

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**THE EFFECT OF DEFENSE EXPENDITURE ON
ECONOMIC GROWTH IN THE SUB-SAHARAN AFRICAN
COUNTRIES: PANEL DATA EVIDENCE**

By

KEFYALEW ENDALE ADANE

JULY 2007

ADDIS ABABA

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF BUSINESS AND ECONOMICS**

**THE EFFECT OF DEFENSE EXPENDITURE ON
ECONOMIC GROWTH IN THE SUB-SAHARAN AFRICAN
COUNTRIES: PANEL DATA EVIDENCE**

By

KEYYALEW ENDALE ADANE

**A Thesis Submitted to the School of Graduate Studies of Addis
Ababa University in Partial Fulfillment of the Requirements
for the Degree of Masters of Science in Economics (Economic
Policy Analysis) in the Department of Economics**

**JULY 2007
ADDIS ABABA**

Acknowledgements

This study benefited much from my sincere supervisor C. Panda. His constructive comments helped me a lot in the completion of the study.

My special gratitude also goes to Seid Nuru (University of Bon), who helped me a lot in my model specification and estimation. This study could not have been finished without his cooperation. His responses to my e-mails have been immediate and very valuable. He also spent his crucial time in helping me here while he was in Addis Ababa for workshop. I also extend my warm thanks to Dr. Abbi Kedir (University of Leicester), who helped me about panel data entry, estimation techniques, STATA transfer and for selecting me to work a research with him.

I am also very grateful to my examiners, Dr. Alemayehu Geda and Dr. Tekie Alemu for their excellent comments especially on my model specification and estimation techniques. In addition, I want to praise them for their overall supports during my study period. Dr. Tassew W/Hanna and all the academic and non academic staffs of the economic department of Addis Ababa University also discharged their valuable services effectively through out the entire study period.

I would like to thank the AERC for sponsoring my study in Nairobi for the CMAP in Economics for Anglophone Africa in its Joint Facility for Electives (JFE). I would further extend my thanks to my mother Etenesh Ashebir, Ato Endale Adane (father), Mulugeta (brother) and all my sisters and brothers for their continuous support and encouragement. I am also grateful to my friends; Sharew Erkehun, Yonathan Minweyelet, Hibret Belete, Mihret Jember, Mollalegn Ababayehu and to all the MSc students of economics in my batch for their various supports during my study.

TABLE OF CONTENTS

Page

List of Tables.....	i
List of Appendices.....	i
Acronym.....	ii
Abstract.....	iii
CHAPTER ONE.....	1
1. INTRODUCTION	1
1.1 Background	1
1.2 Statement of the Problem	2
1.3 Significance of the Study.....	6
1.4 Scope of the Study.....	6
1.5 Objective of the Study	7
1.6 Working Hypothesis.....	7
1.7 Source of Data and Methodology	8
1.7.1 Sources of Data.....	8
1.7.2 Methodology.....	8
1.8 Limitation of the Study	9
1.9 Organization of the Study	9
CHAPTER TWO: REVIEW OF THEORETICAL AND EMPIRICAL WORKS.....	10
2.1 Determinants of Economic Growth	10
2.2 The Theoretical Relationships between Defense Spending and Economic Growth.....	15
2.3 Empirical Evidences on the Relationship between Defense Spending and Economic Growth	20
2.4 Empirical Review of Defense Burden and Economic Growth in African Countries.....	21

CHAPTER THREE: Model specification, Variable Definition and Estimation Technique.....	25
3.1 Model Specification	25
3.1.1 Specification of the Economic Growth Function.....	25
3.1.2 Introducing Defense Burden in the Growth Specification	29
3.1.3 Specification of the Defense Burden.....	31
3.2 Variable Definition.....	34
3.3 Estimation Technique.....	36
CHAPTER FOUR: Specification Tests and Discussion of Empirical Results	38
4.1 Specification Tests	38
4.2 Discussion of Empirical Results.....	40
4.2.1 The Effects of Defense Burden on Growth	40
4.2.2 The Determinants of Defense Burden	44
4.3 Specification Sensitivity.....	45
CHAPTER FIVE : Conclusion and Recommendation	50
5.1 Conclusion.....	50
5.2 Policy Recommendation	53
References	55
Appendix.....	63
Declaration	67

List of Tables

	<u>Page</u>
Table 3.1. The list of variables employed in the analysis with their symbol and definitions.....	34
Table 4.1. The calculated and critical values of for testing fixed and random effects	39
Table 4.2 A test result for one way and two way error component.....	39
Table 4.3 The Estimation result of sectoral value added growth regression.....	42
Table 4.4 The estimation result of value added growth in the various economic sectors in the LIC category.....	47
Table 4.5 Comparison of the marginal effects of defense burden in the low income sample and total sample countries of the Sub-Saharan Africa.....	48
Table 4.6 Comparison of defense burden determinants in the low income sample and total sample countries.....	49

List of Appendices

Annex-1. The list of countries in the study with the average value for some of the variables for the period 1983-2002.....	63
Annex-2. The trend of Defense Burden in the Sub-Saharan African Countries in the period 1988-2004.....	65
Annex-3 The ratio of arm imports to arm exports in the Sub-Saharan African countries.....	65
Annex-4 The percentage of arm imports to total imports in the Sub-Saharan African countries.....	66

Acronyms

AERC.....	African Economic Research Consortium
CMAP.....	Collaborative Masters Program
FE.....	Fixed Effect Estimator
LIC.....	Low Income countries
RE.....	Random Effect Estimator
SIPRI.....	Stockholm International Peace Research Institute
WDI.....	World Development Indicators

Abstract

This paper is a contribution to the debate on the nexus between defense burden and economic growth in less-developed countries. It also aims to identify the determinants of defense burden. The study is based on 38 Sub-Saharan African countries over the period 1983-2002. Based on the Hausman (1978) test, random effect estimator model is selected and employed in the analysis. The empirical result shows that defense burden is destructive to real GDP growth. At sectoral level, its marginal effect on the value added growth of manufacturing and agriculture is significant and negative. These negative effects are especially high in the low income countries. Thus it is necessary to reduce the excessive and unproductive defense expenditure in the region to promote sustainable economic growth and to reduce the persistent poverty.

CHAPTER ONE

1 INTRODUCTION

1.1 Background

Growth performances vary across countries and regions. The determinants of growth are not unique for all countries that contribute to such variations. The growth pattern is linked to characteristics of countries such as economic base, population growth, unemployment rate, investment in physical and human capital, flow of foreign investment, industrial growth, inflation, and development of financial institutions, etc (Hassan, 2003).

African economic performance has been markedly worse than that of other regions. On average, real per capita GDP did not grow in Africa over the 1965-1995 period, while, in East Asia and the Pacific it was over 5 percent and in Latin America it grew at almost 2 percent per annum. During the period 1960-73, growth in Africa was more rapid than in the first half of the century. Indeed, for this period, African growth and its composition were indistinguishable from the geographically different circumstances of South Asia (Collier and Gunning, March 1999). However, during the 1970s both political and economic matters in Africa deteriorated. The leadership of many African nations hardened into autocracy and dictatorship. As a result per capita GDP in Africa declined by 1.3 percent per year in the 1980s, which is a full 5 percentage points below the average for all low-income developing countries. During 1990-94 the decline accelerated to 1.8 percent per year and the gap widened to 6.2 percentage points. Especially, the Sub-Saharan Africa's economic performance has been worse than the other parts of Africa (Collier and Gunning, Summer 1999; Easterly and Levine, 1997).

1.2 Statement of the Problem

Sub-Saharan Africa is the lowest income region in the world (Collier and Gunning, March 1999). The growth pattern in the Sub-Saharan Africa has special characteristics: ranging from bad policies to poor education, political instability, inadequate infrastructure and others. The persistent extent of low school attainment, political instability, fragile financial system, large black market exchange rate premiums, large government deficits, and inadequate infrastructure are significantly correlated with low economic growth and capital formation in the region (Alemayehu and Befekadu, 2005; Easterly and Levine, 1997).

In the mainstream economics there have been numerous empirical studies since Barro's (1991) seminal paper that estimate cross-country regressions to examine the possible determinants of long-term economic growth. An almost ignored explanatory variable in these empirical economic growth literatures is defense spending (Mylonidis, 2006). This oversight is surprising at least for two reasons. Firstly, the issue concerning the impact of defense spending on economy growth has received substantial attention in the defense economics literature. Secondly, defense spending of developing countries consumes large amount of their scarce resources (Deger, 1986). Sub-Saharan African countries, for example, 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 example, Eritrea's defense burden

reached to 37.6 % in the year 1999 (SIPRI, 2006). 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 (Alemayehu and Befekadu, 2005; SIPRI, 2006). Accompanying this high defense burden was the poor economic performance in the region (Brempong, 2002). Given the dismal performance of many Sub-Saharan African countries in the growth of output, reducing poverty and achieving minimum level of per capita income, the relationship between defense spending and economic performance has to be a policy-relevant research topic.

In the defense economics literature there are various studies that examined the effect of defense expenditure in economic performance in the context of developing countries (Benoit, 1973, 1978; Deger and Smith, 1983; Deger, 1986; Chowdhury, 1991, etc). However, lots of problems are observed in these studies. Firstly, there is no consent among researchers about the effect of defense spending. Benoit (1973; 1978) suggested that defense spending has a positive impact on economic development. Although the simple methods used by Benoit have often been questioned, the literature using different models and more advanced methods which followed it has not yet provided a definitive answer to the question concerning the effects of defense expenditure on economic growth (Lindon, 1992). Among these Deger (1986), Deger and Smith (1983), Brempong (1989), Dunne and Vougas (1999) etc 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. One of the underlying motivations for this study is the

lack of robust empirical evidence concerning the effect of defense burden in the defense economics literature.

Second, most of the studies focus on the nexus between defense burden and growth of GDP. Analyzing the effect of defense burden on the growth of GDP alone is not enough as it might affect productive and non productive sectors differently. To the best of my knowledge no previous study has analyzed the effect of defense burden by segregating the economy in to the productive and non productive sectors in the context of Sub-Saharan African countries. This sectoral level analysis is necessary as any positive contribution, if any, of defense on growth might be through the non productive service sector while affecting the productive sectors negatively.

Third, the various empirical works in the defense economics literature relied on the Feder-Ram model. This model is based on modeling the economy into civilian and non-civilian. However, this model has various limitations. It is prone to theoretical misinterpretation, it suffers severe econometric problems, particularly simultaneity bias and lack of dynamics; and it provides too narrow list of possible influences on growth (Dunne et al., 2004). Thus the Feder–Ram model should be avoided and that the defense economics literature should tend to converge with the mainstream growth economics literature.

Fourth, most of the studies in the defense economics literature are characterized by data problems. Majority of the studies used data from a sample of high income countries such as Saudi Arabia, from poorer countries such as Chad and from semi-industrialized countries such as Argentina and Brazil (Brempong, 1989). Some of these semi-

industrialized countries have defense industries and others may be able to adapt imported defense technology to civilian industry while it may be extremely difficult for the poorer countries to do so. Thus it is most likely that the relationship between defense spending and growth in the semi-industrialized and high income countries are different from those of the poorer countries. Under such circumstances, it may be inappropriate to lump countries with such diverse environments together (Brempong, 1989). To this end the present study is based on the Sub-Saharan African countries as they are less heterogeneous in relative in their economic structure and income status. In addition, sensitivity analysis to income differential will be conducted by taking data only from the low income countries as this makes the sample relatively more homogeneous.

Fifth, the majority of empirical studies employed either cross-sectional or time series analysis to examine the effect of defense burden. As various researchers argued these techniques of analysis are inappropriate. Chandra and Sen (2001) argued that Cross-country regressions analysis is based implicitly on the restrictive assumption of homogeneity in the observed relationship across countries. However, there is considerable variation among developing countries in relating to various structural features and institutional aspects. In addition, cross-country growth regressions don't capture the dynamics of the relationship between variables (Bader and Qarn, 2003). On the other hand, empirical studies that use aggregate time-series data alone can, even for relatively homogeneous groups of countries, miss out an important cross-sectional effect (Baltagi, 1995).

The problems of cross sectional and time-series data sets can be overcome by using panel datasets (Dunne and Mohammed, 1995). Unlike cross-section and time-series data, panel data recognize that individuals, households, firms, countries etc are heterogeneous. Panel data sets give more informative data, more variability (e.g. within and between variation), more degrees of freedom and efficiency (i.e. more reliable estimates due to more data) (Greene, 2003). Other benefits include better power properties of the testing procedures when compared to standard time series methods (Banerjee, 1999).

1.3 Significance of the Study

As discussed above, the magnitude of defense burden is substantial in the Sub-Saharan African Countries. This study is valuable in providing information to policy makers during planning of defense spending and other activities such as investment, public expenditure in education, and other social works. If the effect of defense spending is negative, then defense spending has to be reduced to meet 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 size.

1.4 Scope of the Study

Any research problem has to be delimited in scope to manageable size. Thus this study is delimited to 38 Sub-Saharan African countries. The list of countries used in the analysis with some historical data on relevant variables is presented in annex1. The countries that are excluded from the study are due to the lack of data especially on defense expenditure.

Using data from only Sub-Saharan Africa-a region that has similar economic, social, military, and political environments, enables to limit the problem of differential response to increased defense spending. The study period is also delimited to the years 1983-2002 as consistent figure for most of the variables are available for this time span.

1.5 Objective of the Study

The general objective of this study is to shed further light about the effects of defense spending in the economic growth as well as in the various economic sectors of less developed countries by applying mainstream economic theory and methodology. The specific objectives of the study are:

- Analyzing the impact of defense burden on growth of GDP
- Examining the effect of defense burden on the value added growth in manufacturing, industry, agriculture and service sectors.
- Analyzing the determinants of defense burden

1.6 Working Hypothesis

Based on theoretical and empirical literatures, the following hypotheses are developed:

- Defense burden is expected to affect the value added growth of productive sectors i.e., manufacturing, industry and agriculture negatively
- The relationship between defense burden and growth of GDP is non-linear.
- When officials become aware of the increased defense burden, then they will use the remaining resources in other public sectors efficiently.

1.7 Source of Data and Methodology

1.7.1 Sources of Data

The main data sources include SIPRI¹ (2006) from which the data of defense expenditure and defense expenditure as a share of GDP (defense burden) are obtained. The SIPRI is preferred as it reveals its sources of data clearly, uses publicly available information, gives details of military expenditures in national currency as well as constant dollars, and also supplies data on military burden. Population, government expenditure /GDP ratio, fixed capital formation to GDP ratio, real GDP growth rates, rate of inflation, value added growth of the economic sectors, growth of money supply and other related economic variables are obtained from WDI (2006). Political variables such as successful coups², attempted coups³ and coup plots⁴ in the region are taken from online data base of African Research Program at the Harvard University.

1.7.2 Methodology

This study employs a panel data analysis within the mainstream macroeconomic framework. Both Random and Fixed Effects model are employed for estimation. However, the test statistics of Hausman (1978) procedure showed that fixed effects are not significant. As a result only the Random effects model estimated results are reported.

¹ Stockholm International Peace Research Institute

² Coup d'etat-is the sudden, forcible and illegal removal of a government by military or political group which doesn't involve mass uprising like revolution. Successful coup is an attainment that is successful.

³ Attempted coups are those which are attempted but abortive

⁴ Coup plots are those coups that are not attempted

1.8 Limitation of the Study

Defense burden for the period 1983-1987 is obtained from the online data base African Research Program as SIPRI releases the data only for the period after 1987. When some figures for a given variable are missing, an effort has been made to fill missing values by using alternative sources like the World Bank's African Development Indicators (various issues) and Summers-Heston data set (Penn World Table, 2006). This is applied especially for public expenditure on education as there are lots of missing values for it. Even using several data sources, it should be recognized that the panel remains unbalanced, as often is the case. In addition, the study is limited to the period 1983-2002 due to the lack of data for the recent years.

1.9 Organization of the Study

To set the scene, the next chapter is about the theoretical and empirical review section. In this section the various theoretical views on the factors that affect economic growth of countries and the types of channels through which defense burden affect the economic development are addressed. In the third chapter, models which can be used for estimation are specified, variables are defined and the estimation techniques are discussed. The fourth chapter discusses some of the specification tests and the empirical results of the estimation. In addition, the specified models are re-estimated only for the low income countries of the sample to see sensitivity of the estimates to income differential. Finally, chapter five contains the conclusion and policy recommendations.

CHAPTER TWO

2 REVIEW OF THEORETICAL AND EMPIRICAL WORKS

2.1 Determinants of Economic Growth

Most growth studies utilize the standard neo-classical growth model or its extended version that includes human capital and recent macroeconomic studies focus on endogenous growth models (Benos, 2004). A key element of the neoclassical growth theory is the assumption that technical change is exogenous and that the same technological opportunities are available across countries. This assumption implies that steady state growth solely depends on exogenous population growth and exogenous technical progress. In other words, the model predicts that poor countries should gradually converge towards richer countries (Solow, 1956).

However, endogenous growth theories have dropped these central assumptions. The basic idea of endogenous growth theories is that long run growth in income per head depends on investment decisions rather than, as in the traditional theory, resulting from unexplained or exogenous improvements in technology. They emphasized that government policy can influence both directly through taxes and subsidies and indirectly via reform of institutional arrangements. These interventions might in principle be used to raise investment and hence the long run growth (Crafts, 1996).

The recent empirical growth literature has suggested a wide range of growth correlates. The list includes among others, the initial conditions, human capital, investment, fiscal policy indicators such as government size, inflation, openness and political instability.

Recent empirical growth literature provides ample evidence about the existence of conditional income convergence across countries. Under the assumption of diminishing marginal returns to capital, the lower the initial level of income then the greater will be the opportunity of catching up through higher rates of capital accumulation and diffusion of technology. The evidence for convergence is the negative relationship between the growth rate of per capita GDP and the initial level of GDP per capita after controlling for other relevant variables (Makdisi et al., 2003).

Human capital has been identified as a leading factor in explaining economic growth. Barro (1991), based on his study on 98 countries, concluded that the growth rate of real per capita GDP is positively related to initial human capital. Ben Habib and Spiegel (1994) have found evidence that human capital affect total factor productivity growth through its impact on the capacity of a country to innovate and capability of using and adapting foreign technology. Barro (2003) stresses on the distinction between the quantity of education, measured by years of attainment at various levels and the quality gauged by scores on internationally comparable examinations such mathematics, science and reading scores. His research results suggest that the quality and quantity of schooling both matter for growth but quality is much more important.

The robustness of investment in explaining cross-country differences in growth performance has been a well-identified empirical fact (Levin and Renelt, 1992).

Investment plays a crucial role in models of economic growth. It is an essential component of aggregate demand, and fluctuations in investment have considerable effect on economic activity and long-term economic growth (Asante, 2000). Solow (1956) argued that nations which devote a large fraction of their income to saving and investment will have a high steady-state capital stock and a high level of income and those nations which save and invest small fraction of their income will be poor. The empirical work of Mankiw et al. (1992) by using cross-country data shows that the ratio of investment to GDP is an important determinant of growth.

One of the important and frequently studied issues in economics is the role of fiscal policy in economic development. Empirical attempts to link aggregate measures of fiscal policy with average per capita growth rates in cross country studies have tended to use various measures of government activity. A common measure of the role of the government in economic activity is the ratio of government consumption expenditure to GDP. Levin and Renelt (1992) used this definition and they found a negative relationship between government consumption and growth, though the coefficient is insignificant. Although subject to data limitations, the ratio of total government expenditure to GDP is a more complete proxy for the size of the government in economic activity than government consumption to GDP (Levin and Renelt, 1992). They again found a negative relationship between government expenditure to GDP ratio and growth, though the coefficient is insignificant too. Barro (1991) included an explanatory variable that reflects total central government expenditure, but removes from those expenditures any funds used for producing services that are often considered public goods such as military and public expenditure on education. The remaining expenditure are intended to proxy the

extent which the central government wastes productive resources via economically inefficient policies and institutional arrangements that hinder economic growth.

Inflation is also an important macroeconomic variable that affect economic growth. Levin and Renelt (1992) found that those countries that grew faster than the averages have a lower inflation rates than slower-growing countries. However, the relationship between inflation and growth remains controversial in both theory and empirical findings. Monetary policy makers believe that inflation has important adverse effects on long-run economic performance (Mallik and Chowdhury, 2001). Mankiw (2002) described the cost of inflation by dividing it into anticipated and unanticipated.

The cost of steady or anticipated inflation include: the distortion of the inflation tax on the amount of money people hold; inducing firms to change their posted prices more often; increasing the relative price variability so that microeconomic inefficiencies in the allocation of resources and the inconvenience in living with a world of changing prices become substantial. Inflation also alters individual's tax liability as many provisions of tax code do not account its effects.

Unexpected inflation, on the other hand, has an effect that is more destructive than any of the costs of anticipated inflation. It arbitrarily redistributes wealth among individuals and hurts individuals on fixed pensions. Workers and firms often agree on a fixed nominal pension when the worker retires (or even earlier). The worker is hurt when inflation is higher than anticipated and the firm is hurt when inflation is lower than anticipated. It is also noted that inflation uncertainty reduces efficiency by discouraging long-term contracts and increasing relative price variability. However, some economists believe that

moderate inflation-say, 2 or 3 percent per year-can be a good thing as cuts in nominal wages is rare. This is because an increase in supply or decrease in demand leads to a fall in the equilibrium real wage for workers. Since nominal wages can't be cut, the only way to cut real wages is to allow inflation to do the job so that full employment at equilibrium is restored (Mankiw, 2002).

Openness has been used extensively in the literature as a major determinant of growth performance. Makdisi et al., (2003) argued that Openness affects growth positively to the extent that it magnifies the benefits of international knowledge spillover and technological diffusion as well as enforces cost discipline through import competition and the drive to export. Although theoretical discussions frequently focus on the relationships between international trade and growth, empirical examinations have typically examined the relationships between export and growth. Levin and Renelt (1992) examined the relationship between growth with import indicators as well as growth with total trade indicators and they found essentially the same coefficient and standard errors with the export-growth relationship. In addition, they found that the ratio of total trade to GDP was found to be robust in the growth equation only when investment share is dropped from the list of included variables. The relationship between investment share and trade is found to be robust. These results suggest that trade affects growth via investment.

Political instability is also another factor that affects economic growth. Barro (1991) investigated the impact of political instability (proxied by figures on revolutions, coups, and political assassinations) on economic growth by estimating a single cross-section regression and he reported a statistically significant inverse relationship between these

proxies and economic growth. Fosu (1992) argued that political instability has deleterious impact on economic growth. His measure of political instability is based on data on successful coups d'état, attempted coups, and coup plots. Similarly, Gallup et al. (1998) found that political instability, based on the number of assassinations per million people per year and the number of coups per year, is a statistically significant deterrent to economic growth. Mankiw (2002) emphasized that countries that experience more revolutions and coups will have low saving and investment and thus grow more slowly than more stable countries. Alemayehu and Befekadu (2005) also argued that potential unstable political environment limits growth highly.

2.2 Theoretical Relationships between Defense Spending and Economic Growth

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: (1) resource allocation and mobilization, (2) organization of production, (3) sociopolitical structure and external relations.

Resource Allocation and Mobilization

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. 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 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; Mylonidis, 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).

The Organization of Production

The military may be the instrument through which infrastructures such as roads, power supplies, or communication services are developed and introduced to the society that, in turn, have effects on productivity. The military may also provide training in technical skills, organize rural labor (as soldiers) to accept industrial-type discipline, give

educational training and medical care and introduce new technology, which make tangible contributions to growth (Antonakis, 1997).

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. 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).

Sociopolitical 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).

2.3 Review of Empirical Evidences on the Relationship between Defense Spending and Economic Growth

Since 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. There are alternative arguments concerning the growth effects of defense expenditure and each of these arguments is empirically supported. For the most part, models were either supply side, demand side, or some combination of the two.

The overwhelming majority of demand side models uncovered a negative impact of defense on growth due to the trade off between productive investments, such as health and education expenditures and defense expenditures. With regard to this, Smith (1980), 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, Dunne and Nikolaidou (2001) provide empirical evidence which supports that defense expenditure enhances growth through Keynesian type aggregate demand effects. Moreover, when a supply side approach is employed, defense may have a positive influence through spin-offs and externalities. Atesoglu and Mueller (1990) and Ram (1986), by employing supply side models, showed that a positive impact is uncovered which implies that the positive externality effect outweighed any negative productivity influence. Since they excluded important demand-side elements from their supply side studies, it is premature to conclude that defense had a net stimulatory impact on growth.

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. Lebovic and Ishaq (1987) estimate a three-equation model by employing panel data analysis for 20 Middle Eastern countries for the period 1973–1982 and they report a negative effect of military expenditure on economic growth. 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 and Makrydakis (1997) and Dakurah et al. (2001) empirically supported that causality is not clear cut.

2.4 Empirical Review of Defense Burden and Economic Growth in African Countries

Africa remains relatively understudied in the defense burden -economic growth debate. In addition, the majority of existing studies in the continent focus on the case of South Africa (Smaldone, 2006). Nevertheless, as the research summarized below demonstrates, the results of the empirical evaluation of the effects of defense burden in Africa mirror the larger body of Third World studies.

Nabe (1983) specified and estimated multi-equation models in the sample of African countries. He constructed a recursive model in which economic development factors are made to depend upon defense, social development factors depend upon economic development factors and defense, and economic growth rate in turn depends on economic

development factors, defense and social development factors. He concluded that defense spending is negatively related to economic growth rate. Lim (1983) and Faini et al. (1984) also showed that defense spending affects economic growth negatively and the effect is pronounced in the poorer countries of Africa. Faini et al. (1984) found that defense burden has marginal effect of -0.0421 on per capita income growth.

Brempong (1989), using a sample of 39 African states for the period 1973–1983, examined the effects of an increased defense burden on GDP growth rate, the mechanisms by which defense burden affect economic growth, and whether it influence economic growth directly and independently. His results indicated that defense spending affects economic growth through its effects on investment rate and skilled labor supply to the civilian sector. In a later study Brempong (1992) used a methodology which is developed by Hicks and Kubisch (H-K) and used data from a sample of 40 countries to investigate the dynamics of defense budgeting in Sub-Saharan Africa during the 1967-87 periods. The H-K methodology is based on the ratio of the percentage change in the budget allocation of sector j (defense) to the percentage change in the overall size of the government budget. By employing H-K methodology, he found a peculiar pattern in which governments in every geographical region, and regardless of their oil-exporting or -importing status, tended to reduce defense spending when overall budget resources are increasing but to increase military spending in times of austerity.

Looney (1990) analyzed the effect of defense spending on the economic performance of 33 African states during 1970–1982 by making distinction between conflict and non-conflict states. His finding showed that the former experienced almost uniformly negative

linkages between military expenditures and economic indicators, while in the latter group of countries the pattern was reversed. Mbaku (1993) investigated relationships among democracy, military spending, and economic growth in Africa during the 1980s. He found that democracy fostered growth, but defense spending retarded it.

Dunne and Mohammed (1995) studied the determinants and effects of defense expenditure on a sample of 13 relatively homogenous Sub-Saharan African countries during 1967-1985. By analyzing this group of countries as a whole, using different statistical techniques, they found no indication that military spending had positive economic effects, but both aggregate and individual country results showed substantial negative impacts, especially on growth, trade balance and investment. Stroup and Heckleman (2001) employed panel techniques and they found that defense expenditure affects economic growth in the Sub-Saharan Africa non-linearly. This means, the effect is positive when defense burden is at low level and the effect will become negative at higher levels of defense burden.

In addition to the cross-national studies cited above, several empirical case studies have been conducted. Not surprisingly, South Africa has attracted the lion's share of the attention (Smaldone, 2006). McMillan's (1992) statistical analysis of the relationship between economic growth and defense spending in South Africa during 1950–1985 produced a mix of positive and negative effects. A few years later Roux (1996) used a four-equation model to analyze the effects of defense burden on South African economic growth for the period 1960–1990. He also found mixed results, but overall the military burden affects economic growth negatively. Dunne and Vougas (1999) used causality

techniques that recognize the long-term relationship (co-integration) between military spending and economic growth. Their work revealed that defense spending had a “significant negative impact” on economic growth in South Africa during 1964–1996. Dunne and Watson (2000) using firm level employment data found that defense spending decreases employment and efficiency in the South African industrial sector.

From other case studies, Haile (1997) used a model based simulation to quantify the impact of military expenditure in Ethiopian economic performance. He found, for instance, manufacturing, agriculture and total output would have increased over the sample period by about 0.3, 0.1, and 0.75 percent per annum, respectively, if the size of the armed forces and the ratio of military expenditures to total output had been maintained at their 1973 levels. In terms of the social impact his simulation shows that expenditures on education and on health would have increased, on average by about 94.1 percent, and 86.5 percent, respectively over the simulation period.

CHAPTER THREE

3 Model specification, Variable Definition and Estimation Techniques

3.1 Model Specification

The model is developed based on mainstream economic theory. The economic growth specification is developed by modifying Robert Barro's (1991) specification. This is because his growth specification includes variables that control for differences in institutional influence across countries and it incorporates a variety of base variables thought to be possible determinants of long-term growth. For example, Barro's specification control for variation of government expenditure as he used central government expenditure that does not include education and defense expenditure as this remaining expenditure is believed to be a good measure for the extent of wastage created by economically inefficient policies and institutional arrangements. The list of base variables includes investment share of GDP, population growth rate, and a measure for rate of human capital formation. The inclusion of these base variables is justified, at least partially, by the endogenous growth theory.

3.1.1 Specification of the Economic Growth Function

Given factors of production labor (L), capital (K), and technology, growth in output can be decomposed into these factors. Consider the production function with Hicks-neutral productivity parameter, A:

$$Y = AK^\alpha L^{1-\alpha} \quad [1]$$

Taking the logs, we have:

$$\ln Y = \ln A + \alpha \ln K + (1 - \alpha) \ln L \quad [2]$$

By taking the derivative with respect to time and rearranging, we have:

$$\frac{\dot{Y}}{Y} = \alpha \frac{\dot{K}}{K} + (1 - \alpha) \frac{\dot{L}}{L} + \frac{\dot{A}}{A} \quad [3]$$

Equation [3] says that growth in output is equal to the sum of the weighted average growth rate of each factor (capital, labor, and technology). The term $\frac{\dot{A}}{A}$ is referred to as total factor productivity growth or multifactor productivity growth. In practice, economists determine the share of capital and labor in output growth and calculate the share $\frac{\dot{A}}{A}$ as a residual. Due to this, the term is usually called “residual”. While the term $\frac{\dot{A}}{A}$ may contain the impact of other factors, it is usually associated with technological change. Sometimes, it is referred to as “measure of our ignorance” (Mankiw, 2002).

Using of investment to GDP (IS) ratio instead of the growth rates of capital is preferred as investment is more related than with the capital stock. Similarly population growth rate is preferred to the use of the labor force. This is because population growth reflects the negative impact on growth that arises from a low capital-to-labor ratio associated with those countries experiencing over-population pressures (Dunne and Mohammed, 1995; Barro, 1991).

Other variables which are likely to influence growth in the countries are included. Human capital is also included in the economic growth specification. There are various measures

of human capital. The most popular has been provided by Barro (1991), which is the average number of adult male educational attainment. Others such as Dunne and Mohammed (1995) and Dewan and Hussien (2001) argued that public expenditure on education as a share of GDP (ES) can be used as a proxy for human capital formation. In their disaggregated study Bose et al (2003) also found that total expenditure in education significantly affects growth. By reviewing these evidences, the public expenditure on education is employed as a proxy for human capital with the view that it has a likely tradeoff with defense expenditure than the schooling proxy. The central government expenditure less expenditures on public education and defense as a percentage of GDP (GOV) is also included to measure for the extent of wastage created by economically inefficient fiscal policies and institutional arrangements (Barro, 1991). Levine and Renelt (1992) argued that total trade affects growth through investment. According to them inclusion of investment and total trade at the same time will yield insignificant coefficient for the total trade. Similar result is found in this study too. Thus the openness variable is excluded from the explanatory variable list.

The independent effect of inflation (INF) and the associated increased price level variability in hindering economic growth is empirically tested by most researchers (Hassan, 2003; Stroup and Heckelman, 2001). There exists cross country variation in monetary policies which exacerbate inflation. This variation can be controlled by including the annual growth rate of the M1 (money supply) less the growth in potential GDP (M1G) for the preceding year. This explanatory variable does not reflect the variability of price inflation; it rather reflects evidence of poor policies that may cause inflation (Stroup and Heckelman, 2001). In order to account for the effect of inflation

variability the standard deviation for the annual inflation over the preceding five years, (INFL), is used (Barro 1991).

Variables which are designed to capture the influences of political instabilities on economic growth are also included. This study employed the approach of Fosu (1992) to construct an index for political instability. The approach is based on data on successful coups d'état, attempted coups, and coup plots. Of these three components of instability, it is assumed that a successful coup indicates the greatest degree of instability, followed by an unsuccessful coup, and then by plot. Respective weights of 5, 3, and 1 are assigned to each component. For example, the available data showed that Burkina Faso has the highest political instability index followed by Sudan with instability index of 31 and 30 respectively, while countries such as Angola and Botswana have zero political instability indexes in the years 1983-2002. The weighting scheme may seem arbitrary. Different weights may result in considerable changes in political instability rankings. To overcome this problem, Fosu suggested a dichotomous variable (PD) based on the index. Countries that have more than or equal to the average political instability index will be classified as "high"-political instability and PD will take a value of one for these countries. On the other hand, those countries with below the average index will be classified as "low"-political instability index and PD will take a value of zero.

3.1.2 Introducing Defense Burden in the Growth Specification

Defense expenditures are generally reported in current domestic currencies. A problem for international as well as inter temporal comparisons will arise, especially if exchange rates are overvalued and countries vary in size. To overcome these problems the ratio of defense spending to GDP (defense burden, DB) is the appropriate variable (Brempong, 1989). To account the influences of defense expenditure, which is discussed in section 2.2, the defense Burden (DB) is included in the growth function.

Stroup and Heckelman (2001) found that the effects of defense spending on economic growth is positive when it is low and this positive effect will turn to negative as its size increases. To account for this effect the square of defense burden (DBSQR) is included in the specification. Landau (1994) theorized and empirically supported that if public sector decision-makers perceive an increase in the threat to national security arising from a military build-up in a neighboring country, these decision makers may also have a heightened awareness of the increased opportunity cost of maintaining any unproductive government policies and this will motivate for more productive uses of available resources in the civilian, public sector despite the simultaneous increase in defense spending. Heightened perceptions of national security threats could stem from external and also from internal sources, such as the threat of a pending domestic revolutionary movement. These heightened perceptions are exhibited by a relatively higher level of defense burden. The interactive variable DBGOV, which is the product of DB and GOV, is used to account the likely added productivity from these simultaneous increases in defense burden and awareness of its opportunity cost (Stroup and Heckelman, 2001).

Based on the above theoretical and empirical arguments, the growth equation that accounts the impact of defense burden is specified as follows:

$$g_{it} = \alpha_0 + \alpha_1 IS_{it} + \alpha_2 POP_{it} + \alpha_3 ES_{it} + \alpha_4 GOV_{it} + \alpha_5 INF_{it} + \alpha_6 M1G_{it} + \alpha_7 INFL_{it} + \alpha_8 PD_{it} + \alpha_9 DB_{it} + \alpha_{10} DBSQR_{it} + \alpha_{11} DBGOV_{it} + \varepsilon_{it} \quad [4]$$

α_1, α_3 and α_{11} are expected to be positive, $\alpha_2, \alpha_4, \alpha_6, \alpha_7, \alpha_8,$ and α_{10} are expected to be negative, and ambiguous sign for α_5 and α_9 .

Specification of Sectoral Value Added Growth Rates

In this section value added growth of agriculture, manufacturing, industry and service sector is specified. The framework for the specification is developed in a similar fashion like the growth of total output.

The value added growth of agriculture output is a function of rainfall and the growth of labor force in the agriculture sector. It is also affected by variables such as inflation, fiscal policy and political instability indexes. Due to the lack of data, the growth of fertilizer consumption per hectare of land (GFC) is used instead of rainfall and population growth rate is used instead of the growth in labor force of agriculture. The function that incorporates defense burden is given by:

$$AV_{it} = \beta_0 + \beta_1 GFC_{it} + \beta_2 POP_{it} + \beta_3 GOV_{it} + \beta_4 INF_{it} + \beta_5 M1G_{it} + \beta_6 INFL_{it} + \beta_7 PD_{it} + \beta_8 DB_{it} + \beta_9 DBSQR_{it} + \beta_{10} DBGOV_{it} + \varepsilon_{it} \quad [5]$$

β_1 and β_{10} are expected to be positive, $\beta_2, \beta_3, \beta_5, \beta_6, \beta_7$ and β_9 are expected to be negative and others ambiguous.

The value added growth of output of manufacturing, industry and service sector is a function of investment to GDP ratio, human capital (ES), the growth of labor force in respective sectors, fiscal policy , inflation and political instability index. Due to the lack of data in each sector, population growth rate is used instead of the growth in labor force.

The value added growths that incorporate the defense burden is given by:

$$s_{it} = \delta_0 + \delta_1 IS_{it} + \delta_2 POP_{it} + \delta_3 ES_{it} + \delta_4 GOV_{it} + \delta_5 INF_{it} + \delta_6 M1G_{it} + \delta_7 INFL_{it} + \delta_8 PD_{it} + \delta_9 DB_{it} + \delta_{10} DBSQR_{it} + \delta_{11} DBGOV_{it} + \varepsilon_{it} \quad [6]$$

Where, S_{it} - is the specific sector which is either manufacturing, industry or service sector.

δ_1 and δ_3 are expected to be positive, $\delta_2, \delta_4, \delta_6, \delta_7, \delta_8$ and δ_{10} are expected to be negative and others ambiguous.

3.1.3 Specification of the Defense Burden

In attempting an econometric analysis of the determinants of defense burden it is important to have some theoretical framework to allow a specification of causality, functional form and relevant variables. This is normally achieved by using a neoclassical model of the state as a rational actor maximizing social welfare subject to resource constraint. The social welfare function can be determined by the state, based on individual preferences, or based on some voting rule such as the median voter. Defense burden is then determined by balancing its opportunity cost and the security benefits it provides (Dunne and Mohammed, 1995; Sandler and Hartley, 1995)

The social welfare function is a function of utility derived from private consumption (C), the level of security (S), and other governmental spending (GE) all conditioned on political, demographic and strategic factors (Z).

$$W = W (C, S, GE, Z) \quad [7]$$

The level of security will depend upon the level of defense burden (DB), conditioned on political, demographic and strategic variables Z:

$$S = S (DB, Z) \quad [8]$$

Maximizing the social welfare function subject to this and the budget constraint

$$GDP = P_d DB + P_c C \quad [9]$$

Where, P_d and P_c are the prices of DB and C. From this, the demand for defense burden can be derived as:

$$DB = DB (GDP, P_d, P_c, Z) \quad [10]$$

In analyzing the LDCs, the specific nature of these countries has to be taken into account. In many countries defense expenditure is often independent of economic conditions and generated mainly by the internal logic of the state. The overall economic environment may provide a constraint on defense burden over time, but the importance of strategic factors, security and threat perceptions, both internal and external, has to be recognized (Sandler and Hartley, 1995; Dunne and Mohammed 1995; Deger and Smith 1983). Providing an estimable demand function requires the consideration of income variables and some way of quantifying political and strategic effects.

Since defense has some elements of a public good, the share spent on it might be expected to increase with population (N) (Deger and Smith, 1983). From a theoretical

point of view income is a crucial determinant of military expenditures. As GDP rises, a nation has both more resources to protect and greater means to provide protection. Military expenditure and GDP are, thus, hypothesized to be positively related (Sandler and Hartley, 1995). In addition, higher income can lead to structural changes, inequalities and hence conflict requiring higher defense spending to maintain internal control. Because countries don't maintain indices of the prices of defense expenditure, data on price are typically not available. Price can be dropped from the equation without biasing results, provided that the price of military activities has inflated at the same general rate as that of non-defense activities (Sandler and Hartley, 1995). It is likely that increased openness of the economy affects defense spending, though it is not clear what direction this effect takes (Rosh, 1988; Antonakis, 1997). Total trade share in GDP (XM) is, thus, included to account the effect of openness on the defense burden.

Defense expenditure is affected by the change in total government expenditure. Brempong (1992) argued that governments tended to reduce defense spending when overall budget resources are increasing. On the other hand, Dunne and Mohammed (1995) argued that defense expenditure might benefit from increased total government expenditure. Introduction of the share of government expenditure in GDP (GE) will account this effect though the direction of relationship is ambiguous due to the above conflicting arguments. Proportion of armed forces in the total labor force (AP) is also expected to affect military burden positively. The hangover from previous expenditure, or simply the ratchet effect, is another variable which affects defense burden positively. This can be incorporated by estimating a dynamic model where the lagged value of the defense burden (DBI) will pick up such effects (Dunne and Mohammed 1995).

As argued by various researchers, it is important to consider political factors within the countries. The type of government can affect defense spending, with military government's most likely to be higher spenders (Dunn and Mohammed, 1995). Due to the lack of data for military dummy another proxy i.e., dummy variable for centralized government (Cent) is used with the belief that centralized governments have the tendency to spend more on defense than other systems of administration. In addition, Sub-Saharan Africa has also been in considerable flux, with countries experiencing internal and external conflict and changes in government which might have implications on the defense burden of countries (Brempong, 1989). To account for the influence of internal and external conflicts, a dummy variable for civil war (WAR) is included. Based on the above theoretical and empirical arguments the defense burden is specified as follows:

$$DB_{it} = \gamma_0 + \gamma_1 \ln(N_{it}) + \gamma_2 \ln(GDP_{it}) + \gamma_3 XM_{it} + \gamma_4 GE_{it} + \gamma_5 AP_{it} + \gamma_6 DBL_{it} + \gamma_7 Cent_{it} + \gamma_8 WAR_{it} + v_{it} \quad [11]$$

$\gamma_1, \gamma_2, \gamma_5, \gamma_6, \gamma_7$ and γ_8 are expected to positive while γ_3 and γ_4 are ambiguous

GDP and population size are entered in their logarithmic form as the dependent variable is used in percent.

3.2 Variable Definition

Table 3.1 The list of variables employed in the analysis with their symbol and definition

Symbol	Definitions
AV	The growth of agriculture value added (in percent)

AP	The percentage of the armed personnel in the total labor force
Cent	A dummy variable for centralized government. It takes a value 1 for centralized government and zero otherwise
DB	The defense expenditure as a percentage of GDP (i.e., Defense Burden)
DBI	The lagged value of defense burden
DBSQR	The square of defense burden
ES	Public expenditure on education as a percentage of GDP
GFC	Growth of Fertilizer consumption per hectare of arable land (in %)
g	The growth of real GDP (in percent)
GDP	The real gross domestic product
GE	Total government expenditure as a percentage of GDP
INF	Inflation (the consumer price index in percent)
INFL	The standard deviation of the consumer price index in the preceding 5 years
IS	Total fixed capital as a percentage of GDP
IV	The growth of industry value added (in percent)
MV	The growth of manufacturing value added (in percent)
MIG	The growth of M1 (money supply) less potential growth of GDP in the preceding year.
N	The size of total population
PD	A dummy variable which takes a value of 1 if the political instability index is greater than or equal to the average and zero otherwise
POP	The population growth rate (in percent)
SV	The growth of value added in the service sector (in percent)
WAR	A dummy variable which takes a value 1 if there is civil war and zero otherwise
XM	The sum of imports and exports as a percentage of GDP
GOV	$GE - (DB + ES)$

DBGOV	The product of DB and GOV
--------------	---------------------------

In the growth equation, the dependent variable is the annual rate of growth of real GDP. In the sectoral level regressions, value added growth rates are used in the same manner like the growth of real GDP. The value of each explanatory variable represents the data that is the annual observed values.

3.3 Estimation Technique

The analysis is conducted by using panel data set, which makes the investigation of country and time specific effects possible. The basic framework for the discussion is a regression of the form:

$$y_{it} = x_{it}'\beta + \mu_{it}$$

$i = 1, \dots, N$; and $t = 1, \dots, T$, where i represents countries and T represents the time period

The fixed effect (FE) and random effect (RE) estimators are designed to handle the systematic tendency of μ_{it} to be higher for some countries or individuals than for others (individual effects) and possibly higher for some time periods than for others (time effects). If the unobserved individual heterogeneity and time effect are assumed to be uncorrelated with the included variables, the random effects model yields a consistent and efficient estimator (Greene, 2003; Wooldridge, 2005).

If the unobserved heterogeneity and time effects are correlated with the regressors, then the ordinary least squares estimator of β is biased and inconsistent as a consequence of an omitted variable (Greene, 2003; Wooldridge, 2005). In such cases transformation is necessary to remove the unobserved effect.

Both fixed and random effects adjust for heteroskedasticity. However, the two effects have their own advantages and disadvantages. In the presence of correlation between the regressors and individual effects, the RE estimator is inconsistent while the FE estimates are consistent and efficient. If the unobserved effect is correlated with the regressors, the RE estimator is consistent and efficient while the fixed effect estimator is consistent but inefficient.

Hausman (1978) provides a test for discriminating between the fixed effects and the random effects estimators. The test is based on comparing the difference between the RE ($\hat{\beta}_{RE}$ - i.e. coefficient vector of the RE model) and FE ($\hat{\beta}_{FE}$ - i.e. the coefficient vector of FE model) estimators, where the random effects estimator is efficient and consistent under the null hypothesis and inconsistent under the alternative hypothesis. The fixed effects estimator is consistent under both the null and the alternative hypothesis but efficient only in the alternative. If the null is true then the difference between the estimators $\hat{\beta}_{RE} - \hat{\beta}_{FE}$ should be close to zero.

CHAPTER FOUR

4 Specification Tests and Discussion of Empirical Results

4.1 Specification Tests

Hausman tests are conducted in two steps to test for the existence of endogeneity. In the first step, the suspected endogenous variables are regressed on the exogenous variables in an auxiliary regression, and then in the second step the residuals from these regressions are inserted in to the original model. The significance of the residual in this model would indicate the existence of endogeneity if there is only one suspected variable. Since there are more than one suspected endogenous variables, decision will be based on F-test. The F-test showed that the predicted residuals are not jointly significant. As a result endogeneity is not a problem in the specification.

Second, a test is undertaken to discriminate between fixed and random effects. This is tested by applying Hausman (1978) procedure. The test statistics showed that the null hypothesis can't be rejected. In such cases the difference between the fixed and random effect estimators should be close to zero. And employing the random effects technique enables to get efficient and consistent estimator. As a result the estimation is undertaken by using random effects model (see Table 4.1).

Table 4.1. The calculated and critical values of for testing fixed and random effects model.

	g	MV	IV	SV	AV
Calculated statistics	17.2	9.97	16.99	10.82	11.04
Critical Value (5%)	$\chi_{10} = 18.3$	$\chi_{10} = 18.3$	$\chi_{10} = 18.3$	$\chi_{10} = 18.3$	$\chi_9 = 16.9$

NB: The political instability index is dropped during the fixed effects transformation as it is a dummy variable.

Last, but not least, a test is conducted concerning the one way and two way error components. An F-test is conducted to test the significance of time effects. The regression results showed that time effects are not significant as the calculated statistics is less than the critical value. Since there are large numbers of cross-sections compared to the time periods, the individual heterogeneity is taken as with the assumption that it exists.

Table 4.2 A test for one way and two way error component in the growth of GDP and sectoral level value added growth

	g	MV	IV	SV	AV
Calculated statistics	1.38	1.04	1.29	0.82	1.55
Critical Value (5%)	1.75	1.75	1.75	1.75	1.64

4.2 Discussion of Empirical Results

4.2.1 The Effects of Defense Burden on Growth

Most of the variables are with the expected sign and are statistically significant generally, and the Wald statistics shows that overall explanatory power is very high. In the GDP growth estimation, defense burden has negative effect. This effect is found to be significant. However, none of the interactive variables are significant in the GDP growth estimation. This implies the rejection of the second and third working hypotheses. The hypothesis of non-linear relationship is not supported as it has a sign contrary to expectation and insignificant. The hypothesis of the increased efficiency of resource utilization with simultaneous increase in defense spending is also not supported as it is not significant even though it has the expected positive sign.

As a result focus is given only to the defense burden by disregarding the two interactive variables (i.e., *DBSQR* and *DBGOV*). Thus the marginal effect of defense on growth of GDP is about -0.45.

The estimated real GDP growth equation is given as follows:

$$g = 6.98 + 0.51IS^{***} - 1.78POP^{***} - 0.15ES^* - 0.18GOV^* + 0.098INF^{***} -$$

(2.23) (0.17) (0.48) (0.09) (0.1) (0.03)

$$1.94M1G^{***} + 0.01INFL - 0.58PD^* - 0.45DB^{**} + 0.07DBSQR + 0.026DBGOV$$

(0.36) (0.02) (0.37) (0.23) (0.68) (0.02)

Wald chi2 (12) = 64.64, R² = 0.41, Heteroscedasticity: Chi square (11) = 12.9

Note: *** = 1%, ** = 5% and * = 10% level, respectively. Standard error of the coefficient estimates appear in parenthesis

The effect of defense burden is also negative in the three economic sectors like the effect on GDP growth and positive in one sector, i.e., in industry. A significant effect of defense burden is observed in the manufacturing and agriculture sector only. The square of defense burden and the interactive variable of defense burden and government expenditure are insignificant which implies rejection of the second and third working hypotheses at the sectoral levels too. As a result discussion of the effect of these two interactive variables on value added growth at sectoral level is unnecessary.

The largest effect is in the manufacturing followed by agriculture, with marginal effects of -0.97 and -0.86 respectively (see Table 4.3). This shows strong evidence for the negative effects at the aggregate as well as at sectoral level. The effect in the agricultural value added must be emphasized than the effect on manufacturing despite their magnitude. This is because agriculture constitutes the lion share of GDP of the Sub-Saharan African countries. As a result such a negative effect from defense on agriculture can cause poverty by reducing agricultural food supply in the region.

Defense burden is insignificant in the industry value added growth. The insignificant coefficient of defense burden in industry might be due to the less productive sub-sectors in it which are highly favored during military training for constructing camps, roads and training centers. There may not be any pronounced positive externalities as training centers and infrastructure are constructed in area which is not accessible to the society (Deger and Smith, 1983). The effect of defense burden in the service sector is also insignificant.

Table 4.3 The estimation result of sectoral value added growth regression

Explanatory Variables	Dependent Variables			
	MV	IV	SV	AV
IS	0.644* (0.038)	0.77** (0.34)	0.49** (0.25)	-
POP	-3.15*** (1.04)	-0.71 (0.91)	-0.93 (0.64)	-0.35 (1.108)
ES	-0.09 (0.195)	-0.46*** (0.16)	-0.076 (0.12)	-
GOV	-0.21 (0.214)	-0.42** (0.18)	-0.193 (0.132)	-0.084 (0.195)
INF	0.12* (0.074)	0.081 (0.06)	0.11** (0.044)	0.173*** (0.066)
INFL	0.05 (0.046)	-0.048 (0.039)	0.016 (0.025)	0.007 (0.04)
M1G	-2.79*** (0.82)	-0.41 (0.702)	-2.29*** (0.45)	-2.15*** (0.722)
PD	-1.27* (0.76)	-3.21** (1.51)	-0.755 (0.48)	-0.202 (0.73)
DB	-0.97* (0.57)	0.03 (0.44)	-0.26 (0.75)	-0.86* (0.45)
DBSQR	0.25 (0.152)	-0.011 (0.12)	0.016 (0.085)	0.179 (0.135)
DBGOV	0.05 (0.052)	0.014 (0.04)	0.057 (0.031)	-0.016 (0.045)
GFC	-	-	-	0.19* (0.104)
Constant	14.7*** (4.79)	9.56** (4.19)	5.48* (2.93)	7.92* (4.1)
Wald Test	$\chi_{11} = 40.17$	$\chi_{11} = 48.1$	$\chi_{11} = 54.13$	$\chi_{10} = 44.7$
R ²	0.35	0.44	0.39	0.37
Heteroscedasticity	$\chi_{11} = 7.5$	$\chi_{11} = 10.4$	$\chi_{11} = 9.6$	$\chi_{10} = 15.3$

Note: *** = 1%, ** = 5% and * = 10% level, respectively. Standard error of the coefficient estimates appear in parenthesis

Critical value for heteroscedasticity (5%): $\chi_{11}=19.6$ and $\chi_{10}=18.3$

To sum up, the effect of defense burden is unambiguously negative in the growth of GDP as well as in the growth of manufacturing and agriculture value added. Thus defense

burden is very harmful to the economic performance of the Sub-Saharan African countries.

From the other variables; investment is positive and significant at 1% in the GDP growth function, with a marginal effect 0.51. It is also positive and significant in sectoral level empirical evidences. The largest marginal effect is in the industry followed by manufacturing and industry, with marginal effects of 0.77, 0.64 and 0.49 respectively. Population growth is negative, which is consistent with the theory at least in the case of developing countries, and it is significant in the GDP growth. At sectoral level, a significant effect is found only in the manufacturing sector. The government expenditure net of expenditures on defense and public education generates a negative and significant estimate in the real GDP growth. This evidence is also consistent with the theory that government officials create inefficiency in resource allocation. The public expenditure on education is negative contrary to the expectation. This might be due to the data problem as various sources are used due to the high missing values or due to the inappropriateness of the public expenditure on education proxy for human capital. At sectoral level, it is negative but significant only in the industry (see Table 4.3).

From the uncertainty variables, the growth of money supply net the growth in potential GDP (M1G) is negative as expected. This implies that inflationary consequences arising from poor monetary policies are harmful to the growth of GDP. This evidence is also consistent in the manufacturing, service and agricultural sectors. Inflation (INF) is positive and significant in the real GDP, manufacturing, service and agriculture sectors. This positive evidence might be because of the importance of some sort of moderate

inflation if that doesn't arise from the poor management of money supply. The standard deviation of inflation is, however, insignificant in the growth of GDP as well as in the value added growth of the economic sectors. The dichotomous dummy variable for political instability, i.e., PD is negative in all cases but it is significant only in the value added growth of manufacturing and industry (see Table 4.3). The growth of fertilizer consumption per hectare of arable land is found to be positive and significant estimate in the agriculture value added growth.

4.2.2 Determinants of Defense Burden

The results suggest a well-specified relation in which the size of army to labor force (AP), the lagged value of defense burden (DBI) and the civil war dummy (WAR) have a significant positive effect on the defense burden while GDP and population are negative and significant, that are contrary to the expectation. The significant negative effect of GDP and population implies that the normal good nature and public good effects of defense do not seem important. Though insignificant, the proportion of government expenditure in GDP is positive as expected, while the openness and the dummy for central government variables are found to be negative implying that those countries with more open economies and centralized government tend to have lower military burdens.

The dominant effect seems to be the proportion of army in labor force followed by the civil war dummy. The lagged variable, reflecting the inertia or hangover in defense spending is also the third important variable that increases the size of defense burden. Thus it can be argued that the size of armed forces to the total labor force, war and the

ratchet effects are likely to favor defense burden in the region. The model is a good fit as it has large Wald statistics.

The estimation result for the determinants of defense burden is given as follows:

$$\begin{aligned}
 DB = & 9.63^{***} - 1.27IN^{***} - 0.43IGDP^* + 0.017GE + 1.57AP^{***} + \\
 & (5.68) \quad (0.43) \quad (0.25) \quad (0.03) \quad (0.29) \\
 & 0.23DBI^{**} - 0.26Cent + 0.76WAR^* - 0.004XM \\
 & (0.097) \quad (0.40) \quad (0.44) \quad (0.008)
 \end{aligned}$$

Wald chi2 (8) = 80.51, $R^2 = 0.49$; Heteroscedasticity: Chi Square (8) = 13.2

Note: *** = 1%, ** = 5% and * = 10% level, respectively. Standard error of the coefficient estimates appear in parenthesis

4.3 Specification Sensitivity

Reported standard errors provide an indication of only one type of uncertainty attached to the coefficient estimates: that arising from sampling variations. But the estimates are sensitive to a variety of other aspects of the specification. In particular, the statistical estimate obtained for the coefficients of interest will depend on: (a) the data sources used, (b) the other variables included in the equation, (c) the estimation method employed, and (d) the samples used (Deger and Smith, 1983; Smith, 1986; Faini, R et al, 1984).

In this section an attempt is made to address the sample problem. Countries differ substantially in the natural environments they face and in social and economic structure. As a result it may not be appropriate to assume the same relationship for all of them. There are a large number of subgroups in to which the sample could be divided. A more

relevant sub-grouping is the income level categories of the World Bank⁵ definition, in which the Sub-Saharan African countries lie in the; low income, lower middle income⁶ and upper middle income⁷ range of the classification. To check the sensitivity of the estimates to these income differences, lower middle and upper middle income countries are excluded from the sample and regression is undertaken in the low income countries of the Sub-Saharan Africa.

The estimation result is more or less similar to the result found for the total sample case both in sign and significance. The effects of defense burden are negative and significant in the growth of GDP as well as in the value added growth of manufacturing and agriculture. The effects in the industry and service sector are again insignificant like the total sample case. An important difference is that the negative effects in the case of low income countries are higher compared to the evidence in the total sample countries. The marginal effects in the growth of GDP, manufacturing and agricultural value added are -0.53, -1.28 and -1.0 respectively (see Table 4.4 and 4.5). This implies that defense burden is harmful especially in the poorer countries of the Sub-Saharan Africa. The square of defense burden (DBSQR) and the interactive variable of defense burden and government expenditure (DBGOV) are again disregarded from the discussion as they appear insignificant like the total sample cases.

⁵ According to World Bank (2006) those countries with per capita income of \$825 or less are classified as Low Income, Lower Middle Income with \$826-3,255, and Upper Middle Income with \$3,256-10,065 and High income with \$10,066 or more.

⁶ include Angola, Cape Verdi, Namibia and Swaziland from the sample

⁷ includes South Africa, Botswana, Seychelles, Mauritius from the sample

The estimated real GDP growth in the low income Sub-Saharan African countries is given as follows:

$$g = 7.87 + 0.45IS^{**} - 1.82POP^{***} - 0.19ES^{*} - 0.2GOV^{**} - 0.1INF^{***} - 1.96MIG^{***} \\ (2.3) \quad (0.18) \quad (0.5) \quad (0.09) \quad (0.1) \quad (0.03) \quad (0.36) \\ + 0.01INFL - 0.54PD - 0.537DB^{**} + 0.09DBSQR + 0.01DBGOV \\ (0.02) \quad (0.37) \quad (0.24) \quad (0.07) \quad (0.02)$$

Wald chi2 (11) = 64.54, $R^2 = 0.38$, Heteroscedasticity: Chi Square (11) = 11.03
 Note: *** = 1%, ** = 5% and * = 10% level, respectively. Standard error of the coefficient estimates appear in parenthesis

Table 4.4 The estimation Result of value added growth in the various economic sectors in the LIC category

Explanatory Variables	Dependent Variables			
	MV	IV	SV	AV
IS	0.61* (0.36)	0.77** (0.36)	0.48* (0.26)	-
POP	-3.38*** (1.06)	-0.57 (0.96)	-1.009 (0.67)	-0.21 (0.19)
ES	-0.06 (0.21)	-0.40** (0.191)	-0.07 (0.134)	-
GOV	-0.188 (0.05)	-0.36* (0.20)	-0.19 (0.14)	-0.143 (0.204)
INF	0.12* (0.075)	0.081 (0.06)	0.109** (0.044)	0.177*** (0.067)
INFL	0.05 (0.046)	-0.05 (0.03)	0.01 (0.02)	0.007 (0.04)
MIG	-2.8*** (0.82)	-0.33 (0.70)	-2.31*** (0.46)	-2.15*** (0.722)
PD	-1.28* (0.80)	-3.29** (1.63)	-0.78* (0.47)	-0.13 (0.74)
DB	-1.28* (0.54)	0.122 (0.47)	-0.27 (0.80)	-1.00* (0.48)
DBSQR	0.25 (0.16)	-0.02 (0.136)	0.015 (0.089)	0.21 (0.142)
DBGOV	0.061 (0.056)	0.018 (0.049)	0.059 (0.036)	-0.03 (0.047)
GFC	-	-	-	0.19* (0.047)

				(0.104)
Constant	15.1 ^{***} (4.79)	4.52 ^{**} (4.19)	5.68 [*] (3.12)	7.92 [*] (4.1)
Wald Test	$\chi_{11} = 36.89$	$\chi_{11} = 34.54$	$\chi_{11} = 39.97$	$\chi_{10} = 33.7$
R ²	0.32	0.42	0.37	0.32
Heteroscedasticity	$\chi_{11} = 6.92$	$\chi_{11} = 9.94$	$\chi_{11} = 8.76$	$\chi_{10} = 11$

Table 4.5 Comparison of the marginal effects of defense burden in the low income sample and total sample countries of the Sub-Saharan Africa

Dependent variable	Marginal effect of Defense burden	
	In the Low income countries	In the total sample countries
g	-0.537 [*]	0.45 [*]
MV	-1.28 ^{**}	-0.97 ^{**}
IV	0.122	0.03
AV	-1.00 [*]	-0.86 [*]
SV	-0.27	-0.26

***, ** and * implies significant at 1%, 5% and 10% respectively

The empirical result for the determinants of defense burden is also more or less similar with the total sample case. The proportion of army to the total labor force, the lagged dependent variable and the civil war dummy are again positive and significant in the case of low income countries. The major determinant of defense burden in the low income countries is the civil war followed by the proportion of the army size in the total labor force and the lagged dependent variables. In addition the civil war dummy is significant at 1% and has higher effect than the effect in the total samples suggesting that war is the major determinant of defense burden in the low income countries of Sub-Saharan Africa (see Table 4.6).

Table 4.6 Comparison of defense burden determinants in the low income sample and total sample countries

Dependent variable –DB	In low income	In total sample
ln(N)	-0.691 [*]	-1.27 ^{***}
ln(GDP)	-0.44 [*]	-0.43 [*]
GE	0.05	0.01
AP	1.18 ^{***}	1.57 ^{***}
DBI	0.112 ^{***}	0.23 ^{***}
WAR	1.23 ^{***}	0.76 [*]
XM	-0.00	-0.00
Cent	-0.062	-0.031
Wald χ_8	82	80
R ²	0.55	0.49

***, ** and * implies significant at 1%, 5% and 10% respectively

CHAPTER-FIVE

5 Conclusion and Recommendation

5.1 Conclusion

The estimation result has strong implications concerning the effects of defense burden. The empirical evidence goes against the findings of Benoit and others regarding the positive effects of defense on growth of GDP in the LDCs. Defense burden have a negative and significant effect in the growth of GDP. This brings clear answer to the effects of defense burden on growth which was ambiguous due to the lack of sound empirical evidence about the effect of defense burden on growth.

The empirical analysis in the sectoral level regression is also informative. The result shows that defense burden affects growth of output in manufacturing and agriculture sectors negatively. These negative effects in the manufacturing and agriculture are significant. This can be used as further evidence that high defense burdens may lead to problems with domestic manufacturing output and agricultural food supply. Especially, the negative effect on agricultural output must be pronounced than manufacturing and industry as agriculture is the dominant economic base in the Sub-Saharan African countries which in turn has implication on the extent of the persistent poverty. The effect of defense burden in the service sector and industry sector is, however, insignificant.

DBSQR is positive, contrary to the expectation, and insignificant. The interactive variable between government expenditure and defense burden (DBGOV) on the other hand maintained its expected positive sign but it is not significant. As a result the second and third working hypotheses can't be supported.

From the other variables, Investment is found to be significant determinant of growth of GDP as well as sectoral value added growth. Population growth is also significant and negative. The proxy for human capital is negative contrary to the expectation which might be due to the inappropriateness of public expenditure on education or due to the poor quality of the data due to the poor quality of the data. The variable for fiscal policy (GOV) is negative and significant in the growth of GDP and industry value added. The growth of money supply net of the growth in potential GDP is found to be negative and significant which enables to argue that inflationary consequences arising from the poor management of money are harmful to the growth of output. Inflation is positive and significant which might be because some sort of moderate inflation is important for the economic growth if it doesn't arise from the poor management of money. The standard deviation of inflation is, however, insignificant. The political instability index (PD) is negative and significant.

In the empirical analysis of determinants of defense burden, the proportion of armed forces in total labor force, the lagged values of the defense burden and civil war dummy are found to be positive and significant, while Population size and GDP are negative and significant implying that the public good and normal good nature don't seem important.

The specification sensitivity analysis showed the advantages of focusing the analysis on relatively homogeneous groups of countries. The evidence concerning the effect of defense burden is more or less similar with the total sample case. The difference lies in the magnitude of the effect. Most importantly, the negative effects on the growth GDP and value added growth of manufacturing and agriculture are negative and significant like the total sample case but with larger marginal effect in the case of poorer countries of the region. This implies that the negative effect of defense is especially destructive in the low income Sub-Saharan African countries. Thus the study supports the proposition that an increased military effort lead to lagging GDP growth, manufacturing output and domestic agricultural food supply in the Sub-Saharan African countries as a whole and it is especially destructive in the low income countries of the region.

In sum, it is enough to know that the effect of defense is negative in the agriculture sector to make generalizations on the overall economic performance as agriculture is the pillar of the economy in the Sub-Saharan African countries. The strong evidence on the agriculture together with the significant and negative effect on the real GDP growth and manufacturing value added will make the defense sector as destructive to the overall economy. Empirical estimates support the view that defense spending does not increase growth rates in the Sub-Saharan African countries. Taking all the aggregate and sectoral level evidences together, there is a negative relationship between the growth of output and defense burden.

5.2 Policy Recommendation

A strong and important result that emerges from the analysis is that there is strong evidence of defense spending having negative economic effect both on the total as well as in the low income countries of Sub-Saharan African. Even though increased defense spending may have some beneficial effects, the effects via the productive sectors are significantly negative which result unambiguously negative effect on the overall economic performance. Based on the empirical result of the study, the following policy recommendations are set:

- The first policy implication is that increased defense burden leads to slow growth in the Sub-Saharan African countries. As a result reducing defense burden will enhance the process of economic development in the region.

- Reducing defense burden is a good step. However, reallocating resources from the defense sector to the civilian may not result in increased growth unless the civilian allocation favors the productive sectors. In order to foster economic growth, resources should be reallocated to the productive sector especially to the manufacturing and agriculture.

- Governments have to be legitimate in reducing civil as well as external wars. This is important as war is found to be the major determinant of size of defense burden with largest marginal effect especially in the low income Sub-Saharan Africa.

It is hoped that a contribution has been made by the provision of a stimulus for further research on the topic especially as to how defense sector affects the real GDP growth as well as value added growth of the productive and non productive civilian sectors. Considerable work remains to be done on the theoretical and empirical levels. Thus scholars are highly encouraged to join in these research efforts.

References

- Admasu Shiferaw (2002) "Private Investment and Public Policy in Sub-Saharan Africa: An Empirical Analysis." ORPAS-*The Institute for Social Studies*, Working Paper 356
- Alemayehu Geda and Befekadu Degefe (August 2005) "Explaining African Growth Performance: The Case of Ethiopia" (AERC Explaining African Economic Growth Project)
- Antonakis, N., (1997) "Military Expenditure and Economic Growth in Greece, 1960-90." *Journal of Peace Research*, Vol. 34, No., pp. 89-100
- Asante, Y., (2000) "Determinants of Private Investment Behavior" *African Economic Research Consortium*, Nairobi, AERC Research Paper 100.
- Atesoglu, H. S. and Mueller, M. J. (1990) "Defense Spending and Economic Growth," *Defense Economics*, 2 (1), 89–100.
- Bader, A., and Qarn, A., (2003) "Government Expenditure, Military Spending and Economic Growth: Causality Evidence from Egypt, Israel and Syria"
- Baltagi, B.H. (1995) *Econometric Analysis of Panel Data*. New York: Wiley.
- Banerjee, A. (1999) "Panel Data Unit Roots and Co integration: An Overview," *Oxford Bulletin of Economics and Statistics*, Special issue, 607-629
- Barro, Robert J. (1991) "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics* 106, vol. 2 (May): 407-433.
- _____ (2003) Education and Economic Growth (www.google.com)

Ben Habib, J. and M. Spiegel (1994) "The Role of Human Capital in Economic Development: Evidence for Cross-Country Data," *Journal of Monetary Economics*, 34:143-173.

Biswas, Basudeb and Ram, Rati (1986) "Military Expenditures and Economic Growth in Less Developed Countries: An Augmented Model and further Evidence", *Economic Development and Cultural Change*, 34(2), 361-72.

Benoit, E. (1973) "Defense and Economic Growth in Developing Countries," Boston: Lexington Books.

_____ (1978) "Growth and Defense in LDCs," *Economic Development and Cultural Change* **26**, 271-280.

Benos, N., (2004) "Fiscal Policy and Economic Growth: Empirical Evidence from OECD Countries," *Discussion paper* 2005-01.

Bose, N., M.Emranul Haque, and Denise R.Osborn (2003) "Public Expenditure and Economic Growth: A Disaggregated Analysis for Developing Countries," *Journal of Economic Literature*

Brempong, K.G (1989) "Defense Spending and Economic Growth in Sub-Saharan Africa: An Econometric Investigation," *Journal of Peace Research*, Vol.26, No.1, pp.79-90.

------(1992) "Do African Governments favor Defense in Budgeting?" *Journal of Peace Research*, Vol.29, No.2, PP.191-206

------(2002) "Researching Military Expenditures in Africa: Findings and Lessons for Researchers", Paper presented at the Workshop on Military Budgeting Process in African Countries, Accra, Ghana.

- Chandra, P.A and K. Sen (2001) "Modeling Business Investment in Developing Countries: An Indian Case-Study." *Journal of Economic Literature*
- Chowdhury, A.R., (1991) "A Causal Analysis of Defense Spending and Economic Growth," *Journal of Conflict Resolution* **35**, 80-97.
- Collier, P. and J.W.Gunning (1999), "Explaining African Economic Performance," *Journal of Economic Literature*, 37, (March) pp.64-111.
- _____ (1999) "Why Has Africa Grown Slowly?" *The Journal of Economics*, Vol.13, No.3, (Summer) pp.3-22.
- Craft, C., and Joseph P.Smaldone (2002) "The Arms Trade and the Incidence of Political Violence in Sub-Saharan Africa, 1967-97". *Journal of peace research*
- Crafts, N., (1996) "Post Neoclassical Endogenous Growth Theory: What are its Policy Implications?" *London School of Economics*.
- Dakurah, H., S. Davies and R. Sampath (2001) "Defense Spending And Economic Growth In Developing Countries: A Causality Analysis," *Journal of Policy Modeling* **23**, 651-658.
- Deger, S. (1986) "Economic Development and Defense Expenditure," *Economic Development and Cultural Change*, Vol.35, No. 1, pp.179-196.
- Deger, S and R. Smith (1983) "Military Expenditure and Growth in Less Developed Countries", *Journal of Conflict Resolution*, vol.27, no. 2, pp. 335-353.
- Dewan, E. and S. Hussein (2001) Determinants of Economic Growth; *Panel Data Approach*. Working Paper 01/04. Reserve Bank of Fiji

- Dunne, Paul and E. Nikolaidou (2001) "Military Expenditure and Economic Growth: A Demand in Supply Model for Greece, 1960-96," *Defense and Peace Economics*, vol. 12(1), pp. 47-67.
- Dunne, P. and D. Watson (2000), "Military Expenditures and Employment in South Africa", *Defense and Peace Economics*, 11, 587-596.
- Dunne, P. and D. Vougas (1999) "Military Spending and Economic Growth in South Africa," *Journal of Conflict Resolution*, vol. 43(4), pp. 521-537.
- Dunne, J.P, R. Smith and D. Willenbockel (2004) "Models of Military Expenditure and Growth: A Critical Review."
- Dunne, J.P and Nadir A.L.Mohammed (1995) "Military Spending in Sub-Saharan Africa: Some Evidence for 1967-85," *Journal of Peace Research*, Vol.32, No.3, pp. 331-343.
- Easterly, W and R. Levine (1997) "Africa's Growth Tragedy: Policies and Ethnic Divisions," *The Quarterly Journal of Economics*, vol.112, No.4, pp.1203-1250.
- Faini, R., Annez, P. and Taylor, L. (1984) "Defense Spending, Economic Growth, and Growth Evidence among Countries Over Time," *Economic Development and Cultural Change*, 32 (3), 487-498.
- Feder, Gershon (1983) "On Export and Economic Growth" *Journal of Development Economics* in K. Hartley and T. Sandler [eds], pp. 275-307.
- Fosu, A.K. (1992). "Political Instability and Economic Growth: Evidence from Sub-Saharan Africa." *Economic Development and Cultural Change* 40(4): 829-841.
- Mallik, G. and A.Chowdhury, (2001) "Inflation and Economic Growth: Evidence from Four South Asian Countries," *Asia-Pacific Development Journal*.

Gallup, J.L, J. Sachs, and A.D. Mellinger (1998) "Geography and Economic Growth," Paper prepared for the Annual Bank Conference on Development Economics, Washington D.C., April 20-21.

Greene, W.H (2003) "Econometric Analysis", *Prentice Hall*, New York, Fifth edition

Haile Kebret (1997) "Military Expenditures and Economic Performance: Lessons from the Ethiopian Economy" *Ethiopian Journal of Economic*, 6(1) in Alemayehu Geda and Befekadu Degefe (August 2005) "Explaining African Growth Performance: The Case of Ethiopia"

Hassan, M. K (2003) "FDI, Information Technology and Economic Growth in the MENA Region" University of New Orleans, 10th ERF Paper.

Harvey Starr; Francis W.Hoole; Jeffrey A.Hart and John R.Freeman (1984) "The Relationship between Defense Spending and Inflation," *The Journal of Conflict Resolution*, Vol.28, No.1, pp. 103-122.

Hausman, J. A., (1978) "Specification Tests in Econometrics." *Econometrica*, Vol.46 (6).

Kollias, Christos, and S. Makrydakis (1997) "Is there a Greek-Turkish arms race?" Evidence from cointegration and causality tests, *Defense and Peace Economics* 8:355-79.

Kollias C., N. Mylonidis and S. M. Paleologou (2005) "A Panel Data Analysis of the Nexus between Defense Spending and Growth in the European Union," *Quarterly Review in Economics and Finance* (forthcoming).

Landau, D., (1994) "The Impact of Military Expenditures on Economic Growth in the Less Developed Countries." *Defense and Peace Economics*, 5(3):205-220

- Lebovic, J and Ishaq, A. (1987) "Military Burden, Security Needs and Economic Growth in the Middle East," *Journal of Conflict Resolution* 31(1):106-138.
- Levine, R and Renelt, D (1992) "A Sensitivity Analysis of Cross Country Growth Regression," *American Economic Review*, 82(4) 942-63.
- Lim, D., (1983) "Another Look at Growth and Defense in Less Developed Countries," *Economic Development and Cultural Change*, Vol.32. No.2, pp.377-384.
- Lindon, M. (1992) "Military Expenditure, Government Size and Economic Growth in the Middle East in the Period 1973-85," *Journal of Peace Research*, vol.29, No.3, pp.265-270.
- Looney, R.E, (1990) "The Role of Military Expenditures in the African Economic Crisis," *Jerusalem Journal of International Relations* 12(1), pp 76-101.
- Mankiw, N.G (2002), *Macroeconomics*, McGraw Hill, USA
- Mankiw, N. G., D. Romer and D. N. Weil (1992) "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, Vol. 107, pp. 407-437.
- Makdisi, S, Zeki Fattah and Imed Liman (2002) "Determination of Growth in the MENA Countries," *Arab Planning Institute Working Paper*.
- Mbaku, J.M., "Political Democracy, Military Expenditures and Economic Growth in Africa." *Scandinavian Journal of Development Alternatives* 12(1), 1993, pp 49-64.
- McMillan, S.M., (1992) "Economic Growth and Military Spending in South Africa," *International Interactions* 18(1), pp 35-50.
- Mylonidis, N., (2006) "Revisiting the Nexus between Military Spending and Growth in the European Union" *Department of Economics, University of Ioannina*.

- Mohammed, N., (1992) "Military Expenditure in Sub-Saharan Africa: A comparative Analysis and Case Study of the Sudan," *Unpublished PhD Dissertation*, University of Cambridge
- Nabe, O., (1983) "Military Expenditure and industrialization in Africa", *Journal of Economic Issues*, vol.18, no.2, pp.575-587
- Ram, Rati., (1986) "Government Size and Economic Growth: A New Framework and Some evidence from Cross-Section and Time Series Data," *American Economic Review*, 76(1), 281-4
- Rasler, K. and W.Thompson (1988) "Defense Burden, Capital Formation, and Economic Growth: The Systemic Leader Case," *The Journal of Conflict Resolution*, Vol.32, No.1, pp. 61-86.
- Rosch, R.M., (1988) "Third World Militarization Security Webs and the States they Ensnare," *Journal of Conflict Resolution*, vol. 32, no.4, December, pp.671-698.
- Rothschild, Kurt W. (1973) "Military Expenditure, Export and Growth," *kyklos*, 26(4), 405-26 cited in K. Hartley and T. Sandler [eds], pp. 275-307.
- Sandler, T. and K. Hartley (1995) "The Economics of Defense," Cambridge University Press.
- SIPRI (2006) *Yearbook 2006: World Armaments and Disarmament*, Oxford: Stockholm International Peace Research Institute, Oxford University Press.
- Smaldone, J. P. (2006) "African Military Spending: Defense versus Development?" *African Security Review Vol.15 No 4*
- Smith, R., (1980) "Military Expenditure and Investment in OECD Countries, 1954–1973," *Journal of Comparative Economics*, 4 (1), 19–32.

Stroup, M. D. and J. C. Heckelman (2001) "Size of the Military Sector and Economic Growth: A panel data analysis of Africa and Latin America," *Journal of Applied Economics*, vol. IV, pp. 329-360.

Solow, R. (1956) "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, 70: 155-173.

Uinbasoglu, M. and C. Doucouliagos (2004), "Institutions and Economic Growth: A Systems Approach"

Wooldridge, J.M. (2005) "Econometric Analysis of Cross Section and Panel Data." Cambridge: *MIT Press*

World Bank (2003, 2006), World Development Indicators.

World Military Expenditures and Arms Transfers (WMEAT), Various Years.

Yildirim, J. and S. Sezgin (2002) "Defense, Education and Health Expenditures in Turkey, 1924–96," *Journal of Peace Research*, vol. 39, no. 5, 2002, pp. 569–580.

Appendix

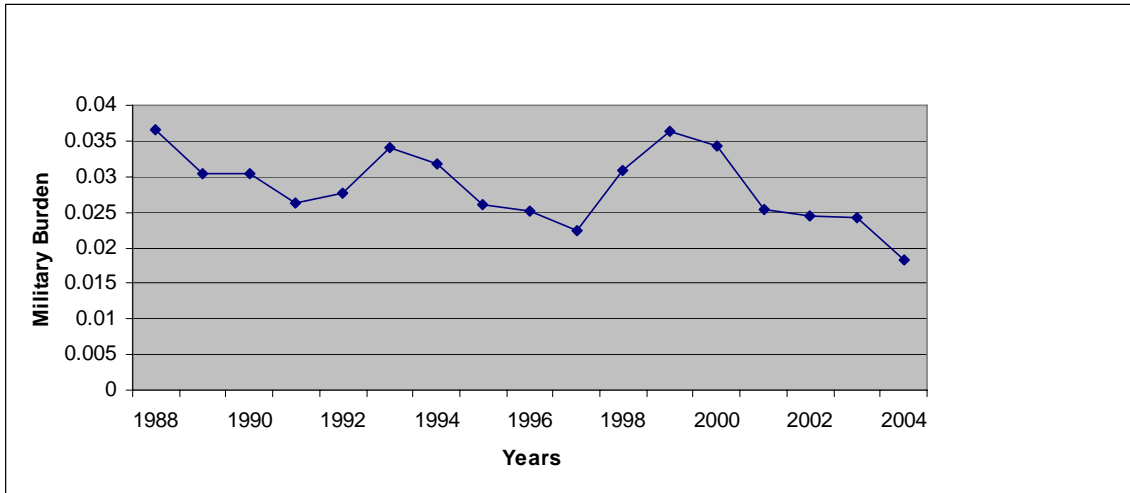
Annex-1. The list of countries in the study with the average value for some of the variables for the period 1983-2002

Country Name	MV	IV	SV	AV	DB	POP	IS	GFC	g
Angola	-1.89415	4.618568	0.390902	1.78292	6.106667	2.784072	23.55258	4.331023	3.122606
Botswana	6.645348	5.657291	10.8651	1.208837	3.913333	2.824341	26.89047	13.70808	12.53628
Burkina Faso	1.631651	2.841505	3.827501	3.849599	1.512494	2.40393	19.94925	-3.20271	7.320705
Brundi	0.307909	2.064557	2.168004	1.43443	5.046667	2.417935	12.78024	50.89405	3.703687
Cameroon	2.180766	0.864964	0.248	3.49	1.20	2.66	18.04	9.62	4.75
Cape Verdi	6.352412	5.514654	5.425048	3.468265	0.990909	2.183546	27.20414	21.2784	9.034272
Cent. African Republic	1.335125	1.14	-1.68452	2.854831	1.342857	2.24369	11.61408	11.5646	4.304689
Chad	2.34	6.640502	4.327709	4.770636	1.533333	2.851958	13.28041	34.81336	7.463974
Congo, Dem Rep	-4.2275	-6.2256	-4.96398	2.296374	1.1	2.995047	10.21336	18.16307	1.217677
Coted'Ivoire	3.183417	3.299323	0.526641	2.041315	1.2	3.125903	11.98389	59.28019	5.671454
Ethiopia	2.031803	2.129527	4.828397	2.256082	4.943327	2.612411	15.06076	10.69275	7.217149
Gambia,	4.031991	4.898228	4.020212	1.967949	0.897083	3.567104	18.95055	4.492493	5.96308
Ghana	2.767605	5.401099	6.255555	2.603194	0.65	2.761658	16.41133	24.11135	6.217579
Guinea	4.65895	4.036884	10.72303	4.52215	1.844444	2.541978	18.26157	29.37628	6.798047
Guinea-Bissau	2.837906	5.403144	3.429192	3.1975	1.571429	2.793236	25.77603	34.18311	4.786009
Kenya	11.5528	2.621248	3.778798	2.306018	1.906667	2.803388	15.40423	12.33887	5.755632
Lesotho	7.220449	7.633518	3.861366	2.165412	2.868235	1.405169	45.94185	3.051717	6.681054
Madagascar	1.167668	2.587019	1.24369	2.103324	1.178571	2.824015	12.36478	-0.8181	3.819139
Malawi	1.465072	2.147487	2.468896	5.787713	1.046667	2.457526	14.78907	68.32155	6.274742
Mali	3.278919	5.993117	2.708871	3.663236	1.836235	2.513848	20.89372	14.77616	7.467637
Mauritania	-2.71993	2.923271	5.330769	2.928729	2.563759	2.52767	23.24926	10.43193	6.895174
Mauritius	7.238024	7.0838	5.882427	1.658679	0.312726	0.999567	24.36665	223.7674	8.776936
Mozambique	18.73121	18.04043	5.032914	7.23982	1.325	2.234581	28.9775	20.83145	9.352682
Namibia	3.787687	2.706706	4.014836	3.426204	2.908333	3.152459	18.87881	19.47275	5.550044

Niger	1.331264	1.239068	3.62821	3.550193	1.1	3.278469	10.10111	60.91368	4.007305
Nigeria	1.842288	2.723131	4.317441	3.904248	0.886667	2.820097	18.48606	128.5975	6.450896
Rwanda	-0.07472	1.959717	3.380811	3.236986	5.553333	1.978338	15.20175	286.4819	6.586327
Senegal	3.613405	4.059262	2.829169	1.349253	1.598047	2.676845	14.73084	3.500347	5.819902
Seychelles	8.894223	8.236849	3.503166	0.876837	2.8	1.128532	27.24142	146.4081	6.898009
Sierra Leone	4.251418	-0.44984	0.406929	-12.8592	2.78	2.405056	7.510111	38.79581	1.334846
South Africa	1.466999	0.802412	2.535691	2.569724	2.386667	2.23991	17.85727	628.7899	4.728818
Sudan	2.785991	4.624923	4.086504	5.22159	3.092857	2.328433	12.8267	6.507488	6.386906
Swaziland	9.532623	8.107752	4.259842	1.677344	2.071429	2.967237	21.41783	144.8068	9.279515
Tanzania	3.256871	4.895726	3.497046	3.504669	1.47	2.69178	19.60998	-11.5718	10.61742
Togo	4.484624	3.314061	1.529105	4.828376	1.951693	2.874507	16.77923	9.966453	4.358985
Uganda	9.002723	8.809977	6.097981	3.363804	2.226667	3.018353	13.98853	98.89	7.594351
Zambia	3.064286	0.554726	1.655847	4.460027	1.708278	2.578209	12.74374	-	-
Zimbabwe	0.08335	-0.42871	2.720496	2.557844	3.66	2.633095	16.91914	-1.45113	3.469692

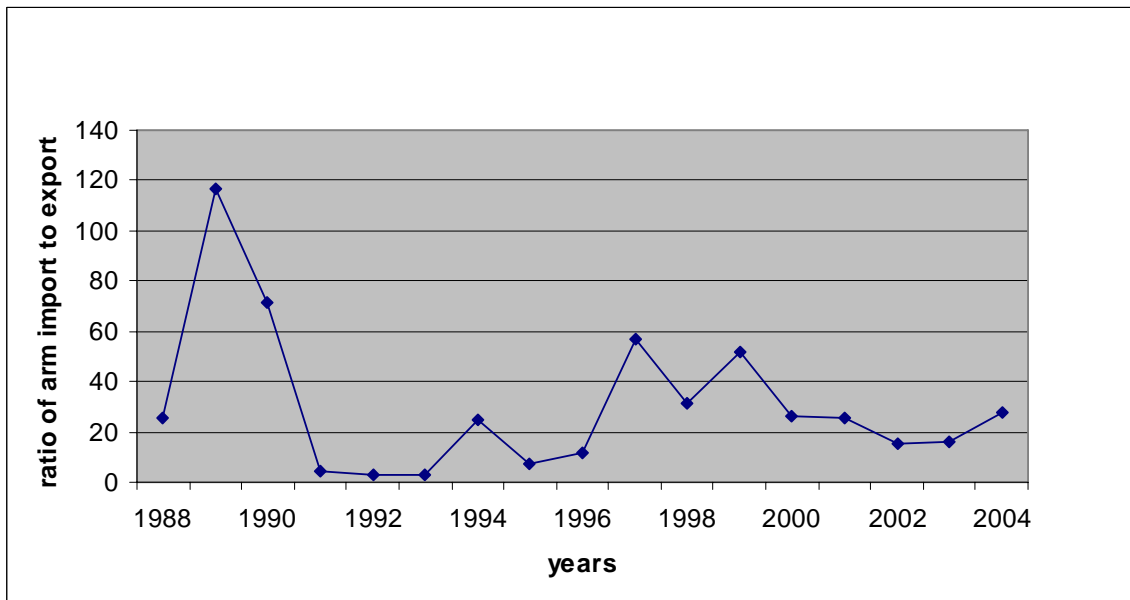
Source: WDI (2006)

Annex-2. The trend of Defense Burden in the Sub-Saharan African Countries in the period 1988-2004



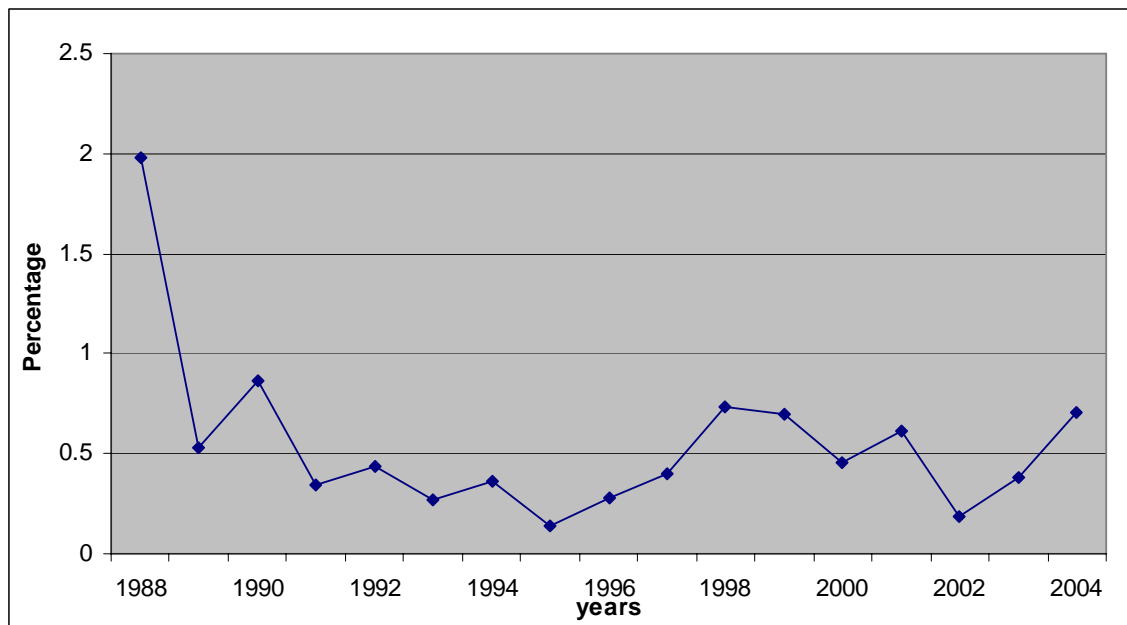
Source: SIPRI (2006)

Annex-3 The ratio of arm imports to arm exports in the Sub-Saharan African countries



Source: SIPRI (2006)

Annex-4 The percentage of arm imports to total imports in the Sub-Saharan African countries



Source: SIPRI (2006)

Declaration

I, the undersigned, declare that this thesis is my own original work and has not been presented in any other University. All sources of materials used for this thesis have been duly acknowledged.

Declared by

Name: Kefyalew Endale Adane

Signature: _____

Date: July 2007

Place and Date of Submission

Faculty of Business and Economics

Department of Economics

July, 2007