An application of the augmented Solow model to measure the impact of military spending on economic growth in Uganda for the period 1962-2018.

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Abstract

This paper provides a case study of the impact of military spending on economic growth in Uganda using an exogenous dynamic growth model and time-series data over the period 1962-2018. This is achieved by estimating and appraising a sample inclusive of periods not covered in previous studies that resulted in structural changes to the Ugandan economy such as conflict and currency devaluations. The results indicate that there is a significant negative effect of a military burden on growth in the long run and short-run when aid is not included as an explanatory variable. Foreign aid increases the magnitude of the regression coefficients however there is no evidence that aid increases the military burden. Overall, the ARDL approach to cointegration supports the data and is effective at providing empirical proof to seemingly axiomatic statements on the military spending and growth relationship. [Word Count: 9 794]

Introduction

In the Third World, countries have been increasing military expenditure in response to demanding security concerns as regional hostilities develop and the risk of civil conflict requires the defense forces to play a more important role in government (Deger and Smith, 1985). The majority of major conflicts since the end of the 2nd World War have occurred in the Third World leading to the loss of tens of millions of lives which raises numerous issues from a political, social, and moral perspective. When The Second World War had ended and many Western nations particularly in Europe were enjoying unprecedented peace and prosperity, numerous African countries continued to be troubled by war and poverty. For example, the International Institute for Strategic Studies estimated that approximately 8.5% of country-years in Africa are conflict years compared to approximately 5% in the rest of the world since 1950. Within the field of political science, there is strong evidence that suggests that conflict is nothing new in Africa (Brecke, 1999). Research by Besley and Reynal-Querol (2014) shows that a

history of conflict is positively correlated with i) a greater incidence of postcolonial conflict ii) reduced trust in society resulting in gravitation toward ethnic identity away from national identity. Third, historical conflict is negatively correlated with subsequent patterns of development. This is especially true in the case of Uganda, where there was a sense of optimism following Independence only for the country to be plagued with conflict and economic mismanagement in the decades which followed. The rise of Idi Amin on 25 January 1971 resulted in the heightened militarization of a country already structured around the armed forces in both pre and post-colonial times. (Okoth, 1993).

The Ugandan military burden is among the highest in Africa despite the country being classified as a Least Developed Country (LDC). For example, military expenditure as a share of Gross Domestic Product (GDP) in Kenya has consistently been less compared to Uganda since both countries gained independence from British rule, with a greater military burden occurring in only 8 years over the 55 years beginning in 1963 and ending in 2017. The Kenyan economy however ranks higher on the Human Development Index (HDI) and has a higher per capita GDP. Uganda recently expanded its military expenditure and the deployment of military personnel as part of the African Union Mission in Somalia (AMISOM). This has required the country to commit substantial resources in terms of money, personnel and equipment. For example, until late 2011, Uganda and Burundi were the only troop-contributing countries to AMISOM providing soldiers funded by donor-support on a similar model used during the African Union Mission in Burundi operation from 2003-2004. Defense assistance has therefore played a major role in Uganda's budget for security operations.

The relationship between military expenditures and economic development is a greatly researched and controversial topic. Empirical evidence for developed countries indicates that military expenditure has a considerable negative effect on capital formation which significantly reduces the rate of economic growth even when the effects of positive spin-offs are allowed for (Smith, 1980). In contrast, for less developed countries (LDCs) the statistical evidence from the seminal work by Benoit (1972) indicated the opposite - that there is a positive correlation between military

expenditure and the growth rate. Although there is no clear-cut answer to the question of how military spending affects economic growth, most empirical evidence tends to support a negative effect. Early research largely focused on single-equation regression models, followed by simultaneous equation models. Recently growth models which incorporate growth theory have been applied in defense economics research with superior results to earlier methods. Within the empirical literature, authors have further proposed a non-linear relationship between military expenditure and economic growth which has been estimated employing a logistic smooth transition regression.

This paper makes use of the extensive literature on the defense-growth relationship to produce an application to Uganda that has recently experienced a surge in military spending mainly in response to terrorist activity in the Horn of Africa. Although the literature is extensive, it is broad with few references to case studies of Uganda. Instead, the focus has been on panel studies of developing countries and this paper adds to the literature by employing more recent modeling and estimation techniques to answer the question: What has been the short-run and long run impact of military spending on economic growth in Uganda? While poverty and underdevelopment have largely characterized Uganda since independence the country's economy has experienced significant investment and high rates of GDP growth since the Financial Crisis of 2007-2008. Uganda, therefore, makes an interesting case study of the economic effects of militarization. Using neoclassical theory, an augmented Solow model is applied to Ugandan data as a general model of economic growth and augmented with the addition of military spending and foreign aid as explanatory variables. The model is then estimated with the Autoregressive Distributed Lag (ARDL) approach to cointegration. The ARDL model is chosen because it allows the data to determine the particular short-run dynamics. The paper is structured into five sections: section two reviews the Neoclassical, Keynesian, Marxist and Institutional theory of military spending including a review of empirical techniques found in the literature. Section three describes the Ugandan economic and security context. Section four covers the model specification, data, and estimation method. Section five provides an empirical analysis and section six is a conclusion.

2: Literature Review

2.1: Theoretical review

The seminal work by Emile Benoit (1972) had postulated a positive relationship between economic growth and military spending presenting statistical results showing positive cross-country correlations between military expenditure rates and economic growth rates in LDCs. Benoit's hypothesis at the time was that "secondary or jointly useful skills and attitudes" could be learned in the military, implying that they have "modernizing" effects which lead to a rise in productivity (Benoit, 1972: 279). The notion of military spending promoting economic growth was in sharp contrast to the concord of social conscience in the United States of America (USA or US) and North Atlantic Treaty Organization (NATO) nations of Europe where there were concerns over an arms race with the Soviet Union. In the United States, contentions over Anti-Ballistic Missiles (ABM) lead to the "great ABM debate", with the USA and Soviet Union seeking to reduce defensive competition via the Anti-Ballistic Missile Treaty of 1972-2002, which was seen as a contributor to strategic stability (Burr, 2001). From this standpoint, Anti-Ballistic Missiles contributed to tensions among major nuclear powers by increasing pressures to pre-emptively deploy missiles. The Kerner Commission called for a substantial increase in social programs which competed with stepped-up demands for military spending and tax relief raising the question of whether military spending in the USA could be controlled (Bingham, 1969).

The case of military expenditure in the United States is important to follow since it is the dominant economy among the advanced capitalist nations of the world. Given the knowledge that US military spending far exceeds that of the rest of the world[1] an understanding of the complexity of the role that military spending plays in economic growth is revealed from a historical analysis of US government spending, output, and unemployment. A valuable starting point begins with the Marxist analysis of military expenditure and capitalism by Smith (1980) and Dunne (1995) who sought to provide

[1] The Stockholm International Peace Research Institute estimates that the United States accounts for 45% of world military expenditure.

empirical evidence of a "military burden" through cross-sectional comparisons of the United States with other advanced capitalist countries notably Japan and Germany that experienced superior economic performance with a notably lower share of military spending in output following the end of World War 2. The idea of a negative causal relationship between military spending and growth was not new in the 1970s and could be traced back to the work of Samuelson (1973) in which the success of Japan and Germany since 1950 is taken as a full demonstration that the capitalist economy does not depend on war preparations to achieve its actual and potential growth rate. Instead, economic performance is expected to markedly increase with a cessation of war. A critique of Smith (1977) by Pivetti (1992) who uses an alternative approach in his comparisons suggests an *a priori* expectation of military expenditure as a burden is a strong influence in the cross-sectional approach used by Smith. Pivetti (1992) then proceeds to provide context to better understand how military expenditure affected U.S economic performance since the end of the 2nd World War.

The 20 years following 1947-1948 are considered to have seen the best performance of the American economy with an average annual GDP growth rate of 4%. In contrast, the 14 years from 1969 to 1982 were less stable with an average growth rate of 2.3% which was largely due to the decreasing importance of spending by the federal government since the beginning of that period. U.S military expenditure increased in 1947 and since government spending was the most dynamic component of demand this resulted from military and space programs. From 1969 U.S military spending decreased, then leveled off in the 1970s and expanded rapidly in the 1980s. By 1987, U.S military spending was responsible for 80% of all purchases of goods and services by the federal government and the economy was in its fifth successive year of expansion. The unemployment rate had fallen by 10% in 1982 according to the United States Department of Commerce. This perspective from underconsumption theory leads to a rational view that military spending played a role in sustaining the low levels of US unemployment (Pivetti, 1992). In response, Smith and Dunne (1994) contend their findings with the Effective Demand approach and the assessment of an axiomatic “military burden” hypothesis highlighting the extensive empirical investigation on US

data and the absence of a positive effect when testing the burden hypothesis against the null hypothesis of a zero effect.

The dominant view among economists was that military outlays were not necessary for the prosperity of the U.S economy and extensive research has been produced largely refuting the notion that militarization causes economic growth. The debate with Benoit's findings sufficiently raised doubt in a positive correlation with single-equation regressions followed up by structural models which produced more significant negative correlations. It is worth noting that earlier research was mostly macro-oriented with no unanimity between cross-sectional and time-series studies. Nevertheless, most work points to a net negative effect of military spending on the rate of real economic growth which Grobar and Porter (1989) note is the result of reduced saving and investment, and therefore growth. The economic theory, therefore, serves as a guide to predicting how changes in military spending will influence growth, development, and welfare. The theoretical underpinnings can be classified as Neoclassical, Keynesian, Marxist, and Institutional and each is deserving of discussion.

In 1952, during a University of Chicago Round Table radio discussion of the facts of the U.S military budget at the time, e.g. planned increases, allocations, and projected expenditures; Milton Friedman notes that the military will be able to spend twice the estimates given by Harry Blough after accounting for appropriations - which represents a potentially major burden for the USA. From the Neoclassical perspective, military spending ought to be judged according to two related questions (Blough et. al., 1952): the first, which focuses on the internal effects of the military budget, asks, what outlays mean at home, how much of a burden or a cost Military expenditure imposes on the home country. The first question is a matter of affordability relative to economic output, the ability of the economy to absorb the expenditure, economic expansion or contraction, and the standard of living. The second question was a matter of the Soviet Union's military capability, hence the threat faced by the home country (Blough et. al., 1952). In summary, Neoclassical theory views defense spending from the supply side with a focus on the externalities that arise from the defense sector and productivity differentials between the defense and civilian sectors.

In contrast to the Neoclassical views on military expenditure, the Keynesian view suggests outlays could result in increased economic activity. This view has its roots in the post-Second World War period when state spending, including military spending in response to the Cold War, resulted in unprecedented growth rates. However, despite the evidence contrary to a positive relationship between military expenditure and growth, renewed interest has developed in Military Keynesianism following the 2008 GFC (Dunne, 2011). Indeed the empirical literature tended to find negative or insignificant effects of military spending; these however do not use specifically Keynesian models and vary in the length of time series and coverage (Dunne and Uye, 2010). A Keynesian perspective would see military spending as simply one component of government spending, with effective demand/multiplier effects. An exogenous rise in military spending increases demand and, if there is spare capacity, increases utilization and reduces unemployment of resources. In this way, Military expenditure can be good for an economy, getting it out of a recession and planning expansions in effective demand. Note however that underconsumption theory reverses this causation (Dunne, 2005).

Cypher (1985) classifies the Marxist argument as 1) Neo-Marxist and 2) Classical Marxist and in the process reconstructs a critical perspective on the subject of military spending. The Neo-Marxist view is preoccupied with monopoly capitalism, the automatic feedback mechanism of capitalism where the profit motive and price competition in a systematic drive for accumulation is "short-circuited" by monopoly/oligopoly/cartels. In the process, the oligopolist reinvests relatively less than the competitive firm, producing more output and magnifying the rate of exploitation, increasing unemployment and the magnitude of potential Gross National Product (GNP). These tendencies promote their countertendencies which encourage militarism as a way to counteract the tendency toward stagnation. The monopolistic firm hires surplus when it is forced to produce and hire labour. The Neo-Marxists then form a dialectic description of advanced capitalism where contradictions appear non-antagonistic, thereby describing advanced capitalism in terms of "structural totality". In this way, the Neo-Marxist method corresponds with the definition of structuralism.

Cypher (1985) does however criticize this method for only giving occasional attention to matters of countercyclical policy.

Defense spending in the Third World has seen rapid growth since the 1970s. far exceeding the rate of growth of military spending in the major Western and Eastern countries. This makes Least Developed Countries (LDCs) deserving of special attention though the theory is less clear-cut and it is not certain that the effect of a reduction in military spending will be transmitted through to investment and spur growth given the risk of conspicuous consumption. LDCs have greater potential to reap the benefits of spin-offs emanating from defense spending which may boost output. Military spending may affect development through several channels and these are a) Capital Formation, b) Human Capital, c) Growth, d) Import Cost and Foreign Exchange, e) Arms Industry, f) Government Expenditure, g) Spin-Off, h) Wars- the Costs (Deger and Smith, 1985).

The first channel, capital formation may be affected both from the supply and demand side. Overall, there are strong grounds to believe that military expenditure can reduce the supply of savings and therefore restrict capital formation. From the perspective of demand, there is an allocation effect that occurs when an increase in military expenditure reduces investment but this effect is seldom one-to-one as the other elements of aggregate demand might fall e.g. civilian government expenditure or the current account surplus. A less pronounced effect on investment occurs as a result of constraints to absorptive capacity however counter-arguments would claim that defense may enhance productivity. The second channel, human capital can be affected both positively and negatively. Defense spending may improve the stock of human capital through training that can be of use in the civilian sectors however it is possible to reduce government spending on health and education and diminish the availability of skilled people, thus lowering the productivity of human capital at the aggregate level. The outcome can only be judged from empirical evidence (Deger and Smith, 1985).

The defense burden tends to have a highly negative and significant impact on saving (investment) and human capital, which deters growth, the third channel. In terms of import cost and foreign exchange, weapons procured with limited foreign exchange result in an allocation cost as fewer reserves are available for importing intermediate inputs and investment goods that are essential for sustaining growth. The benefits of a strategy in which industrialization is promoted through armaments are questionable given the high cost in terms of domestic resources such as scientific and technical skills which may be scarce. Such a strategy depends on extensive imports of components and technology and consequently leads to a reliance on arms manufacturers in industrialized countries. The technology is prone to rapid obsolescence and a costly high-risk product development process increases the uncertainty of returns. Government expenditure is influential since there may be reallocations in the budget in favour of defense over other items of state spending, for example, health, education, and agriculture.

Various positive spin-offs have been claimed for defense spending in LDCs. These can be categorized under the heading of 'modernization' where the military is expected to modernize peoples' attitudes from a pre-industrial disposition to a more industrialized one. The other type of spin-off is technological in nature and related to the manufacture of arms. Technical skills improve by producing and using arms which benefits the civilian economy. Military research and development can, in the case of dual-purpose technology, also provide benefits to the civilian sectors. Arms manufacturing may also help non-defense sectors by promoting inter-industrial demand but this expansionary argument is not supported by the empirical evidence. Regarding the cost of war, wars tend to be costly endeavors. For example, Israel's war of 1973, which is 22 days was estimated to cost the equivalent of a whole year's income. In Pakistan, GDP fell (44 percent) during the period 1969-71 which included the Civil War and war with India. These figures do not include the pure military costs which are considerably large.

2.2: Empirical evidence

The damaging effects of military spending have been extensively tested in the empirical literature with economists observing higher military spending to be associated with lower economic growth. Most of the evidence has three main sources. The first source includes deductive arguments with support from anecdotal evidence and personal experience. The second involves comprehensive studies of individual countries which view the military from a particular socio-economic context. The third is econometric studies which use aggregate data and the macroeconomic determinants of military expenditure for example investment, saving, foreign resources, and human capital. These cross-country studies cover a large sample and reveal some underlying patterns for LDCs as a group. In some cases, they have identified long-term and potentially stable parameters. Caution should be exercised when interpreting such data as structural changes can distort the results. Reverse causality is also an issue. Cross-section analysis reveals a 'representative' view of the effects of military expenditure and can be complemented by time-series analysis of data in case studies of specific countries however the application of this technique may be restricted by the lack of long series and consistent data (Deger and Smith, 1985).

Panel regression models are the dominant econometric approach in empirical work, especially on developing countries. The development of panel data econometrics has been characterized by simultaneous advances in both data and methods. The success of panel estimation techniques is the result of two key features of panel data. Firstly they enable researchers to document dynamic profiles of firms, workers, or countries. Secondly, they allow researchers to control for time-invariant unobserved characteristics ("fixed-effects") in their models. These two aspects explain why panel data is now at the core of applied practice in economics, with difference-in-differences and synthetic control methods being leading methods (Bonhomme and Daveziez, 2019). Other advantages for using panel data include (1) tools to control for individual heterogeneity (2) more precise regression estimates due to using a large sample size relative to the cross-sectional data) (3) a greater ability to identify individual dynamics and (4) the ability to model temporal effects without aggregation bias which is a

common issue in time-series studies. Nevertheless, case studies remain valuable complements to cross-sectional studies because of their ability to overcome the heterogeneity problem and take into account the historical and institutional information unique for each country (Dunne and Nikolaidou, 1999).

The debate on the effect of military spending on economic growth has reached some consensus in the empirical literature by postulating a non-linear relationship between the respective variables in which the marginal effect of a change in the military burden is not constant across different levels. This non-linear literature is primarily limited towards developed countries although developing countries and in particular African countries have been investigated, mostly in panel data studies which come with a host of practical issues. For example, panel studies generalize their empirical findings across various panels with differing country-specific characteristics and steady-state levels of income (Phiri, 2019)[2]. An investigation into the non-linearities in the military spending- growth relationship is conducted by Phiri (2019) using a logistic smooth transition regression (LSTR) derived from a non-linear endogenous growth model developed by (Pieroni, 2009). Typically, government spending will be decomposed into military and non-military items followed by an assessment of their impact on consumption and economic growth along their steady-state paths. When applied to South African data over the period 1988 to 2015, Phiri (2019) finds the empirical results of the LSTR indicate an inverted U-shaped relationship between military spending and economic growth. Thus time-series analysis continues to give researchers a framework for producing case studies of individual countries. An investigation into the presence of a long run relationship between the variables being modeled is achieved using cointegration, and different methods can be combined to generate more consistent results[3]. When variables exhibit uniform or fractional integration the ARDL technique can be used to produce both short-run and long run

2 See Aizenman and Glick (2006); Cuaresma and Reitschuler (2006); and Pieroni (2009) for panel data studies involving developing countries.

[3] For example, Ahmed, Zafar, and Mansoor (2020) apply cointegration and bootstrap causality to study the relationship between military spending, economic growth, and ecological footprint in Pakistan. They combine four different cointegration methods to produce Fisher statistics which are more consistent compared to traditional cointegration.

results. This is due to the error correction model which integrates long run and short-run dynamics.

Popular models used in defense economics research include simultaneous equation models[4] and the widely used supply-side Feder-Ram model, which was the result of Biswas and Ram (1986) adapting Feder's (1983, 1986) model of the effect of exports on growth in developing countries. In defense economics, the Feder–Ram model tends to be widely used, while it is not used in the mainstream growth literature. Thus the Barro (1990) model and the augmented Solow model[5] introduced by Mankiw et al. (1992) might find a role for defense economics in the growth debate, therefore resolving a seeming "disjunction" between the mainstream growth literature and the defense economics literature. The augmented Solow growth model was introduced by Mankiw et al. (1992) and is used to measure the effect of military expenditure on growth by Knight et al. (1996). The key assumption is that the share of military spending m: = M/Y affects channel productivity via a level effect on the efficiency parameter that controls labor-augmenting technical change.

In the growth literature, recent developments have considered the impact of foreign aid on developing countries. While there is no consensus regarding the impact of aid on growth, it is recognized that aid fungibility can result in discretionary spending in the form of military expenditure. Thus it is reasonable to suppose that the impact of military spending may differ between countries that are net aid recipients and those that are non-recipients (Dunne and Tian, 2013). Important factors to consider when selecting a model for estimation are the degree of utilization, the financing of military spending, externalities, and the effectiveness of military objectives. Each channel, and therefore the economic effect of military spending will vary as well as the time horizons of these effects with some being short-run and others being long run effects. All these considerations exist within the context of a chosen model, which will have practical considerations when conducting research; for example identification and the selection

[4] See for example the works of, Dunne, Nikolaidou, and Roux (2007) and Dunne and Nikolaidou (1998).

[5] For readers that are interested in the technicalities of the Barro (1990) see Dunne, Smith, and Willenbockel (2005) who provide a critical review of models of military expenditure.

of variables that are sufficiently robust to capture a relationship between Military expenditure and growth (Dunne, Smith and Willenbockel, 2005).

Previous studies with a focus on Uganda:

Previous studies into the defense-growth nexus of developing countries have mostly focused on panel studies and these usual group countries into regions. For example, the early work of Dunne and Mohammed (1995) studies a sample of 13 Sub-Saharan countries over the period from 1967-1985 which includes Uganda. The authors use a Keynesian theoretical framework to define a social welfare function which describes social welfare as a function of utility derived from private consumption, military spending, and other government spending conditioned on political, strategic, and demographic variables. When the authors use pooled data they find strategic channels such as wars, the size of the army, and inertia become important. A time-series analysis found Military expenditure to harm economic development for the countries as a whole through its negative indirect effects on human resource allocation, investment allocations, and the balance of payments. The results of the time-series analysis were however not found across countries or when the authors used pooled data, which indicates a need for case studies that link the country of interest to the various channels which theoretically cause Military expenditure to have an impact on economic growth.

Recent research since the 2007-2008 Financial Crisis has the advantage of more developed economic models. For example, d'Agostino et. al. (2012) and Dunne and Tian (2013) estimate an augmented Solow growth model with Harrod-neutral technical progress to find a significantly negative impact of military spending on growth in Sub-Saharan Africa over the period 1988-2006 and 1988-2010, respectively. Dunne and Makanza (2019) find the defense-growth relationship to be non-linear in a panel study including Uganda. With the advantage of more developed economic models consistent with developments in growth theory and datasets which cover longer periods, it is now possible to reinvestigate the defense-growth relationship in Uganda.

3: Country Overview

The existence of numerous wars between clans and the state means the army played a pivotal role in maintaining order in pre-colonial Uganda. There always existed some sort of army in Uganda and this was the case whether the state was segmented or centralized. The only difference was in terms of military organization which generally reflected the form of organization in the wider society. A standing army in the modern sense was organized with the establishment of colonial rule and this army was neither national in its duties nor nationalist in its ideals. The first colonial army in Uganda was formed under the sponsorship of the Imperial British East Africa Company and initially consisted of Swahili troops. Later, the army was augmented by the incorporation of the Sudanese troops followed by Baganda in the years 1893 and 1894, who were recruited temporarily as support in the war against the monarch Kabalega. When the war ended the Baganda elements were disbanded and the Uganda rifles were formed in 1895. The rifles were not a national army and consisted principally of Sudanese troops commanded by the British. For example, The Uganda Rifles Ordinance included a specific provision that required it to take military actions even against local groups within the country. This means that the first organized army in Uganda was organized to pacify internal conflict and this is a position which it has retained even in modern times (Okoth, 1993).

In 1962 Uganda gained independence and declared a parliamentary democracy with the monarch Kabaka Mutesa II given the title Head of State and Commander in Chief of the Armed Forces. The influence of the military and Western nations has been a consistent feature of Ugandan politics. For example, on January 23 1964 British troops were called in to quell a mutiny by African troops in the town of Jinja. Among the officers promoted was Idi Amin who went from Major to Colonel. What followed was a period of political turmoil beginning with the termination of the largest party coalition at the time between the Uganda People's Congress and Kabaka Yekka (UPC-KY) and a referendum in Bunyoro which was historically an autonomous region. Tensions began to develop in 1965 when two Ugandan villages were bombed by aircraft from neighboring Congo, an action which was followed by an expansion of Uganda's Armed

Forces with the formation of the 3rd and 4th Battalions and the Brigade Signals Squadron. In 1966 President Obote suspended the 1962 constitution and Amin was made Army Chief of Staff. A period of internal violence persisted with the major elements of Uganda's political class competing for power which culminated in a military coup in 1971 led by then Major General Amin who led Uganda down a path of dictatorship and economic devastation. In 1978 Amin's troops invaded Tanzania which sparked off retaliation from the Tanzania Defense Force which was joined by Ugandan exile forces. Shortly after Amin's overthrow and Milton Obote's return to power, Yoweri Museveni mounted a guerrilla resistance in 1981 resulting in Obote's second administration being overthrown on July 27, 1985 (Omara-Otunnu, 1987).

Figures 1 – 6 provide economic indicators for Uganda. From 1981 to 1985, the growth rate of real GDP declined sharply coinciding with the first International Monetary Fund (IMF) structural adjustment program which aimed to remedy a short-term budgetary crisis and a long-term crisis of productivity which resulted from a combination of the economic mismanagement of the Amin regime and the disruption caused by the civil wars of the following decade. From 1981 to 1983 the real minimum wage declined by 26.4 percent which was the sharpest annual decline in wages on the African continent (Mamdani, 1990). From 1992, The Government pursued liberalization and privatization policies which were intended to improve efficiency in the allocation of resources and the management of businesses. These policies were expected to maximize economic growth and from 1992 to 2000 real GDP grew by an average of 7% per annum then declined to 5.9% between 1999 and 2002. For Uganda, the period after 1990 was characterized by strong economic growth in part, due to external and internal shocks. Uganda's main sources of growth from 1992 to 2000 were favorable economic policies that led to increases in agricultural incomes, foreign direct investment, increased remittances by Ugandans living abroad, and the high growth of the real sector. Increased private sector investment in industry and construction has been instrumental to Uganda's economic growth. The country has also benefitted from increased donor support geared towards public sector spending on social services.

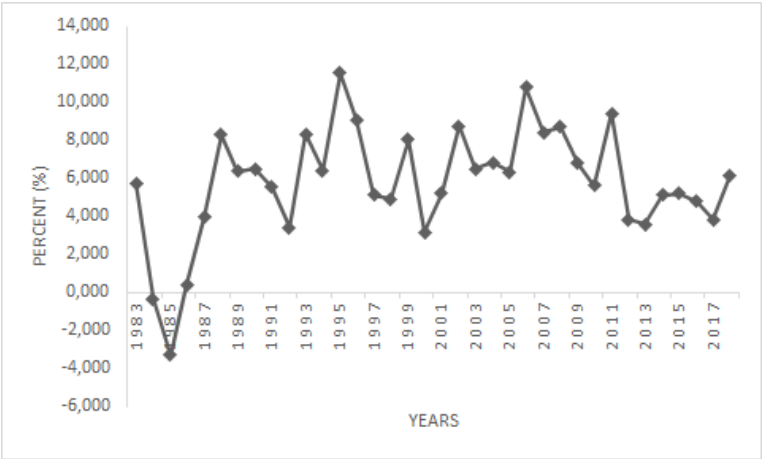

Figure 1: Real Growth Rate of Ugandan GDP in percent for the period 1983 – 2019.

Source: Compiled from World Bank data sourced from World Bank national accounts data, and OECD National Accounts data, extracted in 2020.

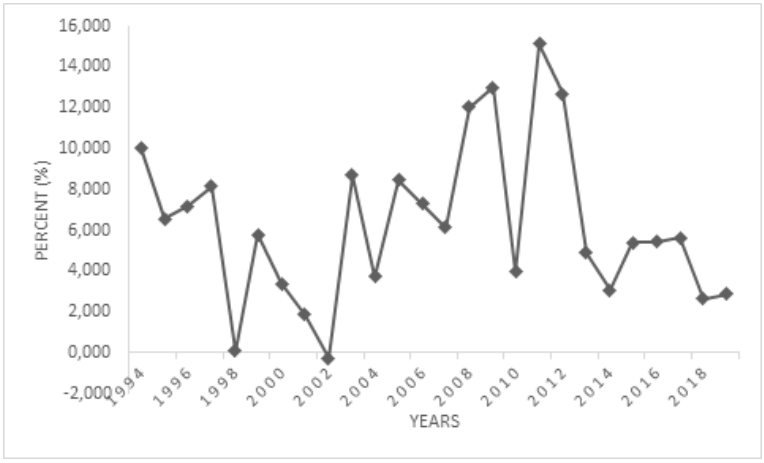

Figure 2: Inflation rate of Uganda in percent for the period 1994-2018.

Source: Compiled from World Bank data sourced from World Bank national accounts data, and OECD National Accounts data, extracted in 2020.

To stabilize the economy, the government repeatedly devalued the Ugandan shilling between 1981 and 1988. The efforts to bring the economy under control eventually succeeded in 1986 reducing the country's soaring inflation from approximately 300 percent in 1986 to approximately 72 percent in 1988. However, the government contributed to rising inflation by increasing the money supply to purchase commodities such as coffee and other farm produce and to finance increased security costs. In 1989 inflation was estimated at more than 100 percent. Shortages of consumer goods,

bottlenecks in transportation, and higher production costs also contributed to inflation. The depreciation of the United States dollar also increased the cost of Uganda's imports. To curb inflation, the government tried increased disbursements of import-support funds and tightened controls on credit. These measures helped lower the rate of inflation to 30 percent by mid-1990 however by late 1990 inflation began to rise again. Uganda's growth environment between 1992 and 2000 focused mainly on controlling inflation which was seen as a necessary condition for investment and therefore economic growth. Annual underlying inflation rates fell from 26% between 1992-1993 to 5% in 1999-2000. Since 1996, annual inflation has been in the single digits.

The formation of the Uganda Protectorate under British rule on June 19, 1894, saw the introduction of cash crops and from 1949 agriculture thrived and manufacturing developed beyond simple processing of exports. Uganda's terms of trade and the purchasing power of exports dropped sharply during the last phase of the Amin regime as commodity prices declined and oil prices increased as a result of the 1974/1975 oil crisis. Coffee exports had until recently accounted for over 80% of the total value of Uganda's exports. To insulate the economy from adverse terms of trade and instability in export earnings associated with commodity concentration, there has been an effort since 1987 to diversify Uganda's exports. The aim has been to move away from traditional (coffee, tea, cotton, and tobacco) towards non-traditional exports, mainly composed of agricultural commodities (Blake, et. al. 2001).

Despite making progress in alleviating poverty and improving human development indicators particularly during the 1990s and early 2000s, the creation of decent jobs for the rapidly expanding working-age population of Uganda is insufficient. The low-productivity agricultural and services sectors continue to be the primary sources of employment and there is a lack of absorption of workers into high-productivity sectors. The insufficient structural transformation of the Ugandan economy has held back a sustained increase in gainful employment and these labor market outcomes are strongly linked to the type of economic growth that has characterized Uganda over the past two decades (Waeyenberge et. al., 2018)

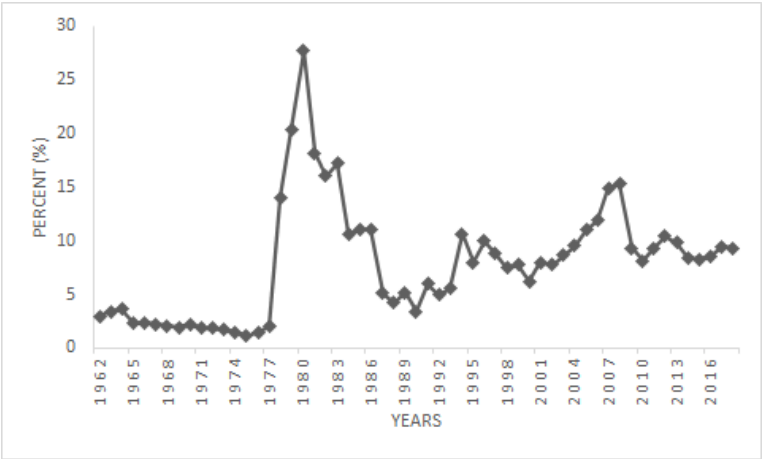

Figure 3: Exports as a share of GDP from Uganda for the period 1962-2018.

Source: Compiled from International Monetary Fund data, extracted 2020.

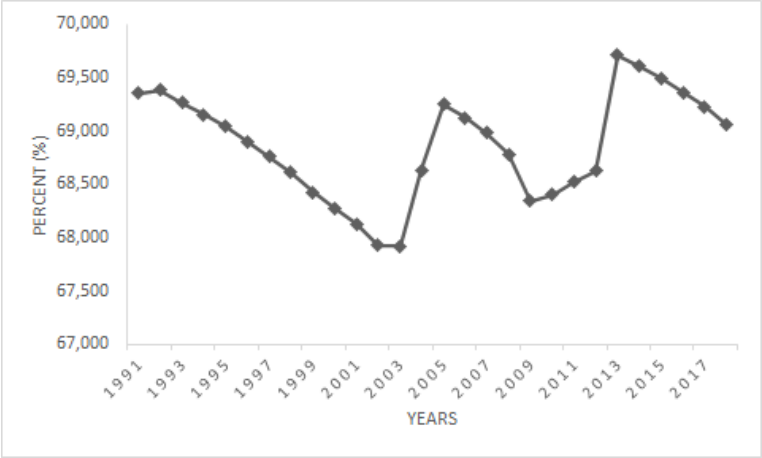

Figure 4: Employment to Population Ratio in percent for Uganda for the period 1991-2018.

Source: Source: Compiled from World Bank data sourced from World Bank national accounts data, and OECD National Accounts data, extracted in 2020.

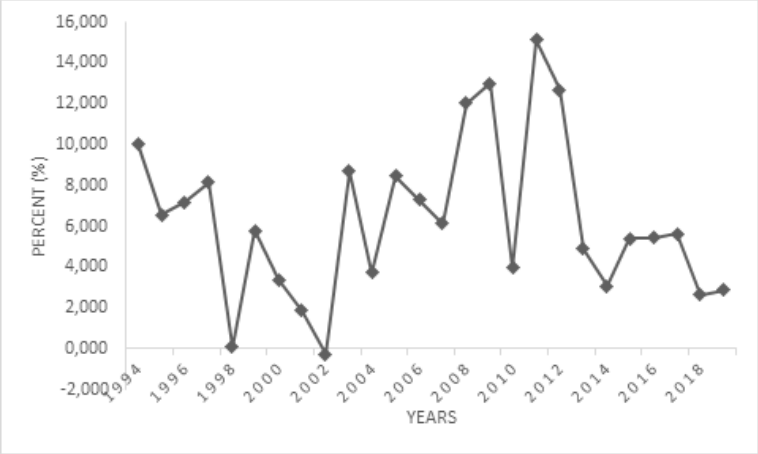

Figure 5: Investment as a percentage of Real GDP for Uganda

Source: Compiled from data from University of Groningen, extracted 2020.

Investment has seen significant growth since 2000 in part due to growth in the financial services sector. Following the deregulation policies in the late 1980s, the country has had an impressive record of attracting foreign investments particularly since the discovery of oil in the Albertine region which heightened investor interests in the country. The high levels of military spending under the Amin dictatorship have been maintained and rapidly increased following the Financial Crisis of 2007-2008 largely as a result of the modernization of the military and an increased regional presence in Central and East Africa. The large spike in spending is directly attributed to Uganda's peacekeeping operations in Somalia as part of the African Union Mission in Somalia. Deployed to Mogadishu, Somalia in March 2007, (AMISOM) became the African Union's lengthiest, most extensive, and most costly operation in terms of financing and fatalities. Uganda is one of only six troop-contributing countries to AMISOM and all six have experienced large spikes in military spending. The decision to join AMISOM was most commonly justified because events in Somalia posed a direct security risk to the troop-contributing countries (TCCs) and rather than normative commitments to African solidarity, a combination of institutional, political, and economic factors was generally more important in understanding why these six states became AMISOM TCCs. Joining AMISOM alleviated some regional security concerns however TCCs did acquire tangible benefits in the process (Williams, 2017).

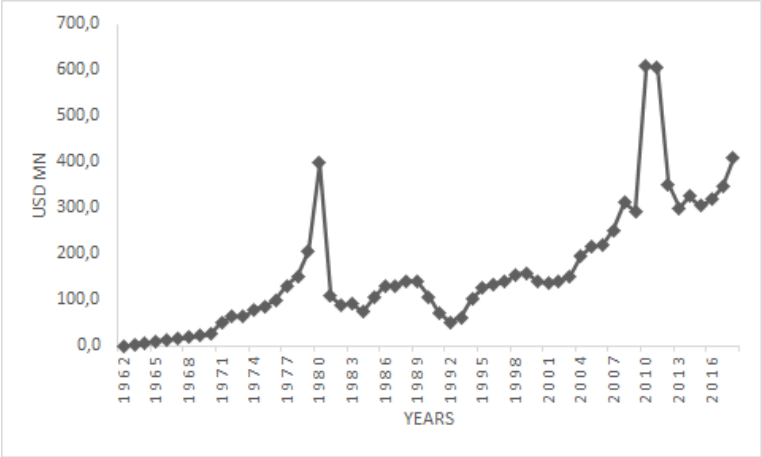

Figure 6: Ugandan Military Expenditure in millions of US Dollars for the period 1962-2018

Source: Compiled from SIPRI data, extracted in 2020.

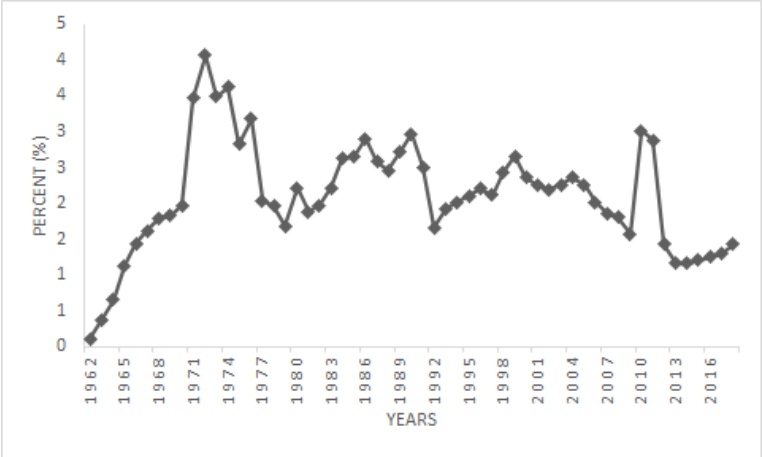

Figure 7: Military Spending as a percentage of GDP for Uganda for the period 1962-2018

Source: Compiled from SIPRI data, extracted in 2020.

4: Model Specification, Data, and Estimation Method

4.1: Model

The model derivation begins with an aggregate neoclassical production function featuring labour augmenting technological progress (Dunne et. al., 2005) :

$$Y(t) = K(t)\alpha[A(t)L(t)](1-\alpha) \quad (1)$$

where Y(t) denotes output, K(t) is the real capital stock, L(t) is labour with the t in parentheses indicating each variable at time t. The technology parameter A has output elasticity of (1−α) and evolves according to:

$$A(t) = A_0\, e^{gt}\, m(t)^{\theta} \quad (2)$$

where g is the exogenous rate of Harrod-neutral technical progress and m is the share of military expenditure in GDP. Labour is assumed to grow at an exogenous rate of n, technical progress grows at the exogenous rate of g. Human and physical capital depreciates at an identical rate d. According to this specification, a permanent change in m does not affect the long run steady-state growth rate, but has potentially a permanent level effect on per-capita income along the steady-state growth path and affects transitory growth rates along the path to the new steady-state equilibrium. The re-parameterized general first-order dynamic model has all variables in log form :

$$\begin{aligned}\Delta\, ln\, y(t) = {} & \beta_0 + \beta_1\, ln\, y(t-1) + \beta_2\, ln\, s + \beta_3\, ln(n+g+d) \\ & + \beta_4\, ln\, m(t) + \beta_5\, ln\, m(t-1) + \epsilon \end{aligned} \quad (3)$$

Where y is GDP per capita, s is gross fixed capital formation as a share of GDP and thus a proxy for investment or capital stock. Military expenditure is m and the variable (n + g + d) is the population growth plus 0.05. All variables are in logs when performing the estimation i.e. ln to control for extrema and allow elasticity interpretations of the coefficients; Δ represents the change in the variable, (t-1) denotes a lag of one period.

All the variables are measured in logs. In all regressions, the dependent variable is ∆lny which is the change in the log of per capita GDP. As in the Feder–Ram model, the dependent variable is the growth rate and it is a function of the share of investment (equal to savings) and the rate of growth of the labour force, although the functional forms are different. Military expenditure appears as current and lagged share. The term (n + g + d) denotes the growth rate of the labour force plus depreciation where population growth is used as a proxy for the growth rate of the labour force. The model includes an intercept and an ad hoc error term.[6]

4.2: Data

Time series data is collected for Uganda covering the period 1962-2018 which is advantageous for analysis of a long run relationship since the major shocks to the Ugandan economy occurred before 1990. Consistent data for per capita GDP is not available for this time frame and is therefore calculated using Real GDP in constant 2017 US Dollars from the University of Groningen divided by population from the World Bank's World Development Indicators (WDI) for each year. Data for investment as a share of GDP is obtained from the University of Groningen. Data for military expenditure is obtained from The Stockholm Peace Research Institute (SIPRI). Official Development Assistance data is from the World Bank's World Development Indicators. Investment is measured as a share of output-side Real GDP at Current Purchasing Power Parities. Military expenditure and official development assistance[7] are measured in current US Dollars and computed as a share of GDP. Table 1 reports descriptive statistics before and after the variables are transformed to logs. The mean of military spending as a percentage of GDP is 3.09% with a standard deviation of 4.24%. The NATO definition of Military Spending typically excludes civil defense expenditures such as veteran's benefits however this definition is not applicable for all countries and would require more detailed information about military budgets than what is available.

6 An explicit derivation based on stochastic technology and labour force growth is given in Lee et al. (1997), who make other criticisms of this model.

7 Hereafter shortened to aid.

Table 1: Descriptive Statistics

Descriptive statistics before transformation.		
Variable	Mean	Standard Deviation
GDP Per Capita	1192,68	383,03
Investment (%) GDP	16%	3.53%
Military Spending (%) of GDP	3,09%	4,24%
Official Defence Assistance (%) of GDP	7,92%	5,77%
Descriptive statistics after transformation.		
Variable	Mean	Standard Deviation
Log of GDP Per Capita	3,06	0,13
Log of Investment (%) GDP	-0,81	0,09
Log of Military Spending (%) of GDP	-1,65	0,32
Log of Official Defence Assistance (%) of GDP	-1,24	0,38
Log (n + g + d)	-1,20	0,008

4.3: Estimation Method

The usefulness of the aid variable in explaining changes in Per Capita GDP is assessed by estimating two models, one without the aid variable and the second including aid. In each case, the estimation proceeds in three steps. The first involves testing for unit roots in each time series utilizing the Augmented Dickey-Fuller (ADF) test for covariance-stationarity. The second is the bounds test to establish cointegration. The third step is the estimation of the long run and short-run model including a discussion of the diagnostic tests and limitations of the study. Traditional cointegration methods do not account for the structural breaks in the data and their outcomes are often not trustworthy in the case of the fractional order of integration and small sample size. The main advantage of the ARDL approach to cointegration is that it can be applied irrespective of whether the regressors are I(0) or I(1) and can avoid the pre-testing problems associated with the standard approach to cointegration analysis which requires the classification of the variables into I(0) or I(1). The ARDL approach however cannot be performed on I(2) variables.

In a situation where the variables contain no more than one unit root, the application of the ARDL approach to cointegration will give realistic and efficient estimates. Unlike the Johansen and Juselius (1990) cointegration procedure, the ARDL approach to cointegration helps in identifying the cointegrating vector(s). If one cointegrating vector (i.e. the underlying equation) is identified, the ARDL model of the cointegrating vector is re-parameterized into the Error Correction Model (ECM). The re-parameterized result gives short-run estimates of the long run relationship of the variables of a single model. The re-parameterization is possible because the ARDL is a dynamic single model equation and of the same form as the ECM. If cointegration is found, then the same error correction form serves as the error correction model, and if it is not found, then it is an autoregressive model indifference of the variables. The ARDL (p, q_1, q_2, …, q_k) model takes the form:

$$\Phi(\mathrm{L}, \mathrm{p})\, y_t = \sum \beta_i(\mathrm{L}, q_i)\, x_{it} + \delta' w_t + u_t$$

L is a lag operator such that $\mathrm{L}y_t = y_{t-1}$, and w_t is a (s x 1) vector of deterministic variables such as the intercept term, seasonal dummies or time trends, or exogenous variables with fixed lags. The model also includes an error term u_t. In practice, an appropriate choice of the order of the ARDL model is crucial for valid inference. But once this is done, estimation of the long run parameters and computation of valid standard errors for the resultant estimators is carried out by the OLS method. The ARDL approach has the additional advantage of yielding consistent estimates of the long run coefficients that are asymptotically normal (Pesaran, 2015). Although the ARDL cointegration technique does not require pre-testing for unit roots, to avoid ARDL model crash in the presence of integrated stochastic trend of I(2), Nkoro and Uko (2016) suggest the unit root test should be carried out to know precisely the number of unit roots in the series under consideration. An initial plot of each logged variable[8] suggests non-stationarity at level values as each variable is trended and exhibits sharp changes coinciding with the currency devaluation. Plots of each variable

[8] See Appendix A

in first differences are not trended suggesting the variables may be difference stationary.

5: Empirical Analysis

5.1: Results of unit root tests

The analysis begins by conducting unit root tests on each variable, namely the Augmented Dickey-Fuller test. The results presented in Table 7.2 show the null of non-stationarity to be rejected for all variables at first differences. The sharp decline in the log of per Capita GDP coinciding with the currency devaluations of 1981-1988 appear to be outliers that are captured by creating a dummy variable for the years 1980-1986 which recorded declines output. The Ugandan government's efforts to control the inflation rate succeeded in 1986 and economic growth rebounded even though devaluations continued until 1988. An additional dummy variable is added to allow for outliers in the log of per Capita GDP which are explained by the 2007-2008 Financial Crisis. The results from the ADF tests established that all the variables are integrated of order one or I(1), therefore the ARDL approach to cointegration is applied to estimate the model. It is only appropriate to estimate the long run coefficients if it has been established that the long run relationship between the variables is not spurious and this is achieved by conducting the bounds test developed by Pesaran, Shin, and Smith (2001). The bounds test is based on standard F- and t-statistics used to test the significance of the lagged levels of the variables in a univariate equilibrium correction mechanism.

5.2: Results of cointegration tests

Tests for cointegration apply because the variables are stationary at I(1). The findings are presented in Table 7.3.1 and 7.4.1 and reveal that the computed F-statistic is below the lower bound of 5% and 10% critical values without the aid variable and greater than the upper bound critical values when aid is included, respectively. The null hypothesis of no cointegration is not rejected in both the no-aid and aid models which

indicates that the long run equilibrium relationship is not present in either model. The bounds tests serve as a preliminary check to establish cointegration and can be unreliable due to small sample properties. An ARDL model is estimated for both models which allows for the investigation of a cointegrating relationship based on the error correction term. When the ECM is negative and significant there is cointegration and thus a basis for estimating the ARDL model. No serial correlation or heteroskedasticity is detected in both models and the assumptions of correct functional form and normality hold with aid however normality is violated without aid.

5.3: Short-run and long run results of the growth model

The long run and short-run effects of the regressors on economic growth are presented in Table 2 and Table 3 for the model estimated without the aid variable. The negative and statistically significant error correction term (-.09) verifies the existence of a long run relationship and the ARDL estimates in Table 2 apply. The negative and statistically significant coefficient indicates that military spending (LMILEX) reduces economic growth in the long run and short-run. Investment (LINVEST) has a positive and statistically significant effect on growth in the long run and short-run. Therefore the higher the investment, the richer the country becomes *ceteris paribus*. Investment in capital stock has generated positive returns to output even as the ratio of investment to GDP decreased by 12% after the 2007-2008 Financial Crisis. Uganda has struggled to maintain the high levels of investment before the 2007-2008 Financial Crisis spurred by the discovery of commercially viable oil deposits in the Albertine Graben region in 2006 yet military spending continues to increase. Population growth + 0.05 is insignificant in the long run however this seems a common feature in Africa growth regressions (Dunne et. al., 2013). The coefficient of population growth + 0.05 (LPOPG) is negative and significant in the short-run which supports gives support to conditional convergence (Murthy and Ukpolo, 1999). The results from the main model without aid are therefore consistent with the theory of the Solow Model and previous research. Plots of the cumulative sum of recursive residuals and cumulative sum of squares of

recursive residuals[9] fall within the critical bounds at the 5% level indicating model stability.

The long run and short-run results are consistent with the results of recent panel studies that have included Uganda for example Dunne and Tian (2013) who find that military spending deters growth in short-run. Dunne and Makanza (2019) find that military spending has no long run effect on growth based on results from a linear error correction model which is in contrast to the results from this paper. Dunne et. al. (2019) however show that military spending has an asymmetric effect on economic growth, with the relationship depending on the size of the military spending burden and the time frame (short run or long run). Heterogeneity and endogeneity may also impact a country's military spending growth relation (Dunne et. al., 2013). Studies that address heterogeneity include Dunne et. al. (2013) who stratify the sample to account for geographical differences and (Saba and Ngepah, 2019) who address endogeneity by employing an alternative estimator i.e. Generalised Method of Moments (GMM).

The ARDL technique is useful for investigating the long run equilibrium information in a model but it does not indicate causality between the variables. The violation of the normality assumption reduces confidence in forecasts which adds to the limitations of the univariate approach employed in this study. The more recently developed GMM model does not require normality and heteroskedasticity can be controlled through valid instrumentation. GMM estimation is, therefore, less prone to misspecification and more suitable for policy-making. A causal relationship between military spending and economic growth suggests a degree of interdependence between defense policy and economic policy. Defense and growth policies require synergy and cannot be pursued independently. Given the fragility of African states, policymakers should avoid prioritizing defense overgrowth (Saba et. al., 2019).

[9] See Appendix.

Table 2: Long run results without the aid variable[10]

ARDL(1,0,0,1) selected based on Schwarz Bayesian Criterion Dependent variable is LGDPC			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LINVEST	.75	.32	2.33[.03]
LMILEX	-.35	.12	-2.83[.01]
LPOPG	-1.99	1.78	-1.11[.27]
INPT	1.74	4.73	.37[.71]
TREND	.017	.01	3.31[.00]
DV	-.21	.21	-.98[.33]
DFC	-.47	.27	-.00[.10]

Table 3: Short-Run results without the aid variable

Error Correction Representation for the Selected ARDL Model ARDL(1,0,0,1) selected based on Schwarz Bayesian Criterion Dependent variable is Dlgdpc			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLINVEST	.07	.03	2.20[.03]
dLMILEX	-.03	.01	-2.96[.01]
dLPOPG	-1.17	.50	-2.35[.02]
dTREND	.00	.46	3.41[.00]
dDV	. -.02	.02	-.97[.34]
dDFC	-.42	.02	-.00[.10]
ecm(-1)	-.09	.02	-3.82[.00]
R-Squared = .55950 52 Observations			

[10]. The lag order suggested by the Akaike-Information criterion is (3,4,4,4) and the Hannan-Quinn Criterion suggests (3,0,2,3) in the no-aid model.

While issues of heterogeneity and endogeneity can be a concern in cross-country studies, the empirical model estimated in this study is well-defined and all the traditional growth models, consistent with Solow (1956) and Mankiw et al (1992) are statistically significant with signs as expected. The dummy variable for the Financial Crisis is also significant in the long run and short-run. Consistent signs between the long run and short-run coefficients suggest a stable defense-growth relationship and the small error correction term indicates a slow adjustment to equilibrium. Uganda is one of the largest recipients of aid in the world. Uganda receives substantial amounts of foreign development assistance. Like most poor developing countries, it depends on two major sources of revenues: taxes and fees collected by the government and foreign aid. Since the 1990s, aid including off-budget sources has equaled approximately 70 percent of government expenditures (Findley et. al., 2017). The influence of aid on government spending suggests that the impact of military spending may differ between countries that are net aid recipients and those that are non-recipients, this paper estimates a separate model which includes aid as an explanatory variable.

Table 4: Long run results with the aid variable

ARDL(1,0,0,0,4) selected based on Schwarz Bayesian Criterion Dependent variable is LGDPC			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LINVEST	11.28	54.76	.21[.84]
LMILEX	.82	5.59	.15[.89]
LPOPG	60.41	321.25	.19[.85]
LODA	5.64	29.54	.19[.85]
INPT	204.91	1044.5	.20[.85]
TREND	-.11	.67	-.17[.87]
DV	-8.50	42.73	-.20[.84]
DFC	-4.02	20.57	-.20[.85]

The results from estimating a model that includes aid as an explanatory variable are given in Table 4 and Table 5. It has been demonstrated that military spending has negative effects in the long run and short-run in the no-aid model. When aid is considered, all of the coefficients are insignificant in the long run and it is only the short-run coefficients for investment, population growth, and aid that are significant however dLODA2 is insignificant. The results show that the further the time horizon, the greater is the significance of aid, and the sign of the coefficient changes from negative to positive. No long-run equilibrium exists when aid is included as an explanatory variable casting doubt on the appropriateness of the ARDL model to investigate the impact of military spending and aid on growth[11]. Aid is expected to have a positive effect on growth by enabling government capacity building and contributing to the development of better-functioning institutions. Accountability to donors pushes politicians to tackle corruption and mismanagement (Findley, Harris, Milner, and Nielson, 2017). The negative and significant coefficients in the short-run contradict this view suggesting Uganda's dependence on aid may constrain the flow of funds to productive activities and instead increase consumption. There is also a widespread concern that aid intended for social programs may be financing military spending given patronage toward military veterans and the influence of the military in the Ugandan parliament.

Uganda constantly faces the risk of internal conflict due to the presence of armed pastoralist groups with a history of cattle raiding. In response, the government deployed numerous paramilitary troops known as Local Defense Units (LDUs) in various regions of the country which increased the proliferation of legal arms thus intensifying conflicts (Mkutu, 2007). The increasing decentralization of government has further contributed to the politicization of LDUs which serve as tools for winning votes in elections instead of providing security to communities. The evidence however suggests that elites in Uganda have not captured foreign assistance as donors are

[11] The use of an alternative model e.g. the VECM, would fall outside the scope of the dissertation. Unfortunately, no alternative measure for aid could be found for the time frame of the analysis.

perceived to exhibit a degree of control over the flow of aid by citizens (Findley et. al., 2017).

Table 5: Short-Run results with the aid variable

Error Correction Representation for the Selected ARDL Model

ARDL(1,0,0,0,4) selected based on Schwarz Bayesian Criterion

Dependent variable is dLGDPC

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLINVEST	.06	.03	2.48[.02]
dLMILEX	.01	.01	.35[.73]
dLPOPG	-.34	.19	1.75[.09]
dLODA	-.03	.01	-2.16[.04]
dLODA1	-.04	.01	-3.37[.02]
dLODA2	.00	.01	.17[.87]
dLODA3	.03	.01	2.71[.01]
dTREND	-.64	.61	-1.04[.30]
dDV	-.05	.02	-2.80[.01]
dDFC	-.02	.02	-1.15[.26]
ecm(-1)	-.01	.02	-.20[.84]

R-Squared = .77322

52 Observations

Investment and aid are significant drivers of growth in the short-run. Population growth remains a much-publicized challenge and the large, significant coefficient in the short-run reflects the need to increase the productivity of the growing population. The devaluation coefficient is only significant in the short-run (dDV) which supports the data since economic growth rebounded shortly after experiencing a sharp decline in 1986. Overall the short-run model provides a good fit for the data with the variables displaying joint-significance and the Durbin-Watson (DW) statistic (1.8843) indicating no autocorrelation in the short-run when aid is considered. CUSUM and CUSUM of squares tests indicate model stability with aid. As with the bounds test, no long run equilibrium exists when the aid variable is considered.

6: Conclusion

Studies into the defense-growth relationship in African countries are dominated by panel studies which often exhibit heterogeneity. Despite recent models capable of capturing country-specific characteristics, there remains the possibility of generalizing results in cross-country regressions. Even as findings from the literature become more consistent, the theoretical link between military spending and growth can be better understood with case studies that provide a greater economic and security context. The influence of the military will be greater in countries with a history of conflict and previous studies have shown African countries to be especially prone to the negative effects of military expenditure. For Uganda, independence from colonial rule brought a sense of optimism as the economy diversified beyond simple processing of exports and a greater proportion of the population gained employment. Following a series of political crises the country became more militarized and autocratic leading to a period of economic turmoil when exports declined sharply and a budgetary crisis required the country to repeatedly devalue its currency.

Military spending by governments remains influential and has been increasing in Uganda even as research consistently points to a negative effect on the economy. The repercussions for peace are considered as strategic objectives are the main drivers of increased military expenditure. The history of conflict and underdevelopment in Africa makes the trend of increasing military spending more concerning given the role of foreign aid in facilitating higher military spending that deters economic growth. The defense-growth relationship in countries that are net foreign aid recipients is deserving of more attention since aid is expected to have a positive effect on economic development and donors are not expected to be a source of funding for conflict in poor nations. When aid is included as an explanatory variable, the impact of military expenditure in Uganda becomes insignificant in the long run and short-run. This result is expected since foreign aid received far exceeded the military budget.

This study contributes to the debate on the economic effects of military spending by analyzing data for the period 1962-2018, using the modeling framework suggested by

Dunne et. al. (2005). It produces a case study and growth equation results for Uganda which complement panel studies prevalent in the literature. Within a well-specified growth model commonly used in the literature and using a dynamic first-order model, the paper finds support for the negative impact of a military burden on growth in both the short and long run. The high coefficients observed in panel studies of low-income countries are also found in this particular case. When aid is considered, the impact of military spending becomes positive however the relationship is insignificant which has been the case in previous studies which have reported a positive impact of military spending on growth. In the standard Solow Model with no aid variable, the long run and short-run estimates produce consistent results and all variables produce the expected sign. Although simple, the chosen estimation method is useful for establishing the presence of a long run equilibrium in Uganda's defense-growth relationship and informing policy.

This research has revealed that military spending in Uganda has diminished the effectiveness of investment and development assistance in supporting economic growth. The implications for defense policy are a need to reduce the proportion of military spending in output and improve monitoring and evaluation of the skills acquired in the armed forces. The potential for internal conflict has increased military spending and policy should seek to reduce domestic tensions which have resulted in the proliferation of legal arms in the country. Economic policy should seek to direct investment and aid toward increasing the productivity of human capital and reducing the rate of population growth.

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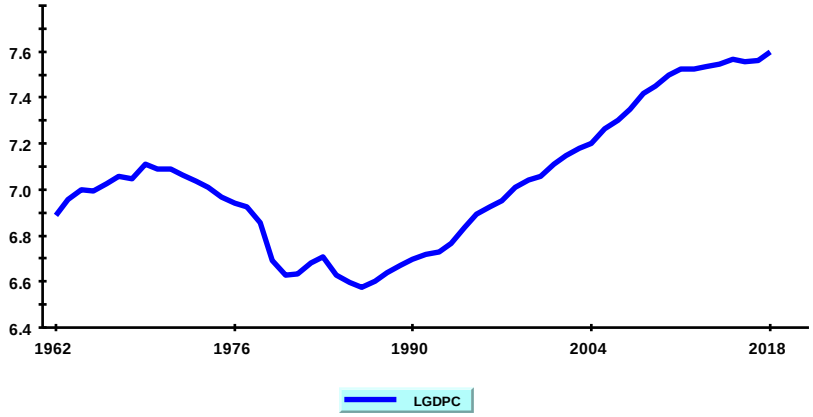
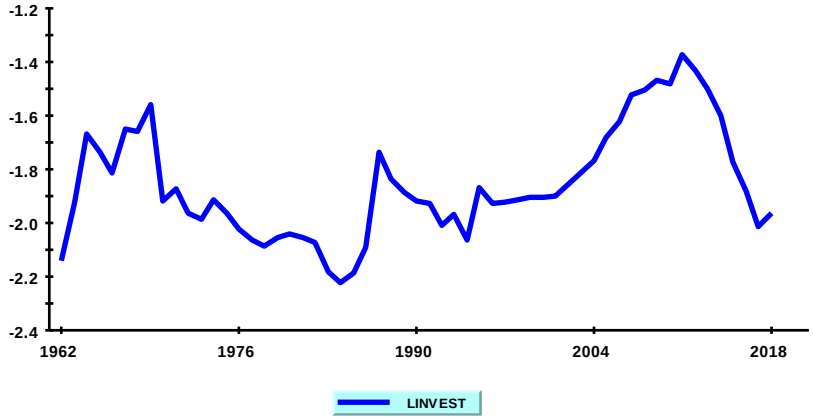
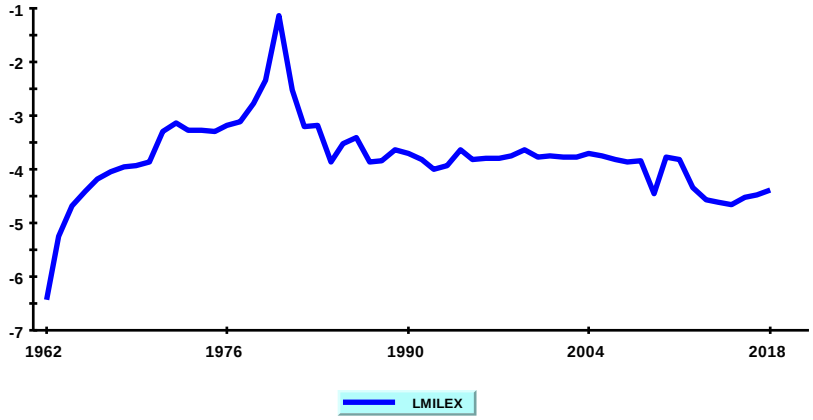
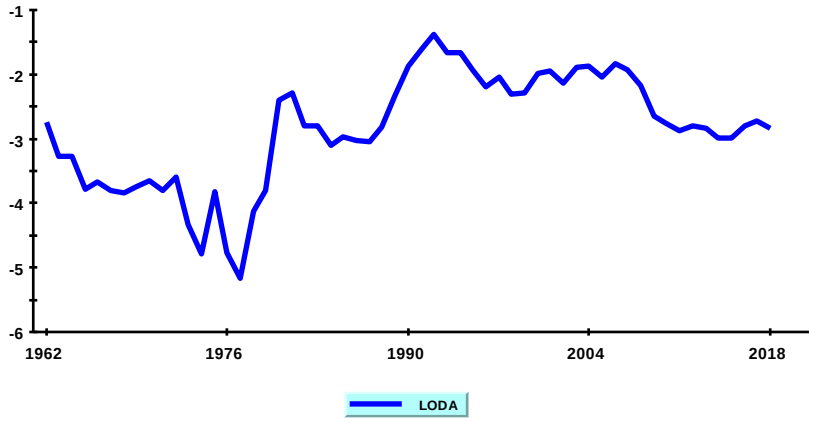
7: APPENDIX A

Figure 7.1.1: Plots of the Log of GDP per Capita, Investment, Military Spending, Population Growth, and Official Defense Assistance.






-1
-2
-3
-4
-5
-6
-7
1962
1976
1990
2004
2018
LMILEX


-1
-2
-3
-4
-5
-6
1962
1976
1990
2004
2018
LODA

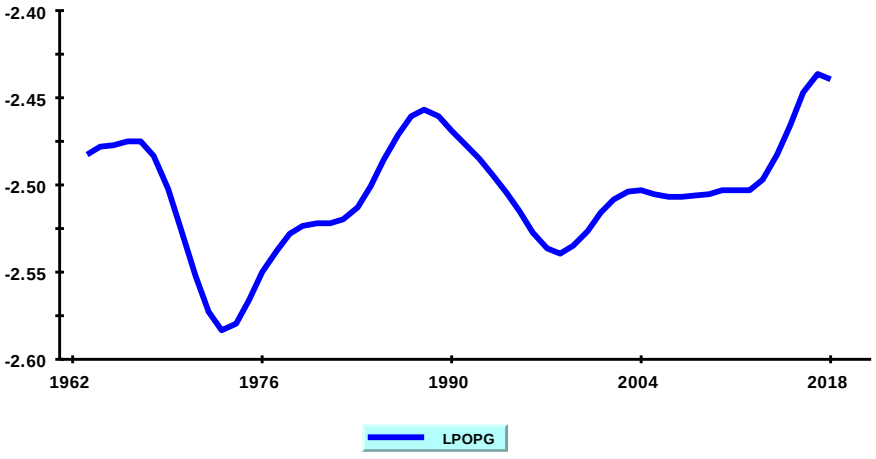

-2.40
-2.45
-2.50
-2.55
-2.60
1962
1976
1990
2004
2018
LPOPG

Figure 7.1.2: Plots of the Log of GDP per Capita, Investment, Military Spending, Population Growth, and Official Defense Assistance, in first differences, respectively.

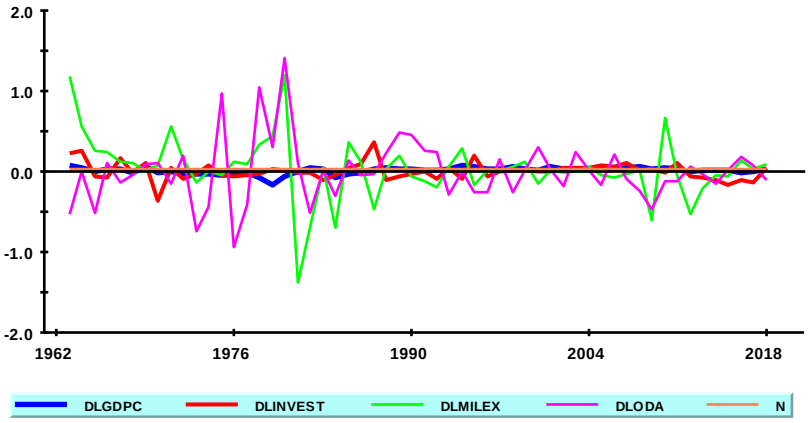


Table 7.2.1 Unit Root Tests

Variable (First Difference)	ADF Test (1 Lag)
Log(GDP Per Capita)	-3.98**
Log(Investment)	-3.95**
Log(Military Spending)	-6.23**
Log(Aid)	-5.30**
Log(Population Growth)	-7.34**

Notes: All variables are tested with an intercept and trend. **Significance levels at 5 % corresponding with a critical value = -3.4987

Table 7.2.2 ARDL bounds test without Official Development Assistance variable

Model	F-Statistic/F-Version	
Log(GDPC) Log(INVEST) Log(MILEX) Log(POPG)	2.5702	
Critical Values	Lower Bound	Upper Bound
5% Critical Values	4.60	5.86
10% Critical Values	3.87	4.10

Notes: The order of ARDL is 4 and model selection is based on the BIC. Results continue to hold with the W-statistic.

Table 7.2.3 Diagnostic Tests for ARDL bounds test without Official Development Assistance variable

Model Log(GDPC) Log(INVEST) Log(MILEX) Log(POPG) Test Statistics	F-Statistic/F-Version	LM Version
A:Serial Correlation	.85[.36]	.70[.41]
B:Functional Form	1.91[.17]	1.60[.21]
C:Normality	34.88[.00]	n/a
D:Heteroscedasticity	1.16[.29]	1.15[.29]

Table 7.2.4 ARDL bounds test with Official Development Assistance variable

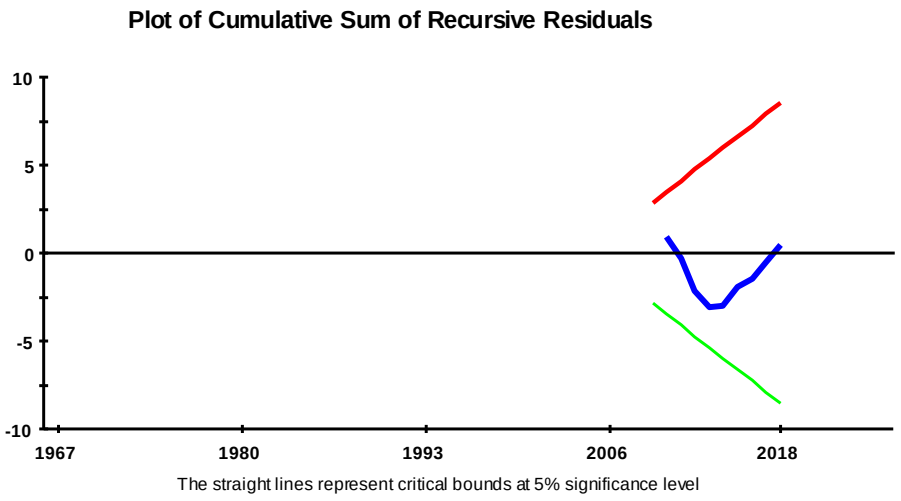
Model Log(GDPC) Log(INVEST) Log(MILEX) Log(POPG) Log(ODA)	F-Statistic/F-Version 8.35	
Critical Values	Lower Bound	Upper Bound
5% Critical Values	4.06	5.35
10% Critical Values	3.44	4.60

Notes: The order of ARDL is 4 and model selection is based on the BIC. Results continue to hold with the W-statistic.

Table 7.2.5 Diagnostic Tests for ARDL bounds test with Official Development Assistance variable

Model Log(GDPC) Log(INVEST) Log(MILEX) Log(POPG) Log(ODA) Test Statistics	F-Statistic/F-Version	LM Version
A:Serial Correlation	.13[.72]	.09[.76]
B:Functional Form	.54[.46]	.40[.53]
C:Normality	1.84[.40]	n/a
D:Heteroscedasticity	2.38[.12]	2.40[.13]

Figure 7.3.1 CUSUM test and the CUSUM of Squares without Aid as an explanatory variable



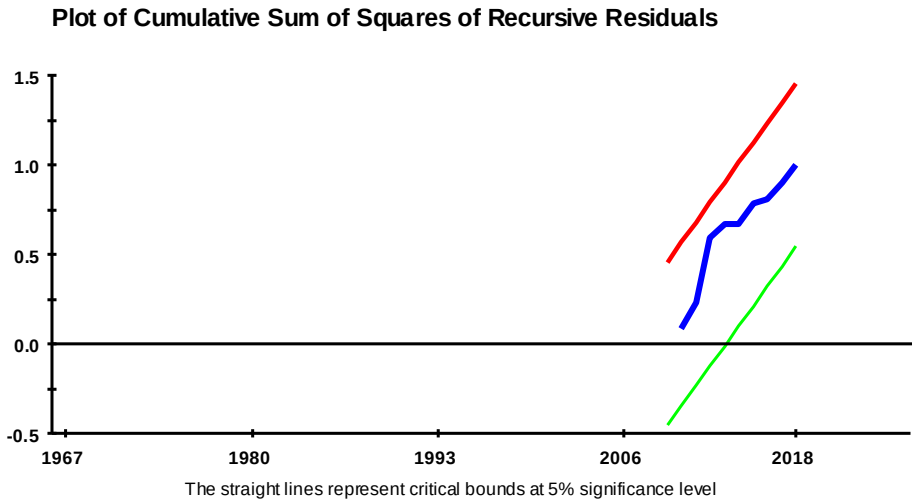
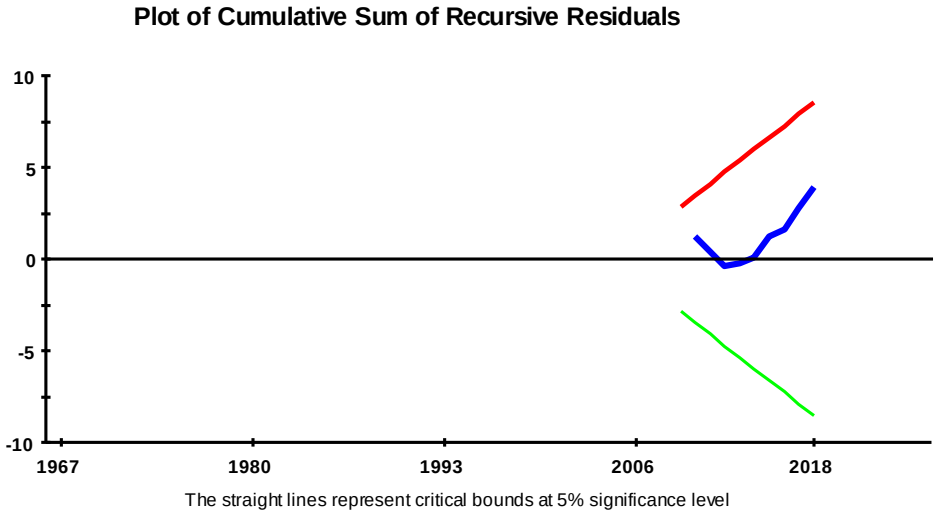
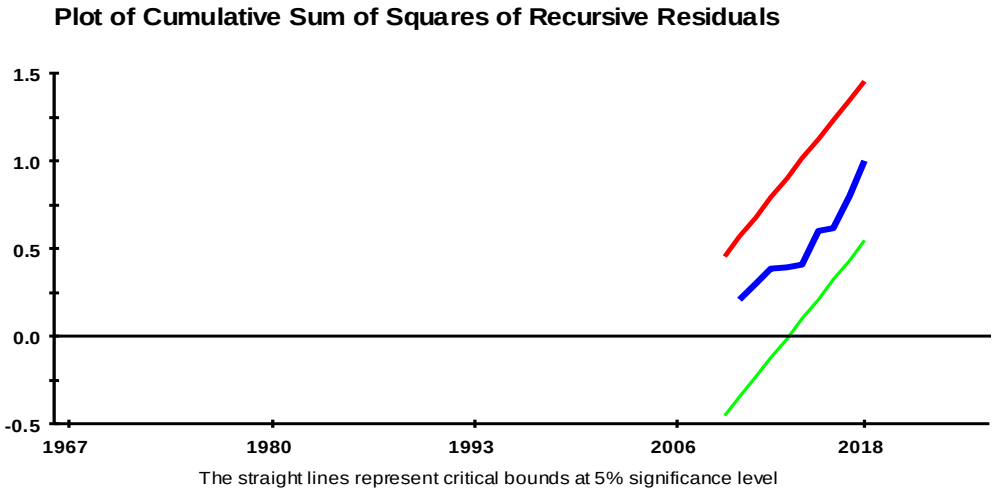


Figure 7.3.2 CUSUM test and the CUSUM of Squares with Aid as an explanatory variable




Plot of Cumulative Sum of Squares of Recursive Residuals
1.5
1.0
0.5
0.0
-0.5
1967
1980
1993
2006
2018
The straight lines represent critical bounds at 5% significance level