mu_6 \Delta GCF_{t-q} \sum_{q-}^{o} \mu_7 \Delta TLF_{t-q} + \varepsilon_{3t} \text{...(17)}$$

$$\Delta SS_t = \varphi_0 + \sum_{q=1}^{P} \varphi_1 \Delta RGDP_{t-q} + \sum_{q=1}^{P} \varphi_2 \Delta ME_{t-q} + \sum_{q=1}^{P} \varphi_3 \Delta ES_{t-q} + \sum_{q=1}^{P} \varphi_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{P} \varphi_5 \Delta OTH_{t-q} + \sum_{q-1}^{P} \varphi_6 \Delta GCF_{t-q} + \sum_{q-1}^{P} \varphi_7 \Delta TLF_{t-1} + \varepsilon_{4t} \text{...(18)}$$

$$\Delta OTH_t = \theta_0 + \sum_{q=1}^{C} \theta_1 \Delta RGDP_{t-q} + \sum_{q=1}^{C} \theta_2 \Delta ME_{t-q} + \sum_{q=1}^{C} \theta_3 \Delta ES_{t-q} + \sum_{q=1}^{C} \theta_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{C} \theta_5 \Delta OTH_{t-q} + \sum_{q-1}^{C} \theta_6 \Delta GCF_{t-q} + \sum_{q-1}^{C} \theta_7 \Delta TLF_{t-q} \text{..(19)}$$

$$\Delta GDS_t = \sigma_0 + \sum_{q=1}^{R} \sigma_1 \Delta RGDP_{t-q} + \sum_{q=1}^{R} \sigma_2 \Delta ME_{t-q} + \sum_{q=1}^{R} \sigma_3 \Delta ES_{t-q} +$$

$$\sum_{q=1}^{R} \sigma_4 SS_{t-q} + \sum_{q=1}^{R} \sigma_5 \Delta OTH_{t-q} + \sum_{q-1}^{R} \sigma_6 \Delta GCF_{t-q} + \sum_{q-1}^{R} \sigma_7 \Delta TLF_{t-q} + \varepsilon_{6t} \text{.............................(20)}$$

$$\Delta TLF_t = \psi_0 + \sum_{q=1}^{K} \psi_1 \Delta RGDP_{t-q} + \sum_{q=1}^{K} \psi_2 \Delta ME_{t-q} + \sum_{q=1}^{K} \psi_3 \Delta ES_{t-q} + \sum_{q=1}^{K} \psi_4 \Delta SS_{t-q}$$

$$+ \sum_{q=1}^{K} \psi_5 \Delta OTH_{t-q} + \sum_{q-1}^{K} \psi_6 \Delta GCF_{t-q} + \sum_{q-1}^{K} \psi_7 \Delta TLF_{t-q} + \varepsilon_{71t} \text{.................................(21)}$$

Where Δ is the first difference operator so that the terms are introduced in differences to ensure that they are stationary or I (0). Here the concept of causality is formulated in terms of changes to the variables and the presence of Granger-causality depends on the significance of the $\Delta Y_{t\text{-}q}$ terms and $\Delta E_{t\text{-}q}$ terms in equations (6) to (10) respectively.

This study considers a number of co-integration tests, namely the Engle-Granger method commonly known as the two-step estimation procedure, the Phillips-Ouliaris methods and the Johansen's procedure. From these co integration tests Johansen Approach was employed.

3.12 Johansen's Method

Johansen (1988) and Johansen and Juselius (hereafter, JJ) (1990) maximum likelihood (ML) procedure is a very popular co-integration test and useful method to determine the long-run relationship among non-stationary variables.

The aim of the co-integration test is to determine whether a group of non-stationary series is co-integrated or not. The Johansen's methods take its starting points in the Vector autoregressive (VAR) model as:

$$Y_t = \varphi + a_1 Y_{t-1} + a_2 {}_{t-2} Y_{t-2} + \ldots a_q Y_{t-q} + A X_t + \varepsilon_t \ldots\ldots (22)$$

Where Y_t is a n- vector of non-stationary I(1) endogenous variables that are integrated of order one-commonly denoted I (1) and X_t is a m vector of exogenous deterministic variables; $a_1,\ldots,a_q$ and A are matrices of coefficients to be estimated and ε_t is white noise residuals; that is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables. Because most economic time series are non-stationary, the above stated VAR model is generally estimated in its difference form as:

$$\Delta Y_t = \varphi + \theta Y_{t-1} + \sum_{i-1}^{q-1} \varpi_i \Delta Y_{t-1} + AX_t + \varepsilon_t; whre, \theta = \sum_{i-1}^{q} a_i and \varpi = -\sum_{j-i+1}^{n} a_j \ldots\ldots (23)$$

Granger's representation theorem states that if the coefficient matrix θ has reduced rank r<n, then there exist nxr matrices α and β each with rank r such that the method state that if θ matrix has reduced rank r<n, then there exist nxr matrices of α and β each with rank r such that $\theta = \alpha\beta'$ and $\beta' Y_t$ is I(0); r is the number of co integration relations (the co-integrated rank) and each column of β' is the co-integrating vector and α is the matrix of error correlation parameters that measures the speed of adjustments in ΔY_t. On the other hand, model is based on the error correction representation given by the following equation:

$$\Delta Y_t = \varphi + \theta Y_{t-i} + \sum_{i=1}^{q-1} \varpi_i \Delta Y_{t-1} + \varepsilon_t$$

Where Yt is an (nx1) column vector of q variables, is an (nx1) vector of constant terms, θ and ϖ represent coefficient matrices, Δ is a difference operator, k denotes the lag length, and ε_t is p dimensional Gaussian error with mean zero and variance matrix (white noise disturbance term). The coefficient matrix θ is known as the impact matrix and it contains information about the long-run relationships. This Equation resembles a vector autoregressive (hereafter, VAR) model in first differences, except for the inclusion of the lagged level of Y_{t-1}, an error correction term (hereafter, ECT), which will contain information about the long run among variables in the vector Y_t. The vector error correction (hereafter, VEC) method equation above allows for three model specifications:

(a) If θ is of full rank, then Yt is stationary in levels and a VAR in levels is an appropriate model.

(b) If has zero rank, then it contains no long run information, and the appropriate model is a VAR in first differences.

(c) If the rank of θ is a positive number, r and is less than p (where p is the number of variables in the system), there exists matrices α and β, with dimensions (p x r), such that $\beta\alpha' = \theta$. In this representation β contains the coefficients of the r distinct long run co-integrating vectors that render β'Xt stationary, even though X_t is itself non-stationary, and α contains the short-run speed of adjustment coefficients for the equations in the system (Awokuse, 2003). The Johansen approach to co-integration test is based on two test statistics: the trace test statistic, and the maximum eigenvalue test statistic, as suggested by Johansen (1988) and Oseterwald Lenum (1992).

Trace Test Statistic: The likelihood ratio statistic (LR) for the trace test (λ_{trace}) as suggested by Johansen (1988) can be specified as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{k} \ln(1-\hat{\lambda}_i)$$

where $\hat{\lambda}$i is the ith largest eigen value of matrix θ and T is the number of observations. In the trace test, the null hyphothesis is that the number of distnict cointegrating vector (s) is less than or equal to the number of cointegration relations (r). In this ststistic λ_{trace} will be small when the values of the charactersitc roots are closer to zero.

Maximum Eigen value Test: The second test statistic is known as the maximal eigen value test which computes the null hypothesis that there are exactly r co-integrating vectors in Yt. The maximum Eigen value test as suggested by Johansen (1988) examines the null hypothesis of exactly r co-integrating relations against the alternative of r+1 co-integrating relations with the test statistic and is given by:

$\lambda_{\max}(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1})$
where $\hat{\lambda}_{r+1}$ is the (r+1)th largest squared eigen value. In the trace test,
the null hyphothesis of r=0 is tested against the alternative of r+1 cointegrating vectors.
If the estimated value of the characteristic root is close to zero, then the λ_{trace} will be small.

For trace statistic, the null hypothesis is the number of co-integrating vectors is less than or equal to co-integrating vectors (r) against an unspecified alternative. In the case of maximum Eigen-value co-integration test, the null hypothesis is the number of co-integrating vectors (r) against the alternative of 1 + r (Ng *et al*., 2008). If the trace statistic is greater than the Eigen-value (critical value), we conclude that the model contains at least one co-integrating equation. Where this condition is violated at a higher order, determines the maximum number of co-integrating equations. Therefore, this study was used Johansen approach. The distributions for these tests are not given by the usual chi-squared distributions. The asymptotic critical values for these likelihood ratio tests are calculated via numerical simulations (Johansen and Juselius, 1990; and Osterwald-Lenum, 1992).

3.13 Vector Error Correction Model

According to Engle-Granger (1987) if two time series are co-integrated then the VECM will represent them most efficiently. If co-integration has been detected between series we know that there exists a long-term equilibrium relationship between them so we apply VECM in order to evaluate the short run properties of the co-integrated series. In case of no co-integration VECM is no longer required and the researcher directly precedes to Granger causality tests to establish causal links between variables.

An error correction model is defined as a dynamic model in which the movement of a variable in any period is related to the previous period's gap from the long-run equilibrium. Although it may be possible to estimate the long-run or co-integrating relationship, $Y_t = \beta X_t + \varepsilon_t$ economic systems are rarely in equilibrium, as they are affected by institutional and/or structural changes that might be temporary or permanent.

A simple dynamic model of a short-run adjustment model is given by:

$$Y_t = \varphi_0 + \varpi_0 X_t + \varpi_1 X_{t-1} + \varphi Y_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (24)$$

Where,

Yt is dependent variable, and Y_{t-1} are lagged values; X_t is independent variable, and X_{t-1} are lagged values; $\varphi_0, \varpi_0, \varphi_1$ and ϖ_1, are parameters; ε_t is the error term assumed to be $\varepsilon_t \sim IID(0, \sigma^2)$ The problems associated with the use of the short-run model are multicollinearity, and spurious correlation. The problems are solved by estimating the first difference of equation (16) to get

$$\Delta Y_t = \varphi_0 + \varpi_0 \Delta X_t + \varpi_1 \Delta X_{t-1} + \varphi_1 \Delta Y_{t-1} + \varepsilon_t \text{ .... (24i)}$$

This, however, introduces problems of loss of information about the long-run equilibrium and the economic theory is differenced away. Thus, the possible solution is to adopt the error-correction mechanism (ECM) formulation of the dynamic structure. The setup is as follows. $\Delta Y_t = \varpi_0 \Delta X_t - (1-\varphi_1)[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}] + \varepsilon_t$ .... (24ii)

The above equation (14 ii) shows the ECM model. Error correction mechanism satisfies the assumptions of classical normal linear regression model. Among others the assumption includes, a linear regression model, residuals are normally distributed, there is no serial correlation among residuals, and there is no perfect multi-collinearity.

Where,

$-(1-\varphi_1)$ is the speed of adjustment; $\varepsilon_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1}$ as error-correction mechanism which measures the distance of the system away from equilibrium. Therefore, the coefficient of ε_{t-1} should be negative in sign in order for the system to converge to equilibrium. The size of the coefficient $-(1-\varphi_1)$ is an indication of the speed of adjustment towards equilibrium in that; Small values of $-(1-\varphi_1)$ tending to -1, indicate that economic agents remove a large percentage of disequilibrium in each period; Larger values, tending to 0, indicate that adjustment is slow; Extremely small values, less than -2, indicate an overshooting of economic equilibrium; Positive values would imply that the system diverges from the long-run equilibrium path.

Given from the above reality that, the variable will be subjected to Johansen co-integration test and if it is found that the variables are co-integrate. Followed by using the Granger causality theorem, we will posit the following testing relationships that constitute a vector error correction (VEC) model for output growth.

$$RGDP_t = \beta_0 + \sum_{k}^{r} \phi_1 u_{t-k} + \sum_{q=1}^{N} \beta_1 RGDP_{t-q} + \sum_{q=1}^{N} \beta_2 ME_{t-q} + \sum_{q=1}^{N} \beta_3 ES_{t-q} + \sum_{q=1}^{N} \beta_4 SS_{t-q}$$

$$+ \sum_{q=1}^{N} \beta_5 OTH_{t-q} + \sum_{q-1}^{N} \beta_6 GCF_{t-q} + \sum_{q-1}^{N} \beta_7 TLF_{t-q} + \varepsilon_{1t} \text{...(25)}$$

$$ME_t = \alpha_0 + \sum_{k}^{r} \phi_2 u_{t-k} + \sum_{q=1}^{M} \alpha_1 RGDP_{t-q} + \sum_{q=1}^{M} \alpha_2 ME_{t-q} + \sum_{q=1}^{M} \alpha_3 ES_{t-q}$$

$$+ \sum_{q=1}^{M} \alpha_4 SS_{t-q} + \sum_{q=1}^{M} \alpha_5 OTH_{t-q} \sum_{q-1}^{M} \alpha_6 GCF_{t-q} + \sum_{q-1}^{M} \alpha_7 TLF_{t-q} + \varepsilon_{2t} \text{..(26)}$$

$$ES_t = \mu_0 + \sum_{k}^{r} \phi_3 u_{t-k} + \sum_{q=1}^{O} \mu_1 RGDP_{t-q} + \sum_{q=1}^{O} \mu_2 ME_{t-q} + \sum_{q=1}^{O} \mu_3 ES_{t-q} + \sum_{q=1}^{O} \mu_4 SS_{t-q}$$

$$+ \sum_{q=1}^{O} \mu_5 OTH_{t-q} + \sum_{q-1}^{O} \mu_6 GCF_{t-q} + \sum_{q-1}^{O} \mu_7 TLFt_{-q} + \varepsilon_{3t} \text{..(27)}$$

$$SS_t = \varphi_0 + \sum_{k}^{r} \phi_4 u_{t-k} + \sum_{q=1}^{P} \varphi_1 RGDP_{t-q} + \sum_{q=1}^{P} \varphi_2 ME_{t-q} + \sum_{q=1}^{P} \varphi_3 ES_{t-q} + \sum_{q=1}^{P} \varphi_4 SS_{t-q}$$

$$+ \sum_{q=1}^{P} \varphi_5 OTH_{t-q} \sum_{q-1}^{P} \varphi_6 GCF_{t-q} + \sum_{q-1}^{P} \varphi_7 TLF_{t-q} + \varepsilon_{4t} \text{..(28)}$$

$$OTH_t = \theta_0 + \sum_{k}^{r} \phi_5 u_{t-k} + \sum_{q=1}^{C} \theta_1 RGDP_{t-q} + \sum_{q=1}^{C} \theta_2 ME_{t-q} + \sum_{q=1}^{C} \theta_3 ES_{t-q} + \sum_{q=1}^{C} \theta_4 SS_{t-q} +$$

$$\sum_{q=1}^{C} \theta_5 OTH_{t-q} \sum_{q-1}^{C} \theta_6 GCF_{t-q} + \sum_{q-1}^{C} \theta_7 TLF_{t-q} + \varepsilon_{5t} \text{..(29)}$$

$$GDS_t = \sigma_0 + \sum_{k}^{r} \phi_5 u_{t-k} + \sum_{q=1}^{R} \sigma_1 GCF_{t-q} + \sum_{q=1}^{R} \sigma_2 ME_{t-q} + \sum_{q=1}^{R} \sigma_3 ES_{t-q} + \sum_{q=1}^{R} \sigma_4 SS_{t-q}$$

$$+ \sum_{q=1}^{R} \sigma_5 OTH_{t-q} + \sum_{q-1}^{R} \sigma_6 GCF_{t-q} + \sum_{q-1}^{R} \sigma_7 TLF_{t-q} + \varepsilon_{6t} \text{...(30)}$$

$$TLF_t = \psi_0 + \sum_{k}^{r} \phi_7 u_{t-k} + \sum_{q=1}^{K} \psi_1 TLF_{t-q} + \sum_{q=1}^{K} \psi_2 ME_{t-q} + \sum_{q=1}^{K} \psi_3 ES_{t-q} + \sum_{q=1}^{K} \psi_4 SS_{t-q}$$

$$+ \sum_{q=1}^{K} \psi_5 OTH_{t-q} + \sum_{q-1}^{K} \psi_6 GCF_{t-q} + \sum_{q-1}^{K} \psi_7 TLF_{t-q} + \varepsilon_{7t} \text{..(31)}$$

The existence of co-integration implies Granger causality; however, does not show the direction of causality. To assess the direction, the study was employed a vector error correction (VEC) modeling. If the variables under study are co-integrated, a vector error correction model should be estimated rather than a VAR as in a standard Granger causality test (Granger, 1988). Thus, following Granger (1988), and Engle and Granger (1987), estimates a VEC model for the Granger causality test. The vector error correction model is given by the following equation as: Where, ui (i= 1,2,3,…) refer to error correction terms whose coefficients measure speeds of adjustment, ϕ_1, ϕ_2, ϕ_3, ϕ_4, ϕ_5, and ϕ_6, are intercepts, and N, M,O,P,C, and H are lag lengths. The ui (i=1,2,3) are derived from long-run co-integrating relationships that is RGDP= F(ES,SS, ME, and OTH, GCF,TLF)

Once the equilibrium conditions represented by the cointegrating relations are imposed, the VEC model describes how, in each time period, output growth is adjusting towards its long-run equilibrium state. Since the variables are supposed to be co-integrated, then in the short term, deviation of output from its long-run equilibrium path will feed back on its future changes in order to force its movement towards the long-run equilibrium state. The co integrating vectors from which the error-correction terms are derived are each indicating an independent direction where a stable, meaningful long-run equilibrium state exists. The coefficients of the error-correction terms, however, represent the proportion by which the long-run disequilibrium in the dependent variables is corrected in each short-term period (Ghali and El-Sakka, 2004).

3.14 Granger Causality Test

Depending on the theoretical facts the researcher discuss, the reported F-statistics of the Wald statistics for the joint hypothesis for each equation will be undertaken. The null hypothesis is that Y does not Granger-cause X in the first regression and that X does not Granger-cause Y in the second regression.

Before testing the causality of the VECM, first Granger causality test between real GDP and military expenditure will be examined to determine the long run causality in VECM context, and then short run causality will be estimated using VECM. The Granger causality test or well known as 'joint F-test' between military expenditure and economic growth was used in order to check the direction of causality between two variables in Ethiopia. The Granger procedure is selected because it consists more powerful but simpler way of testing causal relationship Granger (1986). Using this test the following null and alternative hypotheses will be estimated.

In testing long-run causality, four hypotheses were tested using VAR. First, ‘growth hypothesis’, which asserts that military expenditure cause economic growth as complement to other inputs in the production functions. If such is the case, the policy implications are that military expenditure policies which reduce military expenditure may possibly reduce real output. The growth hypothesis is supported if there is unidirectional Granger-causality from military expenditure to real output.

$$ME_t = \alpha_0 + \sum_{k}^{r} \phi_2 u_{t-k} + \sum_{q=1}^{M} \alpha_1 RGDP_{t-q} + \sum_{q=1}^{M} \alpha_2 ME_{t-q} + \sum_{q=1}^{M} \alpha_3 ES_{t-q} + \sum_{q=1}^{M} \alpha_4 SS_{t-q}$$

$$+ \sum_{q=1}^{M} \alpha_5 OTH_{t-q} \sum_{q-1}^{M} \alpha_6 GCF_{t-q} + \sum_{q-1}^{M} \alpha_7 TLF_{t-q} + \varepsilon_{2t} \ldots\ldots (32)$$

Equation (33) postulates that military expenditure is related to its past values, growth in RGDP, ES, SS, OTH, GCF, TLF and a certain proportion of equilibrating error.

The null and alternate hypotheses in this case are;

H_0: Economic growth doesn’t granger cause military expenditure.

H_1: Economic growth granger causes military expenditure.

Second, hypothesis’ which suggests that policy on military expenditure have no effect on the economic growth. It may be due to little share of military service in the production function. That means economic growth Granger cause military service growth. Unidirectional Granger-causality from real output to military expenditure would lend support for the military service hypothesis. Studies by Kraft (1978), Thomson (2004), and Sari *et al*. (2008) support the conservation hypothesis in the case of the U.S. In this case VECM has the following form;

$$RGDP_t = \alpha_0 + \sum_{k}^{r} \phi_2 u_{t-k} + \sum_{q=1}^{M} \alpha_1 RGDP_{t-q} + \sum_{q=1}^{M} \alpha_2 ME_{t-q} + \sum_{q=1}^{M} \alpha_3 ES_{t-q} + \sum_{q=1}^{M} \alpha_4 SS_{t-q}$$

$$+ \sum_{q=1}^{M} \alpha_5 OTH_{t-q} \sum_{q-1}^{M} \alpha_6 GCF_{t-q} + \sum_{q-1}^{M} \alpha_7 TFL_{t-q} + \varepsilon_{1t} \ldots\ldots (33)$$

Equation (34) postulates that growth in RGDP is related to past values of itself, MEXP, ES, SS, OTH capital and labor and a certain proportion of equilibrating error.

The null and alternate hypotheses in this case are;

H_0: Military expenditure doesn't granger cause economic growth.

H_1: Military expenditure granger cause economic growth.

Third, feedback hypothesis suggest that military expenditure and economic growth are interdependent. Bidirectional causality between military expenditure and economic growth show such behavior. It asserts that military expenditure and real output are interdependent and act as complements to each other. The existence of bidirectional Granger-causality between military expenditure and real output substantiates the feedback hypothesis. Research by Glasure and Lee (1995, 1996), Zarnikau (1997), Lee (2006), and Mahadevan and Asafu-Adjaye (2007) lend support to the feedback hypo-thesis for the U.S.

Fourth, Neutrality hypothesis suggest that military expenditure and economic growth are independent. That is military expenditure and economic growth decisions are taken independently. Furthermore, the neutrality hypothesis views military service as a relatively minor factor in the production of real output in which case military service policies may not adversely impact real output. The absence of Granger-causality between military expenditure and real output is supportive of the neutrality hypothesis. Studies by Akraca and Long (1980), Yu and Hwang (1984), Yu and Choi (1985), Erol and Yu (1987), Yu *et al*. (1988), Yu and Jin (1992), Cheng (1996), Murry and Nan (1996), Soytas and Sari (2003), Chontanawat *et al*. (2006, 2008), Soytas *et al*. (2007), Chiou-wei *et al*. (2008), Narayan and Pra-sad (2008), Pay), and Payne and Taylor(forth-coming) are supportive of the neutrality hypothesis in theU.S.ne2009

3.15 Test of Volatility: Impulse response and variance decomposition

Impulse response is a method of assessing the interaction among the variables in the VECM. it can be used either to assess the dynamic behavior of the VAR or to investigate the policy impact of the variables that constitute the VECM or VAR (Alemayehu, 2009). The coefficients of VAR or VEC models only show the direct or ceteris paribus effect. They do not consider the lagged explanatory variables in each equation are interlinked. That is both with the lag and contemporaneously and thus does not reflect the full impact of one variable on the other. Due to this, the analysis relies to a great extent on impulse response functions to estimate the total short and long run an increase in military expenditure on economic growth. In sum, impulse response shows how one variable, say economic growth responds over time to a shock in another variable (say military expenditure) and compares this response to shocks from other variables. Impulse response only traces out the time path of the effects of shocks of other variables contained in the VAR model on a specific variable (Belay, 2015). On the other hand, this method is designed to determine how each variable responds over time to an earlier shock in that variable and to shocks in other variables (Belay, 2015). The variance decomposition helps in identifying the degree to which one variable influences the other. In this study variance decomposition was used to break down and ascertain the degree to which military expenditure influence other variable in the system and vice versa. To make it clear, variance decompositions show the portion (or relative importance) of variance in the prediction for each variable in the system that is attributable to its own innovations and to shocks to other variables in the system. Enders in Shan *et al.* (2006) as cited in Belay (2015) proposed that the forecast-error variance decomposition permits inferences to be drawn concerning the proportion of the movements in a particular time-series due to its own earlier shocks vis-a-vis shocks arising from other variables in a VECM model. The technique breaks down the variance of the forecast error for each variance following a shock to a particular variable, and thus, it identifies which variables are strongly affected and those that are not.

CHAPTER FOUR

DESCRIPTIVE ANALYSIS OF ETHIOPIAN ECONOMY

4.1 The overall Economic Performance

Obviously, the Ethiopian economic growth has shown different changes in various political regimes. These change in government structure created a problem of inconsistency in implementing the policies by previous regimes including external and internal wars as well as natural disaster like famine and drought had a depressing effect on the history of economic growth of the country. In modern Ethiopian political economic history, the country has experienced three policy transitions: the imperial era (prior to 1973/74), the socialist (Dergue) regime (1974/75-1990/91) and the EPRDF regime (1991/92 till present) each with unique economic policies with different impact on economic performance of the country. Thus, the performance of the country's economy is highly correlated with changing political economy.

During the Imperial period (pre 1974) economic policy was mainly known to be market oriented economic system and the political process was unpredictable and violent; which exerted detrimental impact on the economic performance. As a result, economic performance was not improved. During the Dergue regime (1974/75-1990/91), the government exercised centralized economic system and command economic system. Because of intervention of the government in all types of economic activities and nationalization of all types of property, the economy was goes to the worst. After the down fall of the Dergue regime in 1991/92, the new government (EPRDF) liberalized the economic system, and relatively good economic performance is recorded though it experienced fluctuations. During Derg declaration was further clarified and strengthened by the Declaration on Economic Policy of Socialist Ethiopia of February 1975. The essence of the Economic Policy was to delineate and indicate economic sectors and activities where the state sector, private sector and foreign capital could invest and operate in the country's economic development. The government's aims in taking over the commanding heights of the economy were: to ensure that social justice and equity are promoted; to generate more resources required to accelerate economic development for improving the living standard of the people; and to expedite the construction and the management of the economy through planning and in a resource allocation system that would ensure a steady progress in economic and social development.

In line with these intentions, the first major economic measure came at the beginning of 1975. All banks, insurance companies, and industrial and commercial firms were nationalized. Then the Land Reform Proclamation of March 1975, which made all rural land the collective property of the Ethiopian people. At a stroke it terminated feudal relations of agricultural production -- a widely recognized impediment to economic development in Ethiopia. The proclamation called for the formation of Peasant Associations (PA) with provisions for self-administration and the defense of the reforms as well as to ensure mass participation in the development process. The other measure taken during the first year of the *Derg* was the nationalization of urban land and extra houses on July 26, 1975. The Urban Land Proclamation allowed each family to retain only a single dwelling for its own occupation and transferred all rented-out houses to the state. Rent reductions were made ranging from 15 to 50 per cent, with the percentage reduction biased in favor of low-income groups, with a view to passing on some of the benefits to them.

The Proclamation also called for the establishment of Urban Dwellers Associations was to administer rents below 100 Birr per month and serve as basic units for urban administration and carry out political and local development functions. During its second year the *Deg* brought further ideological clarification to the December 1974 Declaration of Socialism. This came with the issuance of the Programme of the National Democratic Revolution (NDR) of April 1976. According to the NDR Programme, the guiding ideology of the government was thenceforth to be Marxism-Leninism. The long-term goal was to be the building of socialist society. Since the NDR was an interim programme for the transition period, its economic programme was meant to create the technical and material foundations for socialism.

The NDR Programme was further clarified and incorporated in the Programme of the Workers Party of Ethiopia (WPE) issued in 1987. The economic objectives of the WPE were: to accelerate the growth of the productive forces so as to build a strong and internally self-sustaining national economy free from the influences of the capitalist market and division of labor; to expand, strengthen and ensure the dominance of socialist production relations with a view to creating a conducive environment for the growth of the productive forces, and to expand socialist economic organization and management in order to realize this, to accelerate, through sustained growth of the standard of living and cultural well-being of the working people. The NDR Programme and the Programme of WPE provided broad guidelines for the elaboration of the Ten-Year Perspective Plan (TYPP), which was to cover 1984/85-1993/94. The TYPP provides ample evidence on the long-term development objectives, priorities and goals of the government. The major objectives, as stated in the TYPP, were: improving gradually the material and cultural well-being of the people; accelerating growth of the economy through the expansion of the country's productive capacity; conserving, exploring, and developing the natural resources of the country, expanding and strengthening socialist production relations, laying down the basis for the development of national science and technology capability, alleviating social and unemployment problems gradually, ensuring balanced and proportional development of all regions the foundation of the country's economy and industry as the leading sector.

As shown from the figure 4.1, growth rate of GDP show tremendous fluctuation. During the Dergue regime, Ethiopia has recorded the lowest rate of economic growth which is almost -10%. In addition to this, the average growth rate in real GDP was only 1.58% for the seventeenth years. Due to drought, growth was decelerated by 6.29% and 9.63% during 1983/84 and 1984/85 respectively. However, the growth rate displayed amazingly recovery from the previous years and reached 9.9% and 14.04% in 1985/86 and 1986/87 respectively as a result of the economic reforms has been taken and thus it created relatively conducive environment for domestic and foreign private investors. The Ethiopian economy has grown rapidly as the transition from a command to a market based economy took place.

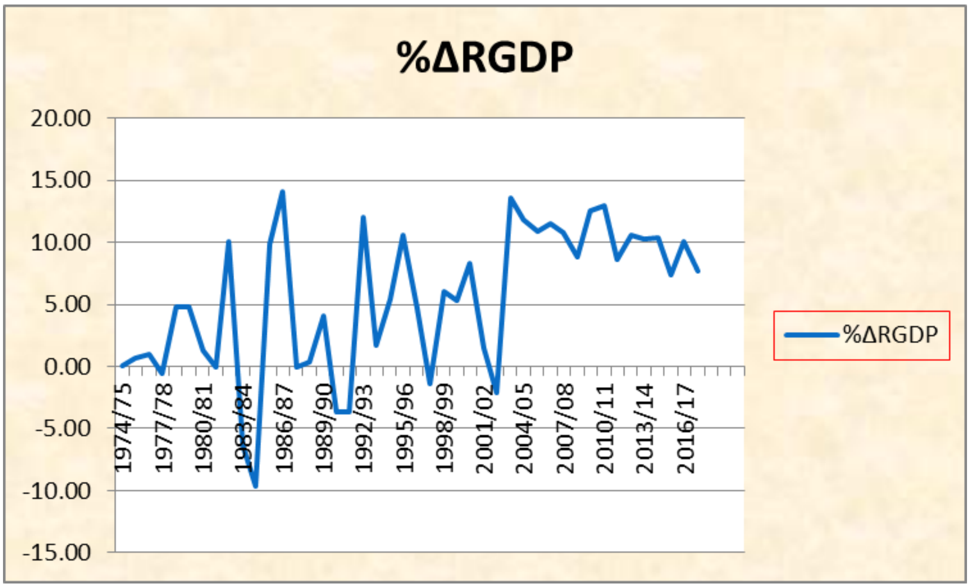
However, the performance of GDP growth rate in the beginning of current EPRDF regime (1991/1992) was discouraging (-3.69%) due to unfavorable economic basis and violent inherited from the Dergue regime. Furthermore, growth rate of GDP had also very low in 1997/98 (-1.44%) because of unexpected Eritrea's aggression. Ethiopia registered the highest GDP growth (double digit growth rate) in the current EPRDF government for the period 2003/04-2017/18, except in 2008/2009 and 2010/11 due to financial crises and inflation.

The Ethiopian economy which had revealed 10.04 percent average annual growth during 2010/11-2015/16, registered 7.33 percent growth in 2017/18 despite challenging macroeconomic and weather conditions. The 8 percent real GDP growth was 3.77 percentage point lower than base case scenario GTPII target set for the fiscal year although it was significantly higher than 1.6 percent average growth estimated for Sub - Saharan Africa (World Economic Outlook, 2017). The Ethiopian economy is targeted to grow 11.1 percent in 2016/17 in contrast to 3.8 and 5.1

percent growth forecast of the IMF for the world and Sub-Saharan Africa (SSA), respectively (WEO, 2016). However, the Ethiopian economic growth during 2016/17 was 10.1 percent. However, the Ethiopian economy annual growth is 7.7 percent on average during 2017/18 which shows decline when we compare with 2016/17. This is due to political instability in our country for past three years.

Trends of growth rate of real GDP from the year 1974/5-2017/18 can be summarized as follows.

Figure 4.1: Trends of growth rate of real GDP from the year 1974/5-2017/8



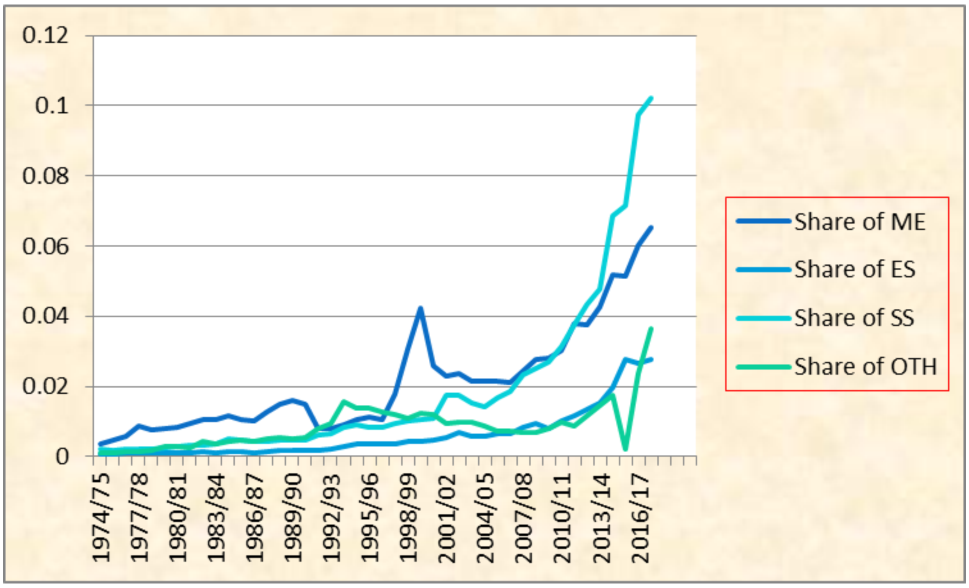
Source: Own computation based on NBE data (2017/18)

4.2 Share of Economics service, social service, other service and military expenditures

Economic service expenditure has an average share of 0.611 percent over the period 1974/75-2017/18. The economic services expenditure varies from the highest 2.76 percent share in the year 2017/18 to the lowest share of 0.067 percent in the year 1974/75. This tells that the process of structural change in the economy was a very high. In the period where the economy has achieved a double digit growth (2003/04-2014/15), the Economic services expenditure is 1.34 percent on average (Figure 4.2).

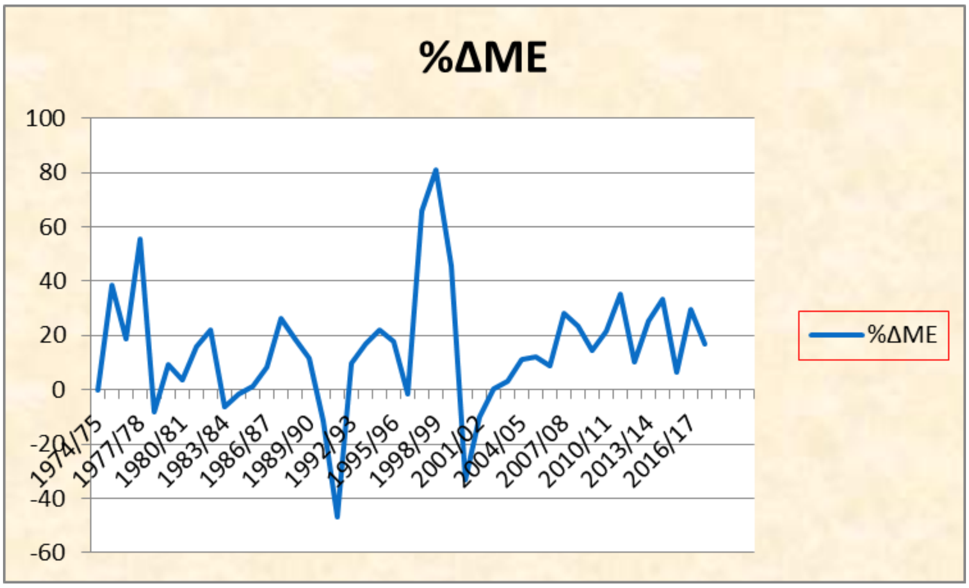
Social services expenditure has an average share of 1.32% over the period 1974/75-2017/2018. The social services expenditure varies from the highest 4.7657 percent share in the year 2017/18 to the lowest share of 0.1969 percent in the year 1974/75. This tells that due to political instability the social expenditure was not big as before. In the period where the economy has achieved a double digit growth (2003/04-2014/15), the social services expenditure is 0.97 percent on average (Figure 4.2). Other services expenditure has an average share of 0.21% over the period 1974/75-2017/18. The other services expenditure varies from the highest 0.9578% percent share in the year 1993/4 to the lowest share of 0.0972 percent in the year 1975/6. This tells that the due to political instability the other expenditure was not big as before. In the period where the economy has achieved a double digit growth (2003/04-2014/15), the other services expenditure was 0.499 percent on average (Figure 4.2). During 2015/16-2017/18 the other share of expenditure is 0. 85 percent on average, which is higher than when the economy registered double digit growth. The average share of military expenditure was also high especially in 1990/1991.

Figure4. 2: Share of Economics service, social service, other service and military expenditure



Source: Own computation based on NBE data (2017/18)

Figure 4.3: Trend of Military Expenditure



Source: Own computation based on NBE data (2017/18)

4.3 Trends in and levels of military expenditure

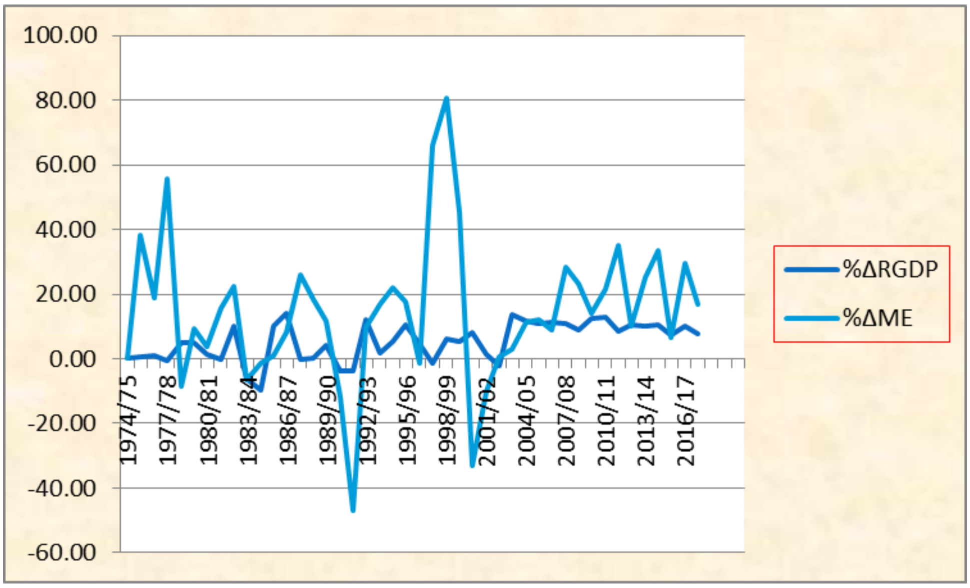
Ethiopia’s military expenditure peaked in 1999 at over $685 million, declining to $406 million (in constant 2000 prices) in 2002. Before the 1999 peak, military expenditure in Ethiopia had placed a great burden on the economy. In the 1980s, on average it took approximately 38 per cent of central government expenditure and 7.3 per cent of GDP. This disproportionate spending on defense in relation to other sectors was the result of the war against the Eritrean People’s Liberation Front (EPLF) and later the EPRDF, which reached its peak between 1989 and 1991, when the Derg regime was defeated. Shortly after, military expenditure declined dramatically both as a share of government expenditure and in real terms.

It fell by more than 50 percent in 1991 on the previous year. By 1995 military expenditure was $99 million (in 2000 prices) or 24 per cent of the 1989 level. As a share of central government expenditure it declined from 41 per cent in 1989 to approximately 8 per cent in 1995 and 1996. This situation was helped greatly by donor support for the demobilization of soldiers begun by the transitional government. This drastically reduced the wage bill and made the new army more manageable. However, by 1996 military expenditure had started to rise again (SIPRI, 2017)

The reason for the new increase, it emerged later, was the preparations for the eventual war with Eritrea. Military expenditure rose by 83 percent in real terms between 1996 and 1997, and by 1998, when the war was under way, it had increased to the 1989 level. By 1999 it was 66 per cent higher, in real terms, than in 1989/90 at the peak of the war against the Derg regime. Although spending started to decline the following year, by 2002 (two years after the war officially ended) military expenditure was still only 1.4 per cent lower in real terms than the 1989 level. As a share of government spending, it increased from the lowest point in 1996 (at 8.2 per cent) to 34.8 per cent in 1999, and by 2002 had only declined to 16 per cent. As a share of GDP, military expenditure was also highest in 1999, at 10.8 per cent, and in 1996 at the lowest level (at 1.9 per cent) over the two decades covered by this study. The trends in these two decades show a pattern of a peak being reached at the height of conflict. Ethiopia’s military expenditure reached an all-time high when the war against the EPRDF was at its fiercest, in FY 1989/90, and the strength of the armed forces was reported to be close to half a million men and women. The war with Eritrea reached its peak in late 1999 and early 2000, just as military expenditure for the year reached a high of 35 per cent of government spending. Thus, conflict (with hostile neighbor and internal crisis) and the influence of donors, particularly after 1991, have played major roles in determining the level and trend of military expenditure in Ethiopia (SIPRI, 2017)

Military expenditure has an average share of 2.12% over the period 1974/75-2017/2018. The military expenditure varies from the highest 6.5421 percent share in the year 2017/18 to the lowest share of 0.3504 percent in the year 1974/75. This tells that the due to political instability the military expenditure was high from time to time specially from 2013/14-2017/18, which is 5.429 percent on average. In the period where the economy has achieved a double digit growth (2003/04-2014/15), the social services expenditure was 2.94 percent on average (Figure 4.2), NBE, 2018))

Figure 4.4: Trend of RGDP growth and growth rate of military expenditure



Source: Own computation based on NBE data (2017/18)

The economy's growth rate was on average 5.34 percent for the last four decades and it has become impressive in the most recent decade. The average growth rate in the EPRDF regime is 7.53 percent which is higher than the pre-EPRDF period. The economy has grown by 10.77percent for the period between 2003/04-2014/15. But even with this highest growth rate the structure of the economy was almost as it was before this period, the only exception is that the service sector has become the leading sector and there is a significant decline in the share of agriculture. In GTP-I, the economy has registered an average growth rate of 10.59 percent a little less of the planned 11 percent average growth rate. On average the military expenditure growth rate is 15.077 percent between 1974/75 and 2017/18. During Dergue regime the military expenditure growth rate is 9.07 percent. In the EPDRF period (1991/92 up to present) it has 16.56 percent growth rate, on average.

4.4 Ethiopia - Arms imports (SIPRI trend indicator values)

Arms transfers cover the supply of military weapons through sales, aid, gifts, and those made through manufacturing licenses. Data cover major conventional weapons such as aircraft, armored vehicles, artillery, radar systems, missiles, and ships designed for military use. Excluded are transfers of other military equipment such as small arms and light weapons, trucks, small artillery, ammunition, support equipment, technology transfers, and other services.

On average the value for arms imports in Ethiopia between 1974/75 and 2016/18 was 233,062,500. During Dergue regime the value for arms import is 329,222,222.22. In the EPDRF period (1991/92 up to present) it has 107,466,666.67 value, on average. In the GTP-I (2010/11-2014/15) period, the value for arms imports is 74,857,142.86 birr on average. This implies that the military expenditure growth rate is yet not decreased as expected. Although national defense is an important function of government and security from external threats that contributes to economic development, high military expenditures for defense or civil conflicts burden the economy and may impede growth. Data on military expenditures are a rough indicator of the portion of national resources used for military activities and of the burden on the economy. Comparisons of military spending among countries should take into account many factors that influence perceptions of vulnerability and risk, including historical and cultural traditions, the length of borders that need defending, the quality of relations with neighbors, and the role of the armed forces in the body politic.

CHAPTER FIVE

EMPERICAL RESULTS AND DISCUSSION

The previous chapter discussed the research design and Methodology. In this chapter, the study analyses the relationship between military expenditure and economic growth using annual data from 1974-2017 in Ethiopia. Before going to the direct estimation of the model, it needs to first employ the unit root test to check whether the time-series is stationary or not. After identifying the optimal lag length, the presence of the co-integrating vectors was tested using the Johansen co-integration procedure. Furthermore, the granger causality test was employed to find the direction of causality of military expenditure and economic growth. Finally, the long-run and short-run relationship is also identified followed by the volatility test. The main aim of this thesis was to examine the dynamics of the relationship between military expenditure and economic growth using time series data over the period 1974/5-2017/8.The data was obtained from Ministry of Finance and Economic Development and National bank of Ethiopia, and SIPRI for Macroeconomic variables.

5.1 Descriptive Statistics

Mean is the average value of the sample. Similarly, maximum and minimum observation value, standard deviation, skewnes and kurtosis result of explanatory variables were depicted in the below. Accordingly the mean value of military expenditure collected over the period 1974-2017 of Ethiopia was 9246.071and also the maximum and minimum value were 62715.68 and 358.8000 respectively. Standard deviation measures how far observations are from the sample average. This data standard deviation of the sample data of military expenditure is 14583.95 far from the mean of the data as shown on the below. This result of high standard deviation shows the variety of expenditure on military from time to time in Ethiopia. Similarly the maximum and minimum result shows high variation in military expenditure. When the researcher comes to skewness, it measures the degree of asymmetry of the series. The military data on table below result showed positive skewed. The positive result of skewness is normally happen because the mean of the data is greater than the median as shown in table 5.1. Similarly RGDP, GCF, TLF, ES, SS and OTH become also positively skewed. In the kurtosis side, Kurtosis measures the peakdness or flatness of the distribution of the series. The result of kurtosis RGDP, GCF, TLF, ES, SS and OTH were 9.364573, 9.673288, 2.211185, 8.311230, 9.889501 and 17.93829 respectively. The kurtosis results except TLF, all variable showed pletykurtic because all are more than the normal value 3. The TLF kurtosis result shows mesokurtic. The measure of normality is measured by kurtosis and skewness. The different level measures of Kurtosis are Mesokurtic, Leptokurtic and Pletykurtic. Mesokurtic (normal distribution) equal to the value 3, for leptokurtic (Positive kurtosis) greater than 3 and for platykurtic (Negative kurtosis) less than 3.

Similarly, the mean value of RGDP is 312924.0 over the period 1974-2017 of Ethiopia stated and the maximum 1719491 and minimum 97651.09 were recorded.

Table 5.1: Descriptive Statistics

	ES	GCF	ME	OTH	RGDP	SS	TLF
Mean	3333.388	105079.0	9246.071	3376.383	312924.0	10691.16	28614691
Median	634.7200	41838.50	2148.790	2095.930	165145.3	1460.355	26069251
Maximum	26503.26	746784.4	62715.68	34976.15	1719491	97845.76	51785921
Minimum	69.18000	14116.00	358.8000	115.4200	97651.09	195.9400	14899600
Std. Dev.	6460.757	167885.2	14583.95	6191.438	381871.4	22108.37	10651483
Skewness	2.512815	2.727212	2.279925	3.754880	2.662396	2.745696	0.589361
Kurtosis	8.311230	9.673288	7.492973	17.93829	9.364573	9.889501	2.211185
Jarque-Bera	98.02121	136.1864	75.12822	512.5064	126.2455	142.3045	3.687958
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.158187
Sum	146669.1	4623478.	406827.1	148560.9	13768655	470411.1	1.26E+09
Sum Sq. Dev.	1.79E+09	1.21E+12	9.15E+09	1.65E+09	6.27E+12	2.10E+10	4.88E+15
Observations	44	44	44	44	44	44	44

Source: Own Computation (2019)

5.2 Unit Root Test

As clearly discussed under methodology chapter, it is necessary to test the nature of stationarity of the variables before running regression analysis. This helps us to avoid the possibility of running a spurious regression, which makes the result to be unreliable and inconsistent. This test can be done using the Augmented Dickey-Fuller (ADF) unit root tests. When the ADF test statistics is larger than the critical value in absolute terms at 5 % level of significance, the null hypothesis of unit root is rejected, and if the ADF test statistics is less than the critical value in absolute terms, we fail to reject the null hypothesis. The results of ADF test for unit root of variables used in the study is presented in the following table (5.2). All variables are in logarithmic forms. It is worth pointing out that all variables was transformed to natural logarithms before analysis to avoid the problem of heteroscedasticity of the error terms; the estimated coefficients on level variables are elasticity's. Since all variables were tested for non-stationary using Unit root test, they were differenced once and the estimated parameters of first differences of the natural logarithms gave approximate growth rates of the variables.

Table 5.2: Results of Augmented Dickey Fuller Test

Variables	ADF t-statistic at level, I(0)	ADF t-statistic at first difference, I(1)	Decision (Order of integration)
	Intercept and trend	Intercept &trend	Decision
LNRGDP	0.205990 (NS)	-4.874381*** (S)	Stationary (I(1))
LNGCF	0.633870 (NS)	-8.342863*** (S)	Stationary (I(1))
LNTLF	-0.735476 (NS)	-7.316802***(S)	Stationary (I(1))
LNES	-2.346703 (NS)	-6.616913***(S)	Stationary (I(1))
LNME	-2.066521 (NS)	-4.902399***(S)	Stationary (I(1))
LNSS	-1.424537 (NS)	-7.548409***(S)	Stationary (I(1))
LNOTH	-4.253163(S)	-7.194257***(S)	Stationary (I(1))
INFL	-6.016702(S)	-8.933345(S)	Stationary (I(1))
UNEM	-1.638312(NS)	-4.787476	Stationary (I(1))
MacKinnon (1996) with constant, no trend 1% level -3.621 Test critical values: 5% level -2.943 10% level -2.610		with constant and trend 1% level -4.227 Test critical values: 5% level -3.537 10% level -3.200	

Where NS & S represent not stationary and Stationary respectively

Source: Own computation (2019)

Table 5.2 showed unit root results of the time series at level and first differences. The absolute values of the calculated test statistics for all variables except LNOTH were less than its critical value at 5 per cent level of significance. The result indicated that all variables were non-stationary at level except LNOTH. Thus, the null hypothesis that each variable has unit root at a level cannot be rejected by the ADF test. Null is rejected only for other service expenditures at level. However, all the variables were found to be stationary at their first differences, and thus the researcher rejected the null hypothesis, and the model can be accepted since the coefficients of variables in all cases were negative and statistically significant. The results implied that all the variables included in the models were integrated of order one, I (1). Thus, with the establishment of the order of integration, the study proceeded to testing for long-run relationship by employing Johansen approach to test co-integration. However, before applying this test, the researcher needs to determine first the appropriate lag length, and check the stability of the VECM since Johansen's co-integration test and thus VECM are very sensitive to lag length determination.

Model I

5.3 Optimum lag length

In the Johansen approach, the first step in testing for co integration and estimating a VECM model is to determine the optimal lag length of the VECM (Alemayehu *et al*, 2009). Johansen co-integration analysis is very sensitive to the number of lags included in the model, the more lags we include, the more initial values we lose. If we include too few lags, the size of the test will be incorrect (Wooldridge, 2000). The stability of VECM is shown in Appendix (1) that the VECM is stable. The optimal lag order is determined with sequential modified Likelihood Ratio test statistics (LR), the Final Prediction Error (FPE), the Akaiki Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). Lag that provides the minimum value is chosen as the optimal lag length that means, among the IC that provides majority lag has been chosen as optimal lag length. While, checking up to three lag orders to include the 5% significance level suggest that lag 1 would be the optimum lag length for multivariate model and this has been confirmed by LR, FPE, SC and HQ in both cases. The smaller the value of the information criteria, the better the model is. Thus, this study employs the optimal lag length of two for estimation techniques. Thus, the next step is to estimate Johansen test of co-integration VECM and Granger causality.

Table 5.3: VAR Lag Order Selection Criteria
Endogenous variables: LNRGDP LNOTH LNME LNGCF LNES LNSS LNTLF
Exogenous variables: C

Date: 04/20/19 Time: 01:46
Sample: 1 44
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-60.53297	NA	6.91e-08	3.376648	3.672202	3.483511
1	234.2521	471.6560*	3.30e-13*	-8.912603	-6.548172*	-8.057699*
2	277.7257	54.34208	5.48e-13	-8.636286	-4.202978	-7.033342
3	347.2483	62.57033	3.91e-13	-9.662416*	-3.160230	-7.311430

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

5.4 Johansen Co-Integration Test for Long Run Relationship

The existence of the same order of integration, therefore, allows us to test for Co-integration among the variables. To determine the number of co integrating vectors two test statistics called the maximum Eigen value (λmax) and trace statistics (λtrace) are computed. The trace test tests the null hypothesis of r co integrating vectors against the alternative hypothesis of k co integrating vectors, where k is the number of endogenous variables, for r =0,1,2…,k-1. The maximum Eigen-value test, on the other hand, tests the null hypothesis of r co integrating vectors against the alternative hypothesis of r+1 co integrating vectors.

It can be seen from table 5.4 that the unrestricted co-integration rank tests (both trace statistics (λ trace) and maximum Eigen value (λmax) show the existence of one co-integrating vectors in the system. This means, the null hypothesis of no co-integration is rejected by both the λ max and the λ trace statistics. If the test statistics is greater than the critical values, the null hypothesis that there exists r co-integrating vectors against the alternative hypothesis that there are r+1 (for λtrace) or more than r (for λmax) is rejected. Thus, both λ trace and maximum Eigen value (λmax) conclude that there is one co integrating vector among the variables and there is only one Eigen value significant at 1% level and this outcome determines that the rank of the co integration is unity. It can be conclude that among the variables there is one long run relationship. The result of testing the number of co-integrating vectors is shown in table 5.4.1 and table

Table 5.4: Johansen co integration

Date: 04/20/19 Time: 02:00
Sample (adjusted): 3 43
Included observations: 41 after adjustments
Trend assumption: Linear deterministic trend
Series: LNRGDP LNOTH LNME LNGCF LNES LNSS
LNTLF
Lags interval (in first differences): 1 to 1

Table 5.4.1: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.682201	140.3497	125.6154	0.0046
At most 1	0.589900	93.34992	95.75366	0.0724
At most 2	0.372325	56.80436	69.81889	0.3464
At most 3	0.306108	37.70931	47.85613	0.3148
At most 4	0.271666	22.72633	29.79707	0.2598
At most 5	0.196607	9.729492	15.49471	0.3021
At most 6	0.018225	0.754134	3.841466	0.3852

Trace 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

Table 5.4.2: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.682201	46.99975	46.23142	0.0413
At most 1	0.589900	36.54556	40.07757	0.1186
At most 2	0.372325	19.09506	33.87687	0.8161
At most 3	0.306108	14.98297	27.58434	0.7496
At most 4	0.271666	12.99684	21.13162	0.4525
At most 5	0.196607	8.975358	14.26460	0.2882
At most 6	0.018225	0.754134	3.841466	0.3852

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

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNRGDP	LNOTH	LNME	LNGCF	LNES	LNSS	LNTLF
-3.888533	-1.365184	-1.234295	2.202071	2.188231	1.658328	0.440379
-4.613411	2.612508	3.233934	4.447985	1.902440	-0.882965	-21.61107
-3.075184	-0.187300	-0.207013	4.112572	-2.280746	0.017534	19.44802
0.035615	0.863961	3.405609	-3.777140	0.426099	1.957759	-15.87483

-3.095699	-1.910791	2.236281	-3.837186	1.143444	2.622817	-0.510557
0.377920	-1.110308	1.570105	1.847962	0.126586	-3.610338	9.973297
-0.650260	0.952262	0.899922	-6.835676	2.653864	1.036397	-8.105294

Unrestricted Adjustment Coefficients (alpha):

D(LNRGDP)	0.052388	-0.025926	0.004834	-0.004279	-8.42E-06	0.011160	0.002326
D(LNOTH)	-0.069027	-0.138817	-0.073816	-0.062605	0.120804	-0.017790	-0.022037
D(LNME)	0.086562	-0.003883	-0.016999	-0.030974	-0.035369	-0.038690	-0.007845
D(LNGCF)	-0.011478	-0.027677	-0.031376	0.062647	-0.054546	0.019021	-0.009207
D(LNES)	-0.058328	-0.048727	0.072865	-0.039790	-0.042014	0.054382	-0.011856
D(LNSS)	0.047919	0.056375	-0.035895	-0.034776	0.002530	0.065091	-0.008310
D(LNTLF)	0.004135	0.001111	0.002329	0.001162	-0.000345	0.000202	-0.000511

1 Cointegrating Equation(s): Log likelihood 238.8906

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNOTH	LNME	LNGCF	LNES	LNSS	LNTLF
1.000000	0.351079	0.327419	-0.566299	-0.562740	-0.426466	-0.113251
	(0.12110)	(0.16173)	(0.32493)	(0.13121)	(0.15685)	(1.08438)

Source: Own Computation (2019)

Both the maximum Eigen Value and trace statistic confirmed that the variable is cointegrated of at most one. Table 5.4 reports that the null of no co-integration vector is rejected by both trace statistics and maximum Eigen value at 1% and 5% significance level respectively. On the other hand, one co-integration vector is not rejected by tests, the researcher can concluded that there exists only one co-integration vector, and thus there exists meaningful long run relationship between the economic growth and military expenditure, economic service expenditure, social service expenditure, other service expenditure, gross capital formation and total labor force.

In addition to this, the existence of one co integrating vector indicates that the first row of β coefficient and the first column of α vectors are important for further analysis. Thus, table 5.4.3 and table 5.4.4 below reports β and α vector respectively.

Table 5.4.3: Standard beta (β) coefficient/ Long-Run Co-integrating Vectors (Linearised)

1 Cointegrating Equation(s):	Log likelihood	238.8906

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNOTH	LNME	LNGCF	LNES	LNSS	LNTLF
1.000000	0.351079	0.327419	-0.566299	-0.562740	-0.426466	-0.113251
	(0.12110)	(0.16173)	(0.32493)	(0.13121)	(0.15685)	(1.08438)

Note: Since the table is not in equation form, the real sign of the coefficients are changed as,

LNRGDP=-0.351079LNOTH-0.327419LNME+0.566299LNGCF+0.562740LNES+0.426466LNSS+0.113225LNTLF

As it is presented in table 5.4.3, the long run Cointegrating vector indicates that LNRGDP, LNOTH, LNME, LNGCF, LNES, LNSS and LNTLF have registered the expected sign and statistically significant. Although LNGCF and LNTLF registered the expected sign, it is not statistically significant. A 1% change in LNOTH, LNME,LNGCF, LNES, LNSS and LNTLF will result in 0.35%, 0.327% decrease in LNRGDP where as 0.56%, 0.56%, 0.42% and 0.11% increase in LNRGDP respectively.

The result of the expected sign of military expenditure on economic growth of Ethiopia is similar with the study of Lim (1983), Degree and Sen (1983), Faini *et al.* (1984), Taylor (1984) Raster and Thomson (1988), Smith (1980) Fiani, Dunne and Vougas (1999), Bader and Qarn (2003), Deger (1986), Deger and Smith (1983) and Lebovic and Ishaq (1987) that found negative relation between the two variables. More recently, Klein (2004) studied the data on Peru and found negative effect of military expenditure on economic growth, indicating the existence of crowding-out effect.

5.5 Granger Causality Test/Long Run Causality (VECM)

The dynamic relationship is the simplest technique use to examine the cause and effect relationship between variables in system and it is applied in the context of the simple linear regression model. However, the simple linear regression model fails to capture the underlying dynamic causality between variables which is efficiently analyzed by Granger (1969) in terms of the Granger causality tests. To investigate further the dynamic relationship between the variable, the researcher employed Granger causality test using the VECM model. The concept behind of this test is that to find out whether changes in one variable cause the other to change. In order to infer the direction of causation between two variables, the granger causality test analysis must make sense. The following table shows Granger causality test for military expenditure and economic growth in Ethiopia.

Table 5.5: Pairwise Granger Causality Tests for VECM Model

Pairwise Granger Causality Tests
Date: 04/20/19 Time: 14:49
Sample: 1 44
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNOTH does not Granger Cause LNRGDP	43	0.33243	0.5675
LNRGDP does not Granger Cause LNOTH		12.3290	0.0011
LNME does not Granger Cause LNRGDP	43	3.05313	0.0883
LNRGDP does not Granger Cause LNME		13.8912	0.0006
LNGCF does not Granger Cause LNRGDP	43	1.49593	0.2285
LNRGDP does not Granger Cause LNGCF		12.3311	0.0011
LNES does not Granger Cause LNRGDP	43	2.50664	0.1214
LNRGDP does not Granger Cause LNES		2.65809	0.1111
LNSS does not Granger Cause LNRGDP	43	0.05581	0.8145
LNRGDP does not Granger Cause LNSS		8.20057	0.0067
LNTLF does not Granger Cause LNRGDP	43	1.59217	0.2143
LNRGDP does not Granger Cause LNTLF		0.21462	0.6457

Source: Own Computation (2019)

From the table above, the null hypothesis is reject that LNRGDP does not Granger Cause LNME, but fail to reject the null hypothesis that LNME does not Granger Cause LNRGDP. Therefore it is shown that granger causality runs one way from LNGDP to LNME and not vice versa. Thus, in the long run the granger causality is unidirectional from economic growth to military expenditure, implies that it is not viable to depend on spending on military alone to promote economic growth and the government can implement to minimize the amount of spending on military without compromising economic growth in the long run.

This study supported with the studies of Anwar, Rafique and Joiya (2012) who examined the defense spending and its linkages with economic growth in Pakistan. The study applied Johansen cointegration method and causality analysis and it was concluded by the study that military expenditure and economic growth are cointegrated, and causality runs from economic growth to defense spending. Pradhan (2010a) used Johansen cointegration test and Pedroni (2004) cointegration test, finding long-run unidirectional causality from economic growth to defense spending in Indonesia, Malaysia, Singapore and Thailand, Safdari et al. (2011), using Pesaran et al. (2001) and Toda and Yamamoto (1995) approaches for a panel of South Korea, Malaysia, Iran and Saudi Arabia over the period 1988-2006, unidirectional relationship from growth to defense spending obtained in South Korea. Karagianni and Pempetzoglu (2009) ran both linear and nonlinear Granger causality tests to investigate defense-growth relationship for Turkey over the period 1949-2004 and linear Granger causality test implied a unidirectional relationship from economic growth to defense spending. Al-Jarrah (2005) found a causality between defense spending and economic growth and unidirectional causality running from non-oil economic growth to defense spending.

5.6 Short Run Vector Error Correction Model

If two series are integrated of order one, i.e, I (1) then it can be easy to model their relationship by taking first difference of each series and including the difference in VECM. From the Johansen test of cointegration of table 5.4.1 and 5.4.2, it is known that there exists a long-term equilibrium relationship between variables with real GDP, so after identifying the existence of long-run relationship among the relevant variables, the vector error correction model is estimated in order to evaluate the short run properties of co-integrated series. The VEC has co-integration relations built into the specification so that it restricts the long run behavior of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics (Harris, 1995). The co-integration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The error correction terms lagged one period is shown in table (5.6). First estimating the short run impact of LNOTH, LNME, LNGCF, LNES, LNSS and LNTLF on growth in real GDP is done. In the estimation of the dynamic short-run model, a three period autoregressive distributed lag as determined by the information criterion and imposed on all variables. Table 5.6 shows the parameters coefficient estimation of ECM (i.e., dynamic short run model). The result from the following table (5.6) shows that, in the short run only the one year lagged value of LNRGDP, LNOTH and LNSS are significant in affecting current growth in real GDP whereas LNGCF, LNES, LNTLF and LNME are not statistical significance in affecting growth in real GDP.

The capital is insignificant in both short run and long run, result may be due to the fact that benefits from capital accumulations (both private and public) are not ensured in the short period of time and may have crowding out effect on growth, and it may also due to small capital accumulation in the country. The additional justification may be due to the macro economic instability like inflation and thus no one is willing to invest and thus accumulate the capital as inline with Belay (2015). Unlike in the long run the coefficient of total labor force in the short run is negative. In both short run and long run the total labor is insignificant This is may be due to labor tends to be abundant and relatively cheaper and thus the existence of hidden unemployment in the sector. Hence, additional labor may reduce the industrial value added. The result shows that 1% growth in LNTLF of the lagged one year decreases the current economic growth by 2.63%, on average.

Table 5.6: Estimation of Vector Error Correction Model

Dependent Variable: D(LNRGDP)
Method: Least Squares
Date: 04/20/19   Time: 15:55
Sample (adjusted): 3 44
Included observations: 42 after adjustments
D(LNRGDP) = C(1)*(LNRGDP(-1) + 0.351079407447*LNOTH(-1) +
0.317419276168*LNME(-1) - 0.566298755352*LNGCF(-1) -
0.562739640541*LNES(-1) - 0.42646636294*LNSS(-1) -
0.113250565244*LNTLF(-1) - 0.915999744265) +
C(2)*D(LNRGDP(
-1)) + C(3)*D(LNOTH(-1)) + C(4)*D(LNME(-1)) +
C(5)*D(LNGCF(-1)) +
C(6)*D(LNES(-1)) + C(7)*D(LNSS(-1)) + C(8)*D(LNTLF(-1)) +
C(9)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1) = CoinEq1	-0.203711	0.04050	-5.03013	0.0000
C(2) = LNRGDP(-1)	0.498139	0.123490	4.033845	0.0003
C(3) = LNOTH(-1)	0.070563	0.03336	2.11500	0.0198
C(4) = LNME(-1)	-0.045561	0.059694	-0.763240	0.4507
C(5) = LNGCF(-1)	-0.060823	0.054421	-1.117640	0.2718
C(6) = LNES(-1)	0.031005	0.040527	0.765049	0.4497
C(7) = LNSS(-1)	-0.222821	0.053235	-4.185589	0.0002
C(8) = LNTLF(-1)	-2.631474	1.631384	-1.613032	0.1163
C(9) = Constant	0.178270	0.047453	3.756737	0.0007

R-squared	0.650337	Mean dependent var	0.131707
Adjusted R-squared	0.540722	S.D. dependent var	0.100856
S.E. of regression	0.068350	Akaike info criterion	-2.340941
Sum squared resid	0.154167	Schwarz criterion	-1.968583
Log likelihood	58.15976	Hannan-Quinn criter.	-2.204457
F-statistic	7.033813	Durbin-Watson stat	2.222305
Prob(F-statistic)	0.000022		

Normality test: Jarque-Bera: 0.117036; probability: 0.943161

Serial correlation test: Obs*R-squared: 1.723731 probability: 0.1892

Heteroskedasticity test: Obs*R-squared: 18.98058 probability: 0.1657

Source: Own computation (2019)

Since Durbin-Watson stat is greater than R-squared we accept the model. Speed of adjustment towards long run equilibrium but it must be significant and the sign must be negative. The coefficient of error correction model depicts that there is long run causality running from independent variables to LNRGDP.

The speed of adjustment or the error correction term (ECT) from the above model is represented by C (1) and come up with the expected sign and level of significance. In an empirical sense, it implies 20.37% of the disturbance in the short run is corrected each year or it adjusts any disequilibrium towards long run equilibrium state path or it indicates that 20.37 % of the disequilibrium from the long run path will be correcting in one year. When a shock occurs in the system each year, about 20.37 % of it will be adjusted towards its long-run equilibrium. The coefficient indicates that there is low correction for divergence of LNRGDP from equilibrium, implying economic agents taking past experience they correct about 20.37 per cent of errors in one year and the remaining 79.63% in the after four year, and imply a low speed of adjustment to equilibrium. According to Bannerjee *et al*. (2003) as cited in Kidanemarim (2014), the highly significant error correction term further confirms the existence of a stable long-run relationship. Moreover, the coefficient of the error term (ECM-1) implies that the deviation from long run equilibrium level of real GDP in the current period is corrected by 20.37 % after period to bring back equilibrium when there is a shock to a steady state relationship.

R^2 is 0.650337 which indicate that the fitted value explain the model well, indicates 65.0337% of the growth in real GDP is explained by the variables included in the regression. The F test which shows the jointly significant indicate that the variables are jointly significant at 5 per cent level of significance. Moreover, the overall significance of (F-test) established all variables are jointly significant.

However; measuring the statistical significance of two independent variables jointly would be very important in order to clearly say whether two independent variables at a given lag length are jointly significant or not. To do this, Wald test of coefficient restriction is examined with null hypothesis of two coefficients can't jointly influence dependent variable, against the alternative hypothesis of joint influence dependent variable. The following table shows Wald test of coefficient restriction.

Table 5.7: Wald coefficient Restriction

Wald-coefficient restriction	Year effect	Chi-square	Prob (chi2)
C (2) =C (3) =0	1	19.51907	0.0001***
C (3) =C (4) =0	1	1.927190	0.3815
C (4) =C (5) =0	1	1.817554	0.4030
C (5) =C (6) =0	1	1.611322	0.4468
C (6) =C (7) =0	1	17.56684	0.0002***
C (7) =C (8) =0	1	19.60899	0.0001***

Source: Own computation (2019)

Note: *** indicates statistical significance at 1%

Performing the joint significance of coefficients provided that the coefficients for growth in real GDP and LNOTH, LNES and LNSS, LNSS and LNTLF at lagged year one jointly affect economic growth for the period under investigation. It can be seen the joint impact doesn't come from the growth in LNOTH and LNME, and LNME and LNGCF, and LNGCF and LNES for the period under investigation. Furthermore, this study was applied Wald tests on the various null hypothesis involving sets of regression coefficients. The results are shown in table 5.7. The P-value indicates that we reject the null hypothesis that regression coefficients of all the variables in the LNRGDP equation are equal to zero. The null hypothesis that regression coefficients in each equation are equal to zero is also rejected as shown by the p-values. Thus, it indicates that all variables are jointly affects RGDP.

Table 5.8: Wald Coefficient Test

Test Statistic	Value	df	Probability
F-statistic	5.726045	(6, 33)	0.0004
Chi-square	34.35627	6	0.0000

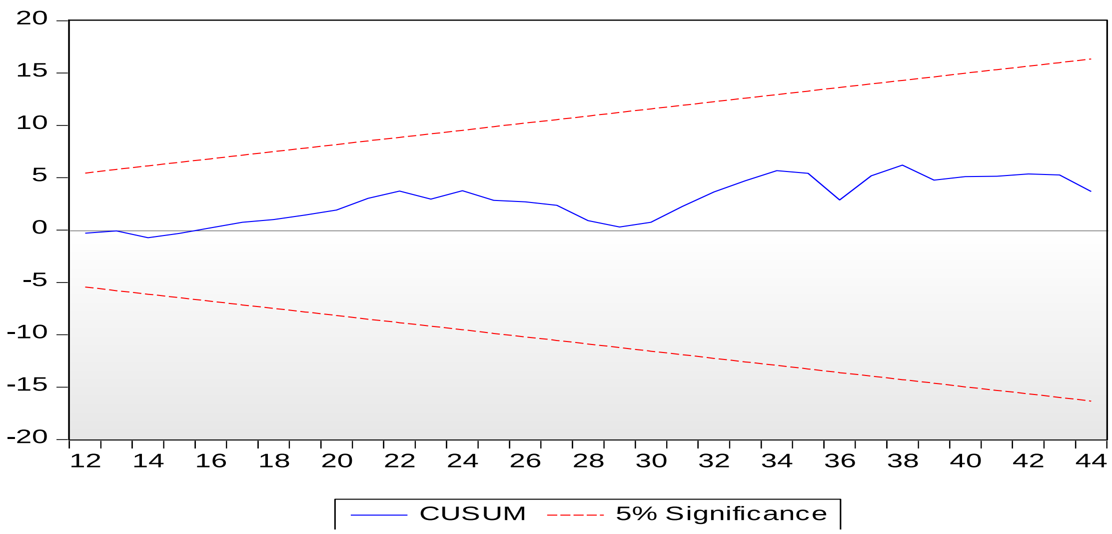
Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2) - C(8)	3.129613	1.647582
C(3) - C(8)	2.661287	1.624845
C(4) - C(8)	2.585913	1.658966
C(5) - C(8)	2.570651	1.631110
C(6) - C(8)	2.662479	1.634214
C(7) - C(8)	2.408653	1.630108

Restrictions are linear in coefficients.

Furthermore, in order to strength the analysis, the stability of the estimated parameters in the model is examined using stability test of Recursive residuals. The stability of the model is checked using CUSUM method and the graph that shows the result is presented as follows. The following figure affirms that the coefficients of the model are stable over a sample interval.

Figure 5.1: Parameter Stability Test VECM: Recursive Estimates (OLS only)



5.7 Diagnostic tests

The Diagnostics test was also employed for VECM to detect model misspecification and as a guide for model improvement. These tests include serial correlation, heteroscedasticity and normality tests. The serial correlation test can be done using Breusch-Godfrey Serial Correlation LM Test to investigate serial correlation, which helps to identify the relationship that may exist between the current value of the regression residuals and lagged values. The null-hypothesis of the LM test that the residuals are not serially correlated is accepted at 5% level of significance (see appendix 1). The Jarque-Bera normality test is used to see whether the regression errors are normally distributed. The null-hypothesis that the residuals are normal is accepted (Appendix 1). The hetreroscedasticity test helps to identify whether the variances of the errors in the model are constant or not. The null-hypothesis of the test is that the errors are homoscedastic was accepted and independent of the regressors'. The null hypothesis that the residuals are homoscedastic is accepted at 5% significance level. This indeed is not surprising, since heteroskedasticity is not much problem in time series (Green, 2003), (Appendix 1).

5.8 Short Run Granger Causality Wald Test: Vector Error Correction Model

As long as, the error correction term has negative sign and got statistical significance that we can test the short run causality between military expenditure and economic growth. To examine the short run causality the researcher uses the technique of Wald coefficient restriction. Table 5.9 shows the result of the tests.

Table 5.9: VEC Granger causality Wald test result

Dependent
variables
LNRGDP

Test Statistic	Value	Df	Probability
t-statistic	-0.763240	33	0.4507
F-statistic	0.582535	(1, 33)	0.4507
Chi-square	0.582535	1	0.4453

Null Hypothesis: C(4)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.045561	0.059694

Restrictions are linear in coefficients.

Source: Own computation (2019)

There is no short run causality running from military expenditure to LNRGDP because the probability of Chi-Square is greater than 5% level of significance, thus the researcher accepts the null hypothesis that says there is no short run causality running from military expenditure to LNRGDP. In the table 5.9 where RGDP is dependent variable the null hypothesis military expenditure does not Granger cause economic growth and the alterative hypothesis is military expenditure Granger cause economic growth. From the table it shown that the P value is 0.4453, which is higher than 5% and based on the "P-value" the researcher tends to accept H0. That is, military expenditure does not granger cause economic growth in the short run.

Table 5.10: Vector error Correction joint model Granger Causality Test

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/21/19 Time: 01:41
Sample: 1 44
Included observations: 41

Dependent variable: D(LNRGDP)

Excluded	Chi-sq	Df	Prob.
D(LNOTH)	4.473239	1	0.0344
D(LNME)	0.539392	1	0.4627
D(LNGCF)	0.800671	1	0.3709
D(LNES)	0.239777	1	0.6244
D(LNSS)	20.74575	1	0.0000
D(LNTLF)	3.447748	1	0.0633
All	28.40113	6	0.0001

Dependent variable: D(LNME)

Excluded	Chi-sq	Df	Prob.
D(LNRGDP)	13.8912	1	0.0006
D(LNOTH)	0.028953	1	0.8649

D(LNGCF)	0.123167	1	0.7256
D(LNES)	0.698162	1	0.4034
D(LNSS)	0.089681	1	0.7646
D(LNTLF)	13.51943	1	0.0002
All	14.84073	6	0.0215

Source: Own computation (2019)

Here also we can induce that there is short run causality running from LNOTH, LNME, LNGCF, LNES, LNSS and LNTLF to LNRGDP.

The result of table 5.10 shows whether independent variable jointly has short run causality or not. The short-run causality is determined by the F-statistics on the explanatory variables, based on the Wald Test or the Variable Deletion Test. However, the long-run causality is confirmed by the error-correction term (ECMt-1) in the same function, which is both negative and statistically significant. Table 5.10 where GDP is dependent variable the null hypothesis military expenditure with other explanatory variables does not Granger cause economic growth and the alterative hypothesis is that military expenditure with other explanatory variables does Granger cause economic growth. From the table it shown that the joint P value is 0.0001 and thus, the researcher accepts H1. That is, military expenditure does not granger causes economic growth in short run. Similarly, when military expenditure is dependent variable and with the null hypothesis GDP with other explanatory variables Granger causes military expenditure and the alternative hypothesis that GDP with other explanatory variables does Granger causes military expenditure. The joint "P-value" is 0.0215 and accordingly we reject the null hypothesis and thus the researcher accepts the alterative

That is in the long run the result support the growth-led military expenditure where causality running from economic growth to military expenditure, indicating that economic development to take first over military expenditure and that economic growth caused high demand for military expenditure. The results further show that there is: unidirectional causality running from economic growth to military expenditure in the long run; unidirectional Granger-causality flowing from economic growth to other service expenditure in the long run; unidirectional causality running from Economic growth to social service expenditure in long run; unidirectional causality running from economic growth to Gross capital formation to in long run; unidirectional causality running from military expenditure to other service expenditure in long run; unidirectional causality running from social service expenditure to other service expenditure; unidirectional causality running from total labor force to other service expenditure; gross capital formation to other service expenditure; economic service expenditure to military expenditure; social service expenditure to military expenditure; gross capital formation to military expenditure; economic service expenditure to social service expenditure; total labor force to economic service expenditure; economic service expenditure to gross capital formation and social service expenditure to gross capital formation.

5.9 Test of Volatility: Impulse response and variance decomposition

Impulse response is a method of assessing the interaction among the variables in the VECM. It can be used either to assess the dynamic behavior of the VECM to investigate the policy impact of the variables that constitute the VECM (Alemayehu, 2009). The coefficients of VECM models only show the direct or ceteris paribus effect. They do not consider the lagged explanatory variables in each equation are interlinked. That is both with the lag and contemporaneously and thus does not reflect the full impact of one variable on the other. Due to this, the analysis relies to a great extent on impulse response functions to estimate the total short and long run increase in military expenditure on economic growth. In sum, impulse response shows how one variable, say economic growth responds over time to a shock in another variable (say military expenditure) and compares this response to shocks from other variables. Impulse response only traces out the time path of the effects of shocks of other variables contained in the VECM model on a specific variable (Belay, 2015). On the other hand, this method is designed to determine how each variable responds over time to an earlier shock in that variable and to shocks in other variables (Belay, 2015). The variance decomposition helps in identifying the degree to which one variable influences the other.

In this study variance decomposition was used to break down and ascertain the degree to which military expenditure influence other variable in the system and vice versa. To make it clear, variance decompositions show the portion (or relative importance) of variance in the prediction for each variable in the system that is attributable to its own innovations and to shocks to other variables in the system. Enders in Shan *et al.* (2006) as cited in Belay (2015) proposed that the forecast-error variance decomposition permits inferences to be drawn concerning the proportion of the movements in a particular time-series due to its own earlier shocks vis-a-vis shocks arising from other variables in a VECM model. The technique breaks down the variance of the forecast error for each variance following a shock to a particular variable, and thus, it identifies which variables are strongly affected and those that are not.

5.9.1 Impulse Response of VECM model

Impulse response function help us to trace the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. We can identify the positive or negative impact of the variables and determine how long it would take for that effect to work. It is a method of assessing the interaction among the variables in the VECM. This study used the generalized impulse response function; the reason is it does not require orthogonalization of innovations and is invariant of the ordering of the variables in VECM. Table 5.11.1 indicates the following results. In response to a one standard deviation disturbance output (LNRGDP) itself future output increase by 0.066687 in the first year and it increases in second year and consequently in third year and it continues increase up to tenth year but it never die out in the long run and reaches 0.169596 at the 10th year. A one standard deviation disturbance originating from capital results in an approximately -0.002694 percent decrease in output in first year and it increase to 0.007339 in the 3rd year and it does not die out in the time horizon and consequently it reaches 0.111732 at the 10th year. A one standard deviation disturbance originating from labor results in an approximately 0.002105 increase in output in first year and it never dies out in the long run and consequently it reaches 0.057832at the 10th year. The result shows the impact of capital and labor is permanent. A one standard deviation disturbance originating from LNME produces a -0.005230 decrease in LNRGDP in the first year. Its effect continues to fall as the forecast horizon is extended and reaches -0.152013 at the 10th year. LNME has no permanent impact on RGDP, and its effect die out. In other words, military expenditure has no a long- run impact on economic growth which is in line with the above findings. The impact of LNES, LNSS, LNGCF and LNTLF are permanent. The conspicuous result is the disturbance originating from military expenditure except in the first year is negative (although it is small in magnitude) suggesting that military expenditure negatively impacts on economic growth. The negative relationship between military expenditure and economic growth implies that expenditure that was spending on military is unproductive in the country.

Table 5.11: Generalized Impulse Response of VECM model

Table 5.11.1: Impulse Response of LNRGDP

: Period	LNRGDP	LNME	LNOTH	LNGCF	LNES	LNSS	LNTLF
1	0.066687	-0.005230	0.001510	-0.002694	0.018437	0.007692	0.002105
2	0.091832	-0.025847	-0.000393	0.007339	0.043695	-0.013505	-0.010011
3	0.108730	-0.058916	-0.028725	0.037514	0.069807	0.009656	0.017490
4	0.121392	-0.076340	-0.018043	0.047395	0.091181	0.013984	0.019878
5	0.132795	-0.098133	-0.047478	0.072126	0.112499	0.029079	0.038286
6	0.142672	-0.110450	-0.031435	0.077951	0.126595	0.032425	0.037547
7	0.152032	-0.127410	-0.059879	0.096370	0.142223	0.043163	0.052528
8	0.158731	-0.135054	-0.040444	0.097855	0.150999	0.043529	0.049445
9	0.165303	-0.148094	-0.068849	0.113282	0.162722	0.052808	0.063108
10	0.169596	-0.152013	-0.046575	0.111732	0.168097	0.051424	0.057832

Table 5.11.2: Impulse Response of LNME

Period	LNRGDP	LNME	LNOTH	LNGCF	LNES	LNSS	LNTLF
1	0.013470	0.171746	0.015179	0.013052	-0.007092	-0.016245	0.027425
2	0.027774	0.210676	-0.006073	0.064226	0.033749	0.010267	-0.025443
3	0.005550	0.173255	-0.029735	0.110933	0.078039	0.050067	-0.014556
4	0.041352	0.140725	-0.016131	0.114898	0.098390	0.042996	-0.019982
5	0.061129	0.111467	-0.041702	0.129081	0.114427	0.046138	-0.001330
6	0.068437	0.098833	-0.028467	0.133111	0.126556	0.047184	0.002322
7	0.073908	0.084282	-0.055930	0.152732	0.142717	0.060035	0.018414
8	0.079511	0.077227	-0.039159	0.156981	0.153123	0.063118	0.016113
9	0.086760	0.064106	-0.065381	0.172507	0.165421	0.072604	0.028532
10	0.092023	0.059124	-0.045320	0.171606	0.171218	0.071389	0.023920

Source: Own computation (2019)

Table (5.11.2) presents the accumulated response of LNME. In response to one standard deviation shock of LNME, LNME itself increases by 0.171746 in the first year and continues to increases in the second year but starts to fall from the third and it reaches 0.059124 in 10th period. A one standard deviation disturbance originating from LNRGDP produces a 0.013470 increase in LNME in the first year and its effect continues to grow and reaches 0.092023 at the 10th year. Hence, LNRGDP has a significant impact on LNME implying that economic growth has a long-run impact on military expenditure. In other words, the empirical results indicated that the response of military expenditure to economic growth negatively while the response of economic growth to military expenditure is positively affected.

5.9.2 Variance Decomposition of VECM model

The impulse response functions trace the effect of a shock to one endogenous variable on the other variables in the VECM whereas variance decomposition separates the variation in an endogenous variable into the component shocks to the VECM. The relative importance of each random innovation in affecting the variables in the VECM can be seen by the variance decomposition results. It highlights the proportion of the movements in the dependent variables that are results of their own shocks, against shocks from the other variables. Table 5.11.1 reports the results of the variance decomposition of output growth in Ethiopia within a 10-period horizon. The researcher limited the discussion on the relative importance of endogenous variables in explaining the variation in LNRGDP and LNME; thus, the researcher only decomposes the forecast error variance on LNRGDP and LNME. In table below (table 5.12.1), the variance estimates indicated that a greater proportion of the variation in LNRGDP is due to its own innovations. The variation due to the other variables is smaller. The other five variables together explain approximately 15.05342 of the future (second year) variation in GDP growth in Ethiopia. The remaining 84.94658% are due to changes in GDP growth itself on the 2nd period and at the RGDP consists 44.70423% period under investigation while other explanatory variables together consisted 55.29577%. When it is looked at the partial effect of factor inputs, LNOTH (3.376326%) as percent of LNRGDP has the highest effect on GDP growth followed by LNGCF (14.38078%) and LNME (3.256825%), LNES (10.12610%) and 23.36413%, 0.791609% due to LNSS and LNTLF respectively. 3.256825%, of future changes in GDP are due to changes in LNME, showing it has less important impact on future growth rate of output in Ethiopia. Military has less important compared to GCF, LNES, LNSS, and OTH. Abu-Qarn (2010) studied the effects of defense spending on economic growth in Israel and its Arab rivals of Egypt, Syria and Jordan for the 1960-2004 period using Toda and Yamamoto (1995) approach and generalized variance decomposition, finding weak causality from defense spending to economic growth or no causality. As it can be seen from the table 5.12.1 the response of output growth to shocks coming from military expenditure input is slow during the first periods and its full effect on output continues to over time horizon and it has permanent effect. LNGCF, LNOTH, LNES, LNSS and LNTLF have permanent effects over all period. The relatively low level contribution of military to economic growth for Ethiopia may be suggest that the causal relationship between military expenditure and economic growth is relatively weak when compared to either capital or other expenditure. The low economic performance of the country reinforces expenditure for military.

The finding evidence shows that LNGCF, LNOTH, LNSS, LNES and LNME may be relatively more important input than labor in Ethiopia in the long run. This may be due to the fact that in Ethiopia, labor tends to be abundant and relatively cheaper.

Table 5.12: Variance Decomposition position

Table 5.12.1: Variance Decomposition position of LNRGDP

Period	S.E.	LNRGDP	LNME	LNTLF	LNOTH	LNSS	LNGCF	LNES
1	0.066687	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.123137	84.94658	1.100303	3.506233	0.102595	2.374642	1.953928	6.015714
3	0.182624	74.06671	1.093275	1.651275	2.440008	8.769829	5.540649	6.438251
4	0.242558	67.03297	1.057797	0.940812	1.883511	13.14825	7.842414	8.094252
5	0.309868	59.43983	1.859951	0.689440	3.195986	16.23128	9.966319	8.617192
6	0.374497	55.20813	2.052651	0.588032	2.760222	18.60683	11.44576	9.338373
7	0.443788	51.05001	2.619483	0.643039	3.497350	20.18282	12.49559	9.511713
8	0.508342	48.65778	2.761232	0.659862	3.160263	21.58171	13.31043	9.868727
9	0.575762	46.17236	3.164337	0.753964	3.641291	22.48142	13.87902	9.907615
10	0.637753	44.70423	3.256825	0.791609	3.376326	23.36413	14.38078	10.12610

Table 5.12.2: Variance Decomposition of LNME

: Period	S.E.	LNRGDP	LNME	LNTLF	LNOTH	LNSS	LNGCF	LNES
1	0.171746	0.615104	99.38490	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.296978	1.080364	82.83322	4.001399	2.060513	2.180196	3.482044	4.362265
3	0.383040	0.670422	70.48175	3.705417	3.717654	5.413741	8.759766	7.251247
4	0.445869	1.354962	62.50824	3.771764	3.745080	5.931265	12.68042	10.00827
5	0.498534	2.587317	55.47121	3.221387	4.571495	6.176159	15.97936	11.99307
6	0.545478	3.735237	50.00598	2.788786	4.535764	6.227520	18.79955	13.90717
7	0.594154	4.695605	44.46078	2.351113	5.146739	6.551369	21.39967	15.39472
8	0.640692	5.578382	39.94398	2.021967	5.053437	6.760722	23.76855	16.87296
9	0.689451	6.400822	35.55828	1.789843	5.483931	7.066087	25.77750	17.92354
10	0.734905	7.201450	32.11566	1.595054	5.343995	7.191380	27.55995	18.99250

Source: Own computation (2019)

On the other hand table (5.12.2) shows the variance decomposition result for LNME. The variance estimate result shows that high variation in LNME is due to LNME itself and it explains 32.11566% of future changes in LNME.

Model II

5.10 Inflation as a moderator variable

Table 5.13 for model II**:** VAR Lag Order Selection Criteria for INFL
Endogenous variables: LNRGDP LNGCF LAB*INF INFL GCF*INF LNTLF ME ME*INFL
Exogenous variables: C
Date: 05/15/19 Time: 05:27
Sample: 1 44
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-412.1421	NA	0.109898	20.49474	20.82909	20.61649
1	-134.8488	432.8480*	3.53e-06*	10.09019	13.09939*	11.18597*
2	-84.00318	59.52661	9.67e-06	10.73186	16.41591	12.80168
3	8.458968	72.16558	7.66e-06	9.343465*	17.70235	12.38731

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

Table14: Johansen Cointegration for II model

Sample (adjusted): 3 44
Included observations: 42 after adjustments
Trend assumption: Quadratic deterministic trend
Series: LNRGDP LNGCF LAB*INF INFL GCF*INF LNTLF ME ME*INFL
Lags interval (in first differences): 1 to 1

Table 5.14.1 for model II**:** Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.778517	193.1540	175.1715	0.0040
At most 1	0.524283	129.8427	139.2753	0.1555
At most 2	0.492796	98.63958	107.3466	0.1620
At most 3	0.460256	70.12821	79.34145	0.2018
At most 4	0.372959	44.22848	55.24578	0.3204
At most 5	0.303816	24.62528	35.01090	0.4060
At most 6	0.199580	9.415330	18.39771	0.5380

Trace 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

Table 5.14.2 for model II**:** Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.778517	63.31123	55.72819	0.0074
At most 1	0.524283	31.20317	49.58633	0.8595
At most 2	0.492796	28.51136	43.41977	0.7207
At most 3	0.460256	25.89973	37.16359	0.5237
At most 4	0.372959	19.60320	30.81507	0.5824
At most 5	0.303816	15.20995	24.25202	0.4795
At most 6	0.199580	9.349988	17.14769	0.4599

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNGCF	LAB*INF	INFL	GCF*INF	LNTLF	ME	ME*INFL
1.000000	-0.890005	-0.008250	0.201207	-0.008762	-2.213715	0.009643	-0.012906
	(0.07758)	(0.01563)	(0.08436)	(0.00400)	(1.13643)	(0.00436)	(0.00122)

Both the maximum Eigen Value and trace statistic confirmed that the variable is cointegrated of at most one. Table 5.14 reports that the null of no co-integration vector is rejected by both trace statistics and maximum Eigen value at 1% significance level. On the other hand, one co-integration vector is not rejected by tests, the researcher concluded that there exists only one co-integration vector, and thus there exists meaningful long run relationship between the economic growth and military expenditure, gross capital formation and total labor force.

As it is presented in table 5.14.3, the long run Cointegrating vector indicates that LNME*INFL registered expected sign and statistically significant. 1% change in LNME*INFL will result in 0.0125%, decrease in LNRGDP indirectly.

Table 5.15 model II: Short run vector error correction model for UNEM

Dependent Variable: D(LNRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/15/19 Time: 05:30
Sample (adjusted): 3 44
Included observations: 42 after adjustments
D(LNRGDP) = C(1)*(LNRGDP(-1) - 0.890005454882*LNGCF(-1)
-
0.008249551196*LAB_INF(-1) + 0.0102072526905*INFL(-1) -

0.00876218591781*GCF_INF(-1) + 2.21371518094*LNTLF(-1) +
0.00964319403823*ME(-1) - 0.0129055750263*ME*INFL(-1) - 39.2551068703) + C(2)
*D(LNRGDP(-1)) + C(3)*D(LNGCF(-1)) + C(4)*D(LAB*INF(-1)) + C(5)
*D(INFL(-1)) + C(6)*D(GCF*INF(-1)) + C(7)*D(LNTLF(-1)) + C(8)*D(ME(
-1)) + C(9)*D(ME*INFL(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.282685	0.090027	-3.140004	0.0037
C(2)	0.129679	0.207843	0.623931	0.5372
C(3)	-0.072203	0.098859	-0.730362	0.4707
C(4)	0.000472	0.010093	0.046811	0.9630
C(5)	0.086985	0.066925	1.299748	0.2033
C(6)	0.001738	0.001936	0.897580	0.3763
C(7)	-1.056341	1.414371	-0.746863	0.4608
C(8)	-0.001191	0.002957	-0.402658	0.6900
C(9)	-0.001849	0.000800	-2.310327	0.0277
C(10)	0.019571	0.037606	0.520422	0.6065

R-squared	0.548990	Mean dependent var	0.054237
Adjusted R-squared	0.403503	S.D. dependent var	0.062456
S.E. of regression	0.048237	Akaike info criterion	-3.005271
Sum squared resid	0.072130	Schwarz criterion	-2.550167
Log likelihood	74.11069	Hannan-Quinn criter.	-2.838457
F-statistic	3.773460	Durbin-Watson stat	2.143734
Prob(F-statistic)	0.002116		

Table 5.15 above indicates that the coefficient of inflation which was of interest under model in the Johansen Cointegration estimated was - 0.201207 with the corresponding t statistic of 2.3851 calculated as, (- 0.201207 / 0.08436) = -2.3851 in the long run. In the short run, the coefficient was 0.086985 with value of t statistics 0.086985/0.066925=1.299748 and the p-value was 0.2033 Therefore, the coefficient of inflation was insignificant in the short run rather than in the long run.

Table 5.15 above illustrated the introduction of inflation as a moderator. The coefficient of interest was the coefficient interaction term. The Johansen Cointegration estimated showed that coefficient of interaction terms for military expenditure and inflation was significant in the long run. The null hypothesis that inflation has no moderating effect in the relationship between military expenditure and economic growth in Ethiopia was rejected at the significance levels of 0.05 in the long run. For this reason, inflation has a moderating effect on the relationship between military expenditure and economic growth in Ethiopia. The sign (+ or -) of the interaction term in the long run was positive. Therefore inflation escalates the effect of military expenditures on economic growth in the long run. In the short run, the coefficients of the interaction term of military expenditure and inflation was also significant. The decision making criteria the null hypothesis (that inflation has no moderating effect in the relationship between military expenditure and economic growth in Ethiopia) was rejected at the level of significance of 0.05

This is in contrary to the empirical findings of Loizides and Vamvoukas (2005) who established that economic growth Granger causes increases in the relative size of government in the United Kingdom when in inflation is included in the model as a moderator variable and similar with Molonko(2013) government expenditure and sectoral economic growth in Kenya.

5.11 Unemployment as a moderator variable

Table 5.16 for model II VAR Lag Order
Selection Criteria for UNEM
Endogenous variables: LNRGDP LNGCF G*U LNTLF UNEM
L*U ME ME*UNEM
Exogenous variables: C
Date: 05/21/19 Time: 16:23
Sample: 1 40
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-266.7429	NA	0.000263	14.46015	14.80491	14.58282
1	-16.79538	381.4989*	1.59e-08*	4.673441*	7.776236*	5.777392*
2	45.25442	68.58136	2.82e-08	4.776083	10.63692	6.861323

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

Table 5.17: Johansen co integration for UNEM

Date: 05/21/19 Time: 16:25

Sample (adjusted): 3 40
Included observations: 38 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LNRGDP LNGCF GU LNTLF UNEM LU ME
ME*UNEM
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 1

Table 6.1 model II: Unrestricted Cointegration Rank Test (Trace) for UNEM

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.771485	196.8034	187.4701	0.0153
At most 1	0.693902	140.7097	150.5585	0.1568
At most 2	0.567636	95.72335	117.7082	0.5167
At most 3	0.465379	63.86082	88.80380	0.7394
At most 4	0.410675	40.06535	63.87610	0.8466
At most 5	0.295333	19.97179	42.91525	0.9611
At most 6	0.140070	6.670624	25.87211	0.9959
At most 7	0.024337	0.936241	12.51798	0.9994

Trace 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

Table 5.16.2 model II: Unrestricted Cointegration Rank Test (Maximum Eigenvalue) for UNEM

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.771485	56.09376	56.70519	0.0575
At most 1	0.693902	44.98634	50.59985	0.1704
At most 2	0.567636	31.86253	44.49720	0.5671
At most 3	0.465379	23.79547	38.33101	0.7543
At most 4	0.410675	20.09356	32.11832	0.6447
At most 5	0.295333	13.30116	25.82321	0.7802
At most 6	0.140070	5.734383	19.38704	0.9661
At most 7	0.024337	0.936241	12.51798	0.9994

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5.16.3 model II: Normalized cointegrating coefficients for UNEM

Cointegrating Equation(s): Log likelihood -10.19258

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNGCF	GCF*UNEM	LNTLF	TLF*UNEM	ME	ME*UNEM	UNEM
1.000000	-0.606340	-0.009546	-2.716178	-0.048515	0.014605	-0.070978	0.685270
	(0.07662)	(0.00205)	(1.06249)	(0.02636)	(0.00478)	(0.06978)	(0.20311)

Trace statistic confirmed that the variable is cointegrated of at most one. Table 5.16 reports that the null of no co-integration vector is rejected by trace statistics value at 1% significance level.

The unrestricted cointegration rank test (Maximum Eigenvalue) shows no co-integrating vectors in the system. Sporadically, the trace and the maximum Eigen value test statistics yield conflicting results. In such a case the trace statistics is more robust than the maximum Eigen value statistics in testing for co-integration (Luintel & Khan, 1999, and Roman, 2012). Hence, based on trace statistics result we can conclude that there exists meaningful long run relationship between the variables under investigation. On the other hand, one co-integration vector is not rejected by tests, the researcher concluded that there exists only one co-integration vector, and thus there exists meaningful long run relationship between the economic growth and military expenditure with interaction term (unemployment), gross capital formation and total labor force.

As it is presented in table 5.16.3, the long run cointegrating vector indicated that LNME*UNEM registered expected sign and statistically significant. 1% change in LNME*UNEM will result in 0.070978%, decrease in LNRGDP indirectly.

The speed of adjustment coefficient of ECT (Error Correction Term) is negative and statistically significant at 1% and its value indicated that convergence of economic variables after any shock or disequilibrium occurred in the long run. In magnitude it also indicated that approximately 0.346943% of the previous year's disequilibrium from any shock on explanatory variables will be adjusted.

Table 5.18 model II: Short run vector error correction model for UNEM

Dependent Variable: D(LNRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/21/19 Time: 16:33
Sample (adjusted): 3 40
Included observations: 38 after adjustments
D(LNRGDP) = C(1)*(LNRGDP(-1) - 0.675218622609*LNGCF(-1) -
0.0101033986795*GU(-1) - 1.71775377144*LNTLF(-1) -
0.0528718255137*LU(-1) + 0.0154446183909*ME(-1) -
0.151883928888*ME_UNEM(-1) + 0.722956159306*UNEM(-1) +
23.7517078639) + C(2)
*D(LNRGDP(-1)) + C(3)*D(LNGCF(-1)) + C(4)*D(GU(-1)) + C(5)
*D(LNTLF(-1)) + C(6)*D(LU(-1)) + C(7)*D(ME(-1)) +
C(8)*D(ME_UNEM(
-1)) + C(9)*D(UNEM(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.346943	0.129328	-2.682653	0.0121
C(2)	0.157060	0.212442	0.739305	0.4659
C(3)	0.024743	0.123161	0.200901	0.8422

C(4)	-0.001762	0.001273	-1.383742	0.1774
C(5)	-1.609575	1.408607	-1.142672	0.2629
C(6)	-0.020022	0.019699	-1.016411	0.3181
C(7)	0.003175	0.002827	1.123253	0.2709
C(8)	-0.047570	0.093848	-0.506891	0.6162
C(9)	0.160561	0.126228	1.272209	0.0884
C(10)	0.094467	0.040244	2.347351	0.0262

R-squared	0.341348	Mean dependent var	0.057349
Adjusted R-squared	0.129639	S.D. dependent var	0.064500
S.E. of regression	0.060174	Akaike info criterion	-2.562213
Sum squared resid	0.101386	Schwarz criterion	-2.131269
Log likelihood	58.68204	Hannan-Quinn criter.	-2.408886
F-statistic	1.612344	Durbin-Watson stat	1.958230
Prob(F-statistic)	0.039922		

Table 5.18 indicated that the Johansen Cointegration estimated coefficient of Unemployment in the long run was -0.722956 with a corresponding t statistic of 3.41295 that was, (0.722956/0.21183) = 3.41295. In the short run, the result of VECM coefficient for UNEM was 0.160561, (0.160561 /0.126228) = 1.272209 with p value 0.0884 with a corresponding p-value greater than the significance level of 0.05. Therefore, the coefficient of Unemployment was not significant in the short run.

Table 5.18 above introduced Unemployment as a moderator and the coefficients of interest was the interaction term. The Johansen Cointegration estimated showed that coefficient of the interaction between military expenditure and Unemployment was significant in the long run. The null hypothesis (Unemployment has no moderating effect on the relationship between military expenditure and economic growth was subsequently rejected in the long run. Therefore, Unemployment has a moderating effect on the relationship between military expenditure and economic growth in Ethiopia. On the other hand, Unemployment neither moderates nor explains the relationship between military expenditure and economic growth in the short run. Therefore, Unemployment enhances the effect of military expenditure on economic growth in the long run whereas the effect of military expenditure on economic growth is enhanced in the long run. Null hypothesis (that Unemployment has no moderating effect on the relationship between military expenditure and economic growth in Ethiopia) was supported in the short run. Hence, Unemployment was neither an explanatory variable nor a moderator in short run.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This study paper has been examining the economic implication of military expenditure on economic growth of Ethiopia using time series data starting from 1974/75-2017/18. Large expenditures on weapons occupy resources needed for development. Weapons transfers including both sales and military aid/gifts can be detrimental to developing nations' economies. For instance, debt rose seriously in developing countries because of rising interest rates on loans taken out to finance arms purchases in the most developing nations and Involvement in armed conflict has been a major source of debt in Ethiopia (SIPRI, 2017). Ethiopia military expenditure is increasing from time to time which negatively affects the normal follow of the economy. However, Ethiopia military expenditure contributes 0.7 % as a share of GDP from 2013 to 2016 (MOFED 2017).

To address this research problem, specific objectives were formulated. The specific objectives of the study were to assess the performance of government expenditure on military service in Ethiopia; to determine if the relationship between military expenditure and economic growth in Ethiopia is short run and long run phenomena; to test the direction of causality between the military expenditure and economic growth as well as to investigate moderating effects of inflation and unemployment on the relationship between military expenditure and economic growth in Ethiopia.

Unlike other studies that focused on panel data in Ethiopia, this study focused on time series data to investigate economic implication of military expenditure on economic growth. Besides, the other studies omitted the moderating variables in their papers and used nominal values instead of real values. In cases where real values were used, the base year was the year 2010/11 and for the recent years from 2015 to 2017 it depended on 2015 base year. The study employed a causal research design to measure the effect a specific change has on existing norms and assumptions.

The study used the VECM approach to determine the long run and short run association ship between military expenditure and economic growth. Additionally, Johansen cointegration was employed to determine the existence of long run between economic growth and explanatory economic variables; the granger causality test employed to test the direction of causality. Before applying cointegration test, VECM, error correction result, test for stationarity using Augmented Dickey Fuller (ADF) test for the entire variable was conducted. Accordingly, all the variables were non stationary at level except other service expenditure and stationary at first difference with trend and intercept option.

Testing for time series behaviors, the model stability was done by testing the diagnostic testing techniques. The results were revealed that there was no evidence of serial correlation, the residual was normally distributed and no evidence of hetroscedasticity problem with the collected data. The data used were specific to the following variables respectively: Economic service expenditure, social service expenditure, military service expenditure, other service expenditure, gross capital formation and total labor force.

Further, the study sought to determine the effect of economic service and social service expenditure on economic growth and established a positive effect on economic growth in Ethiopia in the long run but not in short run. The third objective sought to test the direction of causality between the military expenditure and economic growth in Ethiopia and the study confirmed that Economic growth granger causes military expenditure and not vise versa.

Objective four sought to determine the moderating effect of inflation and Unemployment on the relationship between government expenditure and economic growth in Ethiopia respectively. Empirical findings pointed out that inflation had a moderating effect in the short run and in long run. Additionally, it increases the effect military expenditure on economic growth in the long run. Unemployment has a moderating effect in the long run and it is neither an explanatory variable nor a moderator in the short run.

6.2 Conclusion

The study made several conclusions based on the findings in relation to research objectives and hypothesis. In view to assess the performance of government expenditure on military service in Ethiopia and the study revealed that the performance of government expenditure both in pre-EPRDF and current EPRDF regime on military service was very high and it had placed a great burden on the economic growth due to the violent inherited from the Dergue regime and current political instability. On the other hand, on average the military expenditure growth rate was greater than the growth rate of economic growth that was 16.077 percent between 1974/75 and 2017/8.

In view of the test of hypothesis one, military expenditure has no significant effect on economic growth (both in the short run and in the long run). However, in the long run, military expenditure has an effect on economic growth with a negative coefficient. This finding is consistent with other empirical studies (is supported by some studies and equally contradicted by others). Hence, the study concluded that, military expenditure has a negative effect on economic growth of Ethiopia in the long run. Contrary to the long run, results from vector error correction model estimator indicated that military expenditure has no effect on economic growth in the short run. The empirical results from impulse response indicated that the response of military expenditure to economic growth was negatively while the response of economic growth to military expenditure was positively affected and military expenditure has no a long- run impact on economic growth Again the empirical finding from variance decomposition function revealed that military expenditure has less important impact on future growth rate of output in Ethiopia compared to other explanatory variables that was included in the model.

In view of hypothesis two, there was no statistically significant causality between military expenditure and economic growth Ethiopia. Conversely, in this hypothesis, the study result disclosed that as there was causality between military expenditure and economic growth in the long run and the causality runs from economic growth to military expenditure. In short run when real economic growth was dependent variable the null hypothesis military expenditure does not Granger cause economic growth and the alterative hypothesis was that military expenditure does Granger cause economic growth. From the result shown that the joint P value was significant and thus, the researcher accepted the alternative hypothesis that confirmed all explanatory variables jointly cause economic growth in short run.

Similarly, when military expenditure was dependent variable and with the null hypothesis economic growth with other explanatory variables does not Granger cause military expenditure and the alternative hypothesis that economic growth does Granger causes military expenditure. The joint “P-value” was significant showing that economic growth with other explanatory variables granger caused military expenditure in the short run. Accordingly, the researcher rejected the null hypothesis and accepted the alternative hypothesis that says economic growth with other explanatory variables causes military expenditure in the short run and individually the result confirmed that causality is unidirectional in the short run(from economic growth to military expenditure). The short run speed of adjustment coefficient is estimated was significant and have a correct sign. This showed that the existence of one co integration relationship (association ship) among the variables. The λmax and λtrace test statistics were employed to assess the number of co-integration vectors in the models. The result showed that the null hypothesis of zero co integration vector was rejected in favor of one co-integration relationship. The Johansen co integration test confirmed the existence of one co integration association ship between dependent and independent variables. The adjustment coefficient indicated that the short run adjustment made within a year, and the speed of adjustment was 20% implying that it will take around five years for growth in real GDP to move back to its equilibrium once it drifts away from its long run equilibrium value.

Further, empirical findings on the test of hypothesis three indicated that inflation has a moderating effect on the relationship between government expenditure and economic growth both in the short run and long run. On the other hand, inflation also an explanatory variable the long run. Hence, the study concluded that inflation has been increased the effect of military expenditure. Furthermore, it was concluded that inflation moderates military expenditure not explains economic growth, in the short run.

Finally, finding indicated that unemployment had a moderating effect on the relationship between government expenditure and economic growth in Ethiopia in the long run. It further indicated that unemployment has been increased the effect of military expenditure in the long run and it was concluded that unemployment is neither an explanatory variable nor a moderator in the short run.

6.3 Policy Recommendations

Numerous policy recommendations can be derived from this research finding.

Policy makers should reduce military expenditure and transfer the allocation to economic and social service expenditure (to productive sector) since it is growth retarding. This can be achieved through establishment of optimum workforce and streamlining the human resource policies in the public Sector. This will eliminate inefficient work force and bloated public wage bill. Besides that, the government should continue rationalizing expenditures on operations and upkeep spending more on agriculture, natural resources, industry, mining and energy, trade and tourism, transportation and communication, construction, economic development, education and training, culture and Sport, public health, labor and social welfare, and housing.

The government should increase allocations of country's budget to productivity as opposed to unproductivity because investments in productive sectors unlock constraints to growth, including ongoing public investments in the railway network, modernizing seaports and airports, improving road networks and expanding energy and water supplies. Likewise, prioritization and budgetary allocation to productive sectors should be based on the notion of efficient expected return. In addition, budget officers should examine past performance before allocating expenditure to various expenditure components.

The government should evaluate fiscal responsibility that take into account the greatest possible achievement of the country. This will eliminate wasteful spending and enhance prioritization of key projects.

Since inflation has a significant moderating effect on the relationship between government expenditure and economic growth, the fiscal and monetary policy implementers should seek to maintain desirable levels of inflation based on the performance of the economy. This is because inflation increases the effects of military expenditure that do not promotes economic growth. Similarly, since unemployment enhances the effect that military expenditure has on economic growth, the government should create more jobs, make technology transfer and foster unemployment to create new jobs through training.

Suggestion for Further Research

The study finally suggests areas of future research to capture various economic, politico economic, and sociocultural explanatory variables that theory suggests belong in a formal empirical model of the determinants of a great power of military spending

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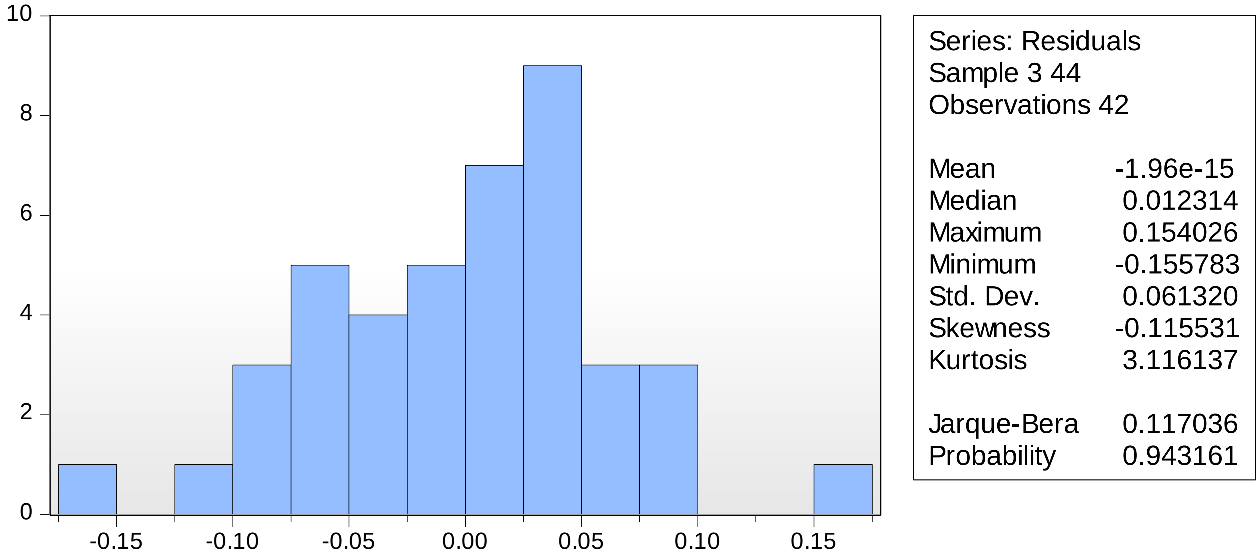
Appendices

Appendix 1:

1 Diagnostic tests of VECM

2.1 Residual test of normality



1.2 Serial correlation test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.369526	Prob. F(1,32)	0.2505
Obs*R-squared	1.723731	Prob. Chi-Square(1)	0.1892

1.3 Heteroskedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.590197	Prob. F(14,27)	0.1461
Obs*R-squared	18.98058	Prob. Chi-Square(14)	0.1657
Scaled explained SS	12.39802	Prob. Chi-Square(14)	0.5744

2. Unit Root Tests

Null Hypothesis: D(LNRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.874381	0.0016
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNRGDP,2)
Method: Least Squares
Date: 05/14/19 Time: 05:49
Sample (adjusted): 3 44
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRGDP(-1))	-0.756543	0.155208	-4.874381	0.0000
C	0.017831	0.026555	0.671454	0.5059
@TREND("1")	0.003667	0.001275	2.875439	0.0065

R-squared	0.378583	Mean dependent var	0.002851
Adjusted R-squared	0.346715	S.D. dependent var	0.100276
S.E. of regression	0.081049	Akaike info criterion	-2.118775
Sum squared resid	0.256189	Schwarz criterion	-1.994656
Log likelihood	47.49428	Hannan-Quinn criter.	-2.073281
F-statistic	11.87988	Durbin-Watson stat	2.089944
Prob(F-statistic)	0.000094		

Null Hypothesis: D(LNME) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.902399	0.0015
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNME,2)
Method: Least Squares
Date: 05/14/19 Time: 05:51
Sample (adjusted): 3 44
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNME(-1))	-0.744310	0.151826	-4.902399	0.0000
C	0.034323	0.067899	0.505506	0.6160
@TREND("1")	0.002240	0.002633	0.850759	0.4001

R-squared	0.382280	Mean dependent var	-0.004034
Adjusted R-squared	0.350602	S.D. dependent var	0.255127
S.E. of regression	0.205594	Akaike info criterion	-0.257074
Sum squared resid	1.648493	Schwarz criterion	-0.132955
Log likelihood	8.398553	Hannan-Quinn criter.	-0.211579
F-statistic	12.06769	Durbin-Watson stat	1.929956
Prob(F-statistic)	0.000083		

Null Hypothesis: D(LNOTH) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.194257	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNOTH,2)
Method: Least Squares
Date: 05/14/19 Time: 05:52
Sample (adjusted): 4 44
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNOTH(-1))	-2.797721	0.388882	-7.194257	0.0000
D(LNOTH(-1),2)	0.945241	0.248755	3.799884	0.0005
C	0.381825	0.165352	2.309161	0.0266
@TREND("1")	-0.003346	0.006017	-0.556195	0.5814

R-squared	0.783627	Mean dependent var	0.007950
Adjusted R-squared	0.766083	S.D. dependent var	0.906883
S.E. of regression	0.438613	Akaike info criterion	1.282071
Sum squared resid	7.118125	Schwarz criterion	1.449249
Log likelihood	-22.28246	Hannan-Quinn criter.	1.342948
F-statistic	44.66700	Durbin-Watson stat	1.998053
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNGCF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.342863	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGCF,2)
Method: Least Squares
Date: 05/14/19 Time: 05:53
Sample (adjusted): 3 44
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGCF(-1))	-1.293333	0.155023	-8.342863	0.0000
C	-0.052102	0.067974	-0.766507	0.4480
@TREND("1")	0.007868	0.002794	2.815811	0.0076

R-squared	0.640951	Mean dependent var	0.015827
Adjusted R-squared	0.622538	S.D. dependent var	0.338138
S.E. of regression	0.207745	Akaike info criterion	-0.236261
Sum squared resid	1.683162	Schwarz criterion	-0.112142
Log likelihood	7.961481	Hannan-Quinn criter.	-0.190766
F-statistic	34.81017	Durbin-Watson stat	1.888770
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNES) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.616913	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNES,2)
Method: Least Squares
Date: 05/14/19 Time: 05:53
Sample (adjusted): 3 43
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNES(-1))	-1.073643	0.162257	-6.616913	0.0000
C	0.056565	0.101270	0.558552	0.5797
@TREND("1")	0.005403	0.004127	1.309261	0.1983

R-squared	0.535371	Mean dependent var	-0.004742
Adjusted R-squared	0.510916	S.D. dependent var	0.437586
S.E. of regression	0.306024	Akaike info criterion	0.540048
Sum squared resid	3.558722	Schwarz criterion	0.665431
Log likelihood	-8.070982	Hannan-Quinn criter.	0.585706
F-statistic	21.89281	Durbin-Watson stat	1.978248
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNSS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.548409	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSS,2)
Method: Least Squares
Date: 05/14/19 Time: 05:54
Sample (adjusted): 3 43
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNSS(-1))	-1.192590	0.157992	-7.548409	0.0000
C	0.112853	0.081089	1.391706	0.1721
@TREND("1")	0.002989	0.003195	0.935488	0.3554

R-squared	0.599968	Mean dependent var	-0.005375
Adjusted R-squared	0.578914	S.D. dependent var	0.370825
S.E. of regression	0.240633	Akaike info criterion	0.059266
Sum squared resid	2.200357	Schwarz criterion	0.184650
Log likelihood	1.785043	Hannan-Quinn criter.	0.104924
F-statistic	28.49619	Durbin-Watson stat	2.022693
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNTLF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.316802	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNTLF,2)
Method: Least Squares
Date: 05/14/19 Time: 05:55
Sample (adjusted): 3 44
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LNTLF(-1))	-1.179646	0.161224	-7.316802	0.0000
C	0.027862	0.004772	5.838806	0.0000
@TREND("1")	0.000282	0.000114	2.468401	0.0181

R-squared	0.579160	Mean dependent var	0.000488
Adjusted R-squared	0.557578	S.D. dependent var	0.012929
S.E. of regression	0.008600	Akaike info criterion	-6.605376
Sum squared resid	0.002884	Schwarz criterion	-6.481257
Log likelihood	141.7129	Hannan-Quinn criter.	-6.559882
F-statistic	26.83586	Durbin-Watson stat	2.016162
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INFL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.933345	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFL,2)
Method: Least Squares
Date: 05/14/19 Time: 12:52
Sample (adjusted): 4 44
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFL(-1))	-2.141864	0.239761	-8.933345	0.0000
D(INFL(-1),2)	0.487518	0.139049	3.506073	0.0012
C	-1.572734	4.985431	-0.315466	0.7542
@TREND("1")	0.058634	0.192668	0.304327	0.7626

R-squared	0.789468	Mean dependent var	0.582814
Adjusted R-squared	0.772397	S.D. dependent var	30.56547
S.E. of regression	14.58209	Akaike info criterion	8.289933
Sum squared resid	7867.579	Schwarz criterion	8.457110
Log likelihood	-165.9436	Hannan-Quinn criter.	8.350810
F-statistic	46.24829	Durbin-Watson stat	2.231971
Prob(F-statistic)	0.000000		

Null Hypothesis: D(UNEM) has a unit root
Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.787476	0.0023
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEM,2)
Method: Least Squares
Date: 05/15/19 Time: 04:11
Sample (adjusted): 3 40
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(UNEM(-1))	-0.788988	0.164803	-4.787476	0.0000
C	0.083467	0.218482	0.382031	0.7047
@TREND("1")	-0.002319	0.009388	-0.246991	0.8064

R-squared	0.395784	Mean dependent var	0.008161
Adjusted R-squared	0.361258	S.D. dependent var	0.793553
S.E. of regression	0.634219	Akaike info criterion	2.002811
Sum squared resid	14.07817	Schwarz criterion	2.132094
Log likelihood	-35.05340	Hannan-Quinn criter.	2.048809
F-statistic	11.46317	Durbin-Watson stat	1.909928
Prob(F-statistic)	0.000148		

3. Granger Causality

Pairwise Granger Causality Tests of VECM model
Date: 05/14/19 Time: 06:08
Sample: 1 44
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNOTH does not Granger Cause LNRGDP	43	0.33243	0.5675
LNRGDP does not Granger Cause LNOTH		12.3290	0.0011
LNME does not Granger Cause LNRGDP	43	3.05313	0.0883
LNRGDP does not Granger Cause LNME		13.8912	0.0006
LNGCF does not Granger Cause LNRGDP	43	1.49593	0.2285
LNRGDP does not Granger Cause LNGCF		12.3311	0.0011

LNES does not Granger Cause LNRGDP	42	2.50664	0.1214
LNRGDP does not Granger Cause LNES		2.65809	0.1111
LNSS does not Granger Cause LNRGDP	42	0.05581	0.8145
LNRGDP does not Granger Cause LNSS		8.20057	0.0067
LNTLF does not Granger Cause LNRGDP	43	1.59217	0.2143
LNRGDP does not Granger Cause LNTLF		0.21462	0.6457
LNME does not Granger Cause LNOTH	43	8.51887	0.0057
LNOTH does not Granger Cause LNME		0.33025	0.5687
LNGCF does not Granger Cause LNOTH	43	12.5525	0.0010
LNOTH does not Granger Cause LNGCF		3.28081	0.0776
LNES does not Granger Cause LNOTH	42	10.6587	0.0023
LNOTH does not Granger Cause LNES		2.38602	0.1305
LNSS does not Granger Cause LNOTH	42	11.9596	0.0013
LNOTH does not Granger Cause LNSS		0.03306	0.8567
LNTLF does not Granger Cause LNOTH	43	16.7592	0.0002
LNOTH does not Granger Cause LNTLF		1.91412	0.1742
LNGCF does not Granger Cause LNME	43	16.8687	0.0002
LNME does not Granger Cause LNGCF		2.01754	0.1632
LNES does not Granger Cause LNME	42	17.9165	0.0001
LNME does not Granger Cause LNES		0.01726	0.8962
LNSS does not Granger Cause LNME	42	9.69987	0.0034
LNME does not Granger Cause LNSS		0.09565	0.7588
LNTLF does not Granger Cause LNME	43	2.63938	0.1121
LNME does not Granger Cause LNTLF		0.28788	0.5946
LNES does not Granger Cause LNGCF	42	4.86494	0.0334
LNGCF does not Granger Cause LNES		0.00081	0.9775
LNSS does not Granger Cause LNGCF	42	7.17392	0.0108
LNGCF does not Granger Cause LNSS		3.27519	0.0780
LNTLF does not Granger Cause LNGCF	43	1.93947	0.1714
LNGCF does not Granger Cause LNTLF		1.77955	0.1898
LNSS does not Granger Cause LNES	42	0.00920	0.9241
LNES does not Granger Cause LNSS		9.66682	0.0035
LNTLF does not Granger Cause LNES	42	5.91518	0.0197
LNES does not Granger Cause LNTLF		2.18284	0.1476
LNTLF does not Granger Cause LNSS	42	2.90295	0.0964
LNSS does not Granger Cause LNTLF		1.11938	0.2966

4For moderator variables

4.1 Inflation as moderator variable

VAR Lag Order Selection Criteria
Endogenous variables: LNRGDP LNGCF LAB_INF INFL GCF_INF LNTLF ME ME_INFL
Exogenous variables: C
Date: 05/15/19 Time: 05:27
Sample: 1 44
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-412.1421	NA	0.109898	20.49474	20.82909	20.61649
1	-134.8488	432.8480*	3.53e-06*	10.09019	13.09939*	11.18597*
2	-84.00318	59.52661	9.67e-06	10.73186	16.41591	12.80168
3	8.458968	72.16558	7.66e-06	9.343465*	17.70235	12.38731

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

Date: 05/15/19 Time: 05:28
Sample (adjusted): 3 44
Included observations: 42 after adjustments
Trend assumption: Quadratic deterministic trend
Series: LNRGDP LNGCF LAB_INF INFL GCF_INF LNTLF ME ME_INFL
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 *	0.778517	193.1540	175.1715	0.0040
At most 1	0.524283	129.8427	139.2753	0.1555
At most 2	0.492796	98.63958	107.3466	0.1620
At most 3	0.460256	70.12821	79.34145	0.2018
At most 4	0.372959	44.22848	55.24578	0.3204
At most 5	0.303816	24.62528	35.01090	0.4060
At most 6	0.199580	9.415330	18.39771	0.5380

Trace 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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.778517	63.31123	55.72819	0.0074
At most 1	0.524283	31.20317	49.58633	0.8595
At most 2	0.492796	28.51136	43.41977	0.7207
At most 3	0.460256	25.89973	37.16359	0.5237
At most 4	0.372959	19.60320	30.81507	0.5824
At most 5	0.303816	15.20995	24.25202	0.4795
At most 6	0.199580	9.349988	17.14769	0.4599

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

1 Cointegrating Equation(s): Log likelihood -138.9937

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNGCF	LAB_INF	INFL	GCF_INF	LNTLF	ME	ME*INFL
1.000000	-0.890005	-0.008250	0.201207	-0.008762	- 2.213715	0.009643	-0.012906
	(0.07758)	(0.01563)	(0.08436)	(0.00400)	(1.13643)	(0.00436)	(0.00122)

Dependent Variable: D(LNRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/15/19 Time: 05:30
Sample (adjusted): 3 44
Included observations: 42 after adjustments
D(LNRGDP) = C(1)*(LNRGDP(-1) - 0.890005454882*LNGCF(-1) -
0.008249551196*LAB_INF(-1) + 0.0102072526905*INFL(-1) -
0.00876218591781*GCF_INF(-1) + 2.21371518094*LNTLF(-1) +
0.00964319403823*ME(-1) - 0.0129055750263*ME_INFL(-1) -
39.2551068703) + C(2)
*D(LNRGDP(-1)) + C(3)*D(LNGCF(-1)) + C(4)*D(LAB_INF(-1))
+ C(5)
*D(INFL(-1)) + C(6)*D(GCF_INF(-1)) + C(7)*D(LNTLF(-1)) +
C(8)*D(ME(
-1)) + C(9)*D(ME_INFL(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.282685	0.090027	-3.140004	0.0037
C(2)	0.129679	0.207843	0.623931	0.5372
C(3)	-0.072203	0.098859	-0.730362	0.4707
C(4)	0.000472	0.010093	0.046811	0.9630
C(5)	0.086985	0.066925	1.299748	0.2033
C(6)	0.001738	0.001936	0.897580	0.3763
C(7)	-1.056341	1.414371	-0.746863	0.4608

C(8)	-0.001191	0.002957	-0.402658	0.6900
C(9)	-0.001849	0.000800	-2.310327	0.0277
C(10)	0.019571	0.037606	0.520422	0.6065

R-squared	0.548990	Mean dependent var	0.054237
Adjusted R-squared	0.403503	S.D. dependent var	0.062456
S.E. of regression	0.048237	Akaike info criterion	-3.005271
Sum squared resid	0.072130	Schwarz criterion	-2.550167
Log likelihood	74.11069	Hannan-Quinn criter.	-2.838457
F-statistic	3.773460	Durbin-Watson stat	2.143734
Prob(F-statistic)	0.002116		

4.2 Unemployment as a moderator variable

VAR Lag Order Selection Criteria
Endogenous variables: LNRGDP LNGCF GU LNTLF LU ME ME_UNEM UNEM
Exogenous variables: C
Date: 05/21/19 Time: 16:23
Sample: 1 40
Included observations: 38

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-266.7429	NA	0.000263	14.46015	14.80491	14.58282
1	-16.79538	381.4989*	1.59e-08*	4.673441*	7.776236*	5.777392*
2	45.25442	68.58136	2.82e-08	4.776083	10.63692	6.861323

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

Date: 05/21/19 Time: 16:25
Sample (adjusted): 3 40
Included observations: 38 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LNRGDP LNGCF GU LNTLF LU ME ME_UNEM UNEM

Warning: Critical values assume no exogenous series
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 *	0.771485	196.8034	187.4701	0.0153
At most 1	0.693902	140.7097	150.5585	0.1568
At most 2	0.567636	95.72335	117.7082	0.5167
At most 3	0.465379	63.86082	88.80380	0.7394
At most 4	0.410675	40.06535	63.87610	0.8466
At most 5	0.295333	19.97179	42.91525	0.9611
At most 6	0.140070	6.670624	25.87211	0.9959
At most 7	0.024337	0.936241	12.51798	0.9994

Trace 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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.771485	56.09376	56.70519	0.0575
At most 1	0.693902	44.98634	50.59985	0.1704
At most 2	0.567636	31.86253	44.49720	0.5671
At most 3	0.465379	23.79547	38.33101	0.7543
At most 4	0.410675	20.09356	32.11832	0.6447
At most 5	0.295333	13.30116	25.82321	0.7802
At most 6	0.140070	5.734383	19.38704	0.9661
At most 7	0.024337	0.936241	12.51798	0.9994

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

1 Cointegrating Equation(s): Log likelihood -10.19258

Normalized cointegrating coefficients (standard error in parentheses)

LNRGDP	LNGCF	LNGCF*NEU	LNTLF	TLF*UNEM	ME	ME*UNEM	UNEM
1.000000	-0.606340	-0.009546	-2.716178	-0.048515	0.014605	-0.070978	0.685270
	(0.07662)	(0.00205)	(1.06249)	(0.02636)	(0.00478)	(0.06978)	(0.20311)

Dependent Variable: D(LNRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/21/19 Time: 16:33
Sample (adjusted): 3 40
Included observations: 38 after adjustments
D(LNRGDP) = C(1)*(LNRGDP(-1) - 0.675218622609*LNGCF(-1) -
0.0101033986795*GU(-1) - 1.71775377144*LNTLF(-1) -
0.0528718255137*LU(-1) + 0.0154446183909*ME(-1) -
0.151883928888*ME_UNEM(-1) + 0.722956159306*UNEM(-1) +

23.7517078639) + C(2)
*D(LNRGDP(-1)) + C(3)*D(LNGCF(-1)) + C(4)*D(GU(-1)) + C(5)
*D(LNTLF(-1)) + C(6)*D(LU(-1)) + C(7)*D(ME(-1)) +
C(8)*D(ME_UNEM(
-1)) + C(9)*D(UNEM(-1)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.346943	0.129328	-2.682653	0.0121
C(2)	0.157060	0.212442	0.739305	0.4659
C(3)	0.024743	0.123161	0.200901	0.8422
C(4)	-0.001762	0.001273	-1.383742	0.1774
C(5)	-1.609575	1.408607	-1.142672	0.2629
C(6)	-0.020022	0.019699	-1.016411	0.3181
C(7)	0.003175	0.002827	1.123253	0.2709
C(8)	-0.047570	0.093848	-0.506891	0.6162
C(9)	0.160561	0.126228	1.272209	0.0884
C(10)	0.094467	0.040244	2.347351	0.0262

R-squared	0.341348	Mean dependent var	0.057349
Adjusted R-squared	0.129639	S.D. dependent var	0.064500
S.E. of regression	0.060174	Akaike info criterion	-2.562213
Sum squared resid	0.101386	Schwarz criterion	-2.131269
Log likelihood	58.68204	Hannan-Quinn criter.	-2.408886
F-statistic	1.612344	Durbin-Watson stat	1.958230
Prob(F-statistic)	0.039922		