

The Determinants of Military Expenditure in Rwanda

Nakiwe Dlamini



A dissertation submitted to the University of Cape Town in partial fulfilment of the requirements for the degree of

Master of Commerce

in

Applied Economics

School of Economics

December 2023

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

ABSTRACT

Military expenditure is a critical component of every nation's central government budget. Despite its important role, very few studies attempt to investigate the determinants of military expenditure for individual countries in the third world. Most studies have focused on cross country and panel studies largely for developed economies. This study addresses these issues by investigating the determinants of military expenditure in Rwanda, a country that has experienced conflict and civil unrest. No studies for Rwanda had been published, regardless of the growing military expenditure. A range of factors such as economic, political, or strategic conditions can drive the demand for defence expenditure. This paper employs a general model of demand for military expenditure and estimates it using the Autoregressive Distributed Lag (ARDL) approach, over the period 1973 to 2022. The results provide strong evidence that trade openness, foreign direct investment (FDI), democracy, genocide and real GDP per capita play a crucial role in determining military expenditure in Rwanda. According to the conclusions drawn from the study, government initiatives should prioritize trade openness to result in less government spending on the defence sector, which in turn frees up funds for other government projects. Additionally, efforts to attract FDI should be intensified, as FDI inflows can lower the intensity of global conflict, promote cooperation and result to a reduced level of military spending.

Keywords: Military Expenditure, Arms Race View, Neoclassical Perspective, Economic Factors, Political Factors, Strategic Factors, ARDL, Rwanda

ACKNOWLEDGEMENTS

My sincere gratitude goes to my Supervisor, Professor Eftychia Nikolaidou. Thank you for your guidance, constructive feedback and taking your time to review all my drafts.

DEDICATION

To my mother, Fikile Magagula-Dlamini.

Plagiarism Declaration

COMPULSORY DECLARATION:

1. This dissertation has been submitted to Turnitin (or equivalent similarity and originality checking software) and I confirm that my supervisor has seen my report and any concerns revealed by such have been resolved with my supervisor.
2. I certify that I have received Ethics approval (if applicable) from the Commerce Ethics Committee.
3. This work has not been previously submitted as a whole, or in part, for the award of any degree in this or any other university. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works of other people has been attributed, and has been cited and referenced.

Student number	DLMNAK002
Student name	Nakiwe Simile Dlamini
Signature of Student	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Signed by candidate</div>
Date:	20/12/2023

TABLE OF CONTENTS

CHAPTER 1: Introduction.....	1
CHAPTER 2: Literature Review.....	5
3.1 Theoretical Review.....	5
3.2 Empirical Review.....	9
CHAPTER3: Background and Overview of Rwanda.....	15
CHAPTER 4: Data, Model Specification and Methodology.....	21
4.1 Model Specification.....	21
4.2 Data.....	22
<i>4.2.1 Variable Descriptions</i>	<i>23</i>
<i>4.2.2 Descriptive Statistics.....</i>	<i>27</i>
4.3 Method.....	28
<i>4.3.1 Estimation Technique.....</i>	<i>28</i>
<i>4.3.1 Unit Root Tests.....</i>	<i>29</i>
<i>4.3.2 Cointegration / Bounds Test.....</i>	<i>30</i>
<i>4.3.3 Long Run Estimates.....</i>	<i>30</i>
<i>4.3.4 Short Run / ECM Estimates.....</i>	<i>31</i>
<i>4.3.5 Diagnostics and Stability Tests</i>	<i>31</i>
CHAPTER 5: Results and Discussions.....	32
5.1 Unit Root Test Results.....	32
5.2 Cointegration Bounds Test Results.....	32
5.3 Estimation Results of the ARDL Model.....	33
<i>5.3.1 Baseline Model Result.....</i>	<i>33</i>
<i>5.3.2 Expanded Model Result.....</i>	<i>35</i>
<i>5.3.2.1 Long Run Results.....</i>	<i>35</i>
<i>5.3.2.2 Short Run / ECM Results.....</i>	<i>39</i>
5.4 Diagnostics and Stability Test Results.....	42
CHAPTER 6: Conclusions, Recommendations and Limitations.....	42

REFERENCE LIST..... 45
APPENDIX..... 56

1. INTRODUCTION

In the wake of recent world events, such as Russia's invasion of Ukraine in 2022, military spending and investment in warfare have come under the spotlight and have faced heavy scrutiny (Lichterman, 2022; Tian et al., 2023). Expenditure on the military has become a vital and unavoidable component of all countries' central government spending. Yet, compared to other components of government expenditure such as education and health, that have been discussed profoundly in the literature, the focus on military expenditure (ME) has not entailed equivalent attention, particularly in the third world. Deger and Sen (1995) further point out that comparable to NATO and the Soviet Union, which experienced a structural break in the 90's, aggregate ME in the third world foresees an upward trend, with little expectations of dying down, a manifestation which has been witnessed in recent years.

SIPRI (2021) regional trends in ME reported a 1.2 percent rise in defence spending in the African continent, for which Sub-Saharan Africa accounted for more than half of the increase. Even though Africa experienced a break in 2022 as ME fell by 5.3 percent, which can partly be attributed to the rise in natural disasters (e.g., locusts in Kenya, floods in Nigeria) resulting to the need for budget shifts (SIPRI,2023; Tian et al., 2023), it is unlikely that the decrease in ME can be maintained. This is due to the rise in coups (e.g., Mali, Niger, Burkina Faso and Guinea among others) which may force countries to re-prioritise their defence spending. Unlike the European Union, African countries are bound to thoroughly invest in their own ME due to the underdevelopment of the Common African Defence and Security Policy (George & Sandler, 2022), meaning there is little to no chance of free riding under military distress. Regional blocs such as East African Community (EAC), Southern African Development Congress (SADC) or Economic Community of West African States (ECOWAS) also have limited military capabilities. In the absence of adequate investment in the military, countries would be at security risk and more vulnerable to external attacks. This is because countries with a weak military can be vulnerable to resource exploitation (Ali and Abdellatif, 2015) and an easy target for takeovers. It can be noted, however, that the budgetary allocations on ME are dependent on the country specific requirements.

Many scholars have mostly concentrated on the developed world's biggest military spenders such as the USA, NATO, UK when assessing the determinants of ME. Yet, developing

countries such as China, Russia and India, amongst others, have also experienced great increases in ME (SIPRI,2022; Khan et al., 2022). It is important to breach the gap by evaluating more individual countries especially in the developing world, that are also vastly affected by high military spending. High military expenditure can overstretch a country's budget, as provisions for excess spending must be catered for. The implications of high ME are even more pronounced for developing economies, as it may involve budget cuts from essential services. This is because countries are constantly faced with the problem of scarcity, which may result in guns and butter trade-off (d'Agostino et al., 2017; Russett, 1969).

Therefore, excessively large spending on the defence sector may have the opportunity cost of channelling funds away from productive processes such as infrastructural development, education or health (see Yildirim & Sezgin, 2002). On top of that, security can be regarded as a global public good (Engerer, 2011). Resultantly, the non-excludability feature of a public good makes it accessible even to those without active participation in the economy or non-taxpayers. Thus, spending on defence may not carry direct benefits in comparison to spending in areas such as education. Moreover, excessive spending on the military does not necessarily amount to an improved standard of living or guarantee the absence of violence and conflicts (Arif, 2012). Factors such as poverty and low livelihoods could force human beings to act in a hostile manner in pursuit of their rights and freedoms, all of which could be addressed through proper investments in areas of education, health, good sanitation, etc.

Then again, the role of the military is undeniably crucial as development and economic progress can be meaningless without the protection of a strong military base, as witnessed in the case of Ukraine, where Russian troops vandalised developments such as infrastructure in 2022. Or the catastrophic civil wars that have transpired throughout the world. Also, other areas of the economy such as trade with other countries can be adversely affected if investors foresee a fragile security climate. Perhaps, given the extent to which security is intertwined with most sectors of the economy, it may be worthwhile to commit large sums of the economy's wealth for defence purposes?

Although there is a lot of work on the economic effects of military spending (see Benoit, 1973 and 1978; Fontanel, 1990; Landau, 1993; Yildirim et al., 2005; Saba & Ngepah, 2019), there is not much on the determinants of military expenditure. Therefore, the purpose of this study is to understand the determinants of military expenditure in Rwanda. This specific case study

is of utmost importance because, although Rwanda is a low-income country, it spends a lot on defence. There are also no studies on the drivers of defence spending in Rwanda. Rwanda, just like most of Sub-Saharan African countries, falls under the heavily indebted poor countries (HIPC) status. About 52 percent of the Rwandan population lives below the poverty line, with an estimated \$2.15 per day as per 2017 adjusted purchasing power prices (World Bank, 2023). Efforts to end poverty are crucial and are one of the blueprints of the United Nation's 2030 Sustainable Development Goals (SDG), for which countries must adhere to globally (UNDP, 2023). Consequently, proper rationing of the economy's funds amongst the different sectors is important. Perhaps, targeting areas of enormous spending, in this case ME, could improve Rwanda's economy through better informed decisions in as far as spending allocations are concerned. Also, a growing economy, fears of the past (genocide), limited natural endowment and a questionable political regime makes Rwanda of suitable basis for this review. Some of the major questions that this research highlights are; whether the high military spending in Rwanda may be a response to the past genocide in 1994? This is because it has been argued that the prevention of conflict is more preferable, and cost effective compared to conflict resolution (Chalmers, 2007). In addition, Corr (2013,2016) found evidence of avoidance behaviour innate in human beings, where the recurrence of past traumatic events (i.e., genocide in this case) is avoided at all costs. Likewise, economies are governed by individuals who themselves are not immune to these instincts. As stated, ME is not just an economic issue, but a result of the interplay of economic, political, psychological, strategic or moral components (Nikolaidou, 2008). Or the rising ME can be explained as a natural occurrence inherent in a growing economy like that of Rwanda? This is because economic growth may require new levels of security to protect emerging and growing industries such as Tourism in Rwanda. Consequently, these factors may vastly contribute to the rising military expenditure in Rwanda.

Arif (2012) points out the importance of recognizing the drivers of defence spending for policy ramifications. Knowledge about this can assist policymakers in making better informed decisions to control for the rising military expenditure in Rwanda. Further, according to Solarin (2018), determining the drivers of ME in a country helps to economise on the distribution of military budgets and control for arms or disarmament policies. In turn, prioritisation of defence allocations becomes a vital economic and political issue. Droff and Malizard (2022) describe a contemporary era of increasing defence demands, however, accompanied by depleting economic conditions. As a result, nations should tread carefully in as far as their defence policies and decisions are concerned, more especially as the need to adapt defence policies in

line with international standards post-cold war has also contributed to the increasing defence needs (Droff & Malizard 2022).

In the literature, the most effective and comprehensive approach is to estimate a general model for the demand of military expenditure (discussed in further sections), that incorporates economic, political and strategic factors to understand the drivers of military expenditure. This study employs this approach to provide a thorough understanding of the determinants of military expenditure in Rwanda. The model is estimated by the Autoregressive Distributed Lag (ARDL) method to cointegration over the period 1973-2022. Firstly, this paper presents a baseline model which includes economic variables as commonly used in the literature. Further, an expanded model which encompasses country specific factors such as political and strategic variables is presented for the case of Rwanda. Upon compilation of this study, no prior studies specifically examining the determinants of military expenditure in Rwanda had been published. Most studies on defence spending have centred around the developed world, with inadequate research on developing nations, especially in Africa. Therefore, this study adds to the scant literature on the determinants of military expenditure by focusing on a developing country in Africa, Rwanda.

The remainder of the study proceeds as follows: Chapter (2) reviews the theoretical and empirical literature providing a comparison between developing and developed countries. Emphasis is put on two theories, specifically the arms race view and the neoclassical perspective. Chapter (3) provides a brief overview of Rwanda's military spending, economic and political background. This chapter further justifies the choice to concentrate on Rwanda in the current study. Chapter (4) delves into the empirical work, focusing on the model specification, data and method. Chapter (5) provides the empirical results. Lastly, Chapter (6) concludes the study and provides recommendations for further research.

2. LITERATURE REVIEW

2.1 Theoretical Review

Theoretically, there have been different views on the factors that determine the level of military expenditure in any country. Amongst those, the arms race framework (Richardson, 1960) has shown to be better suited in explaining external factors such as a military threat. Quantifying the drivers of defence spending based on only a single aspect, however, has proven inadequate and misconstrued. As such, the determinants of military expenditure have been best elucidated in terms of political, strategic and economic factors (Looney, 1986). This assertion is supported by Nikolaidou (2008) who posited that military spending is not just an economic issue; it also has political, strategic, psychological, and even moral components. Altogether, general models of demand for military expenditure encompass all the above-mentioned factors to explain the determinants of military expenditure (see Dunne, 1996; Nikolaidou, 2008).

The theoretical underpinnings of the arms race paradigm insinuate that fluctuations in a country's defence spending, is due to or in proportion to an adversary nation's military expenditure (Richardson, 1960). To explain this, studies by Dunne and Perlo-Freeman (2003) highlight the influence of potential rivals in determining military expenditure (ME). Vasquez (1995) further raised the importance of proximity to explain why most conflicts are amongst neighbouring countries relative to countries further away. As claimed, irrespective of the advancement in technology which may presume to erase the distance factor, it is still difficult and costly to wage a war further away from home (Webb, 2007). Thus, it is unreasonable to discard the influence of potential enemies. Alternatively, an earlier study by Rosh (1988) found that a country's neighbours or influential powers determined ME, in his attempt to explain the strategic factors influencing ME. Collier and Hoeffler (2004) also added that a country is likely to imitate the actions of its neighbours regarding defence spending, irrespective of whether a threat exists or not. Overall, these findings were confirmed in a study by Skogstad (2016), who stated that due to uncertainty post-cold war, external factors may play an even greater role in determining military budgets.

Even so, the above interpretation of the determinants of military expenditure may only provide a piece of the puzzle and ignore other crucial factors driving a country's ME. As argued, the

arms race view is vastly better suited to analyse conflict situations and therefore only marginally useful (Solarin, 2018). Also, the determinants of military spending have not been adequately explained by the arms race viewpoint based on bilateral relationships (Majeski & Jones, 1981; Albalade et al., 2012). As such, the arms race framework may fail to reach consensus on whether countries in good terms with one another (e.g., countries trading with each other) can be involved in an arms race. Furthermore, Smith et al. (2000) found evidence that an arms race between countries only exists temporarily.

A recurring argument has been on whether to assess military stocks (weaponry) or expenditures (as defined by SIPRI) among the adversary nations in the arms race paradigm. According to Hill (1992), it may be easy to defeat an adversary nation given the existence of current large stocks of weapons. However, weapons just like other forms of equipment get outdated and lose their efficacy over time. Choulis et al. (2022) also put forth the need to acknowledge the unique defence priorities that countries involved in an arms race may have. In their analysis, they provide the example of Turkey and Greece. The former's investment in defence largely channelled on stock purchases as well as research and development (R&D) whilst the latter invests more on military personnel (Waszkiewicz, 2016).

Also, whilst the arms race perspective may be applicable and make sense in the case of Turkey and Greece, with a long-known history of rivalry, the same may not apply for other nations. Even in this case, the literature has been inconclusive on the significance of arms races in ensuing conflict (see Richardson, 1960 versus Morrow, 1989). This is because there has only been a handful of countries or regions assessed to date with arms race linkages, such as USA/Soviet Union, Greece/Turkey, Israeli/Arab, India/Pakistan, South/North Korea (Lembelet, 1971; Öcal, 2003; Bae, 2004; Dunne et al., 2008). Still, for these two NATO allies (Greece and Turkey), evidence suggests otherwise, with the underlying presumptions of an arms race dating back from the sovereignty over Cyprus, to airspace violations and gas discoveries in the Mediterranean (Avramides, 1997; Ocal & Yildirim, 2009; Choulis et al., 2022).

Furthermore, the simplicity of the arms race framework (Richardson, 1960) has faced a lot of criticism (Luterbacher, 1975; Ward, 1984; Hill 1992). For instance, the allowance of boundless increases in arms has been refuted. Some theorists claim that other forces such as fiscal restraints and dwindling savings to support purchases automatically prevents any further

increases in arms ornaments (Chan, 1988; Hill, 1992). Consequently, different variants of Richardson's arms race paradigm have been devised to extend its scope (Dunne et al., 2008). However, some of these extensions have not erased the underlying challenges. For example, as economic conditions worsen, the expectation would be to avoid any further increases in ME; by either maintaining current defence spending or decreasing ME altogether. Yet, nations have exploited the financial aid basket for military purposes. Langlotz and Potrafke (2019) assessed whether development aid increases ME. Their results highlight aid to cause a rise in military expenditure, especially for conflict ridden and donor dependant nations, as the case for several developing countries.

At the country level, most studies have delved on the opportunity cost of military spending to productive non-military expenditure such as education (Yildirim & Öcal, 2006; Dunne & Tian, 2020; Yalta, 2022). Conversely, Josselin and Malizard (2022) put emphasis on the fact that countries with good economic standing can actually afford to spend more on defence. In this regard, the above may only be applicable to countries with poor economic prospects as the need for security increases with income (Solarin, 2018). Whilst at the international level, the image and reputation of countries involved in an arms race may be at stake, which can affect aid assistance in the future, especially for impoverished nations. Therefore, to overcome the challenges above, a general model of demand for military expenditure becomes of outmost importance. Its foundations are based on maximising a welfare function subject to budget and security restraints.

In the neoclassical framework, security is essential to the state's goal of maximizing social welfare. The social welfare function is resolved by the state based on community preferences (Dunne & Sam Perlo-Freeman, 2003). Additionally, the cost-benefit analysis is used to determine military spending. Hence, the neoclassical perspective puts emphasis on the positive externalities that emanate from spending on the defence sector for the civilians and economy (see Karadam et al., 2017; Abura, 2021). However, opponents of the neoclassical perspective reject the neutrality of the state or the state's responsibility in only serving civilian interests as assumed by the neoclassical perspective (Maizels & Nissanke, 2009; Sivard, 1983). This is based on the argument that in most developing countries, military power is in the hands of the ruling party. Fairly so, investment in the military may be at the discretion of the authority in charge to protect itself from potential oppositions and threats. Simply put, military power may be used as a tool to retain and ensure supremacy (Yalta, 2022), which raises questions of power

and legitimacy. Consequently, the expectation would be the allocation of higher military budgets for autocratic regimes in comparison to democratic societies (see Dunne & Perlo-Freeman, 2003; Dizaji et al., 2016; Dizaji, 2019b). Nonetheless, there is no perfect democracy without any hurdles, and every system as managed by human beings is bound to be flawed and fall prey to their ulterior motives, which even western countries cannot escape.

Further, spending on the defence sector to hinder any potential threats (external or internal), remains at the centre of all nations' peacekeeping efforts. Kamlet and Mowery (1987) detail that expenditure on the military is best justified by the presence of ongoing conflicts. Nevertheless, the recruitment, training and maintenance of armed forces does not come cheap. Far worse, to keep up with the times, the need for more sophisticated defence mechanisms is evident. Military intelligence and military technology have become of particular interest in recent years and further adopted by developed nations such as the USA. As developing countries endeavour to catch up on these new developments, it stretches their military budgets. Take for instance, the rise in ME due to a call to modernise Spain's armed forces after being enervated by the lost fight with the USA in the 1898 war, and for which USA had a technological advantage (Ortiz-Villajos & Martos-Gómez, 2023). Regardless of its shortcomings, the neoclassical perspective as applied in the general model for the demand of ME, has proven to be highly beneficial in empirical studies. It adopts a holistic strategy by accounting for political, economic and strategic factors when assessing the determinants of military expenditure (Batchelor et al., 2002).

Political factors have been widely recognized as crucial in addressing military spending in the literature (Smith, 1995; Deger & Sen, 1995; Albalade et al., 2012). According to Dizaji, 2019 and Dizaji & Farzanegan (2023), political behaviour of governments in developing countries is influenced more heavily by their spending on the military sector than by their spending on the non-military sector. To a large extent, however, the literature has given more focus on economic factors, which seeks to test the validity of earlier studies that had maintained that economic variables were crucial factors influencing military spending (see Benoit 1978; Ball, 1983; Maizels & Nissanke, 1986; Deger & West 1987). Economic factors encompass elements such as inflation, GDP, unemployment, trade, exchange rate, etc. Their influence on ME has been inconclusive, both in prior and recent studies (see Andriamahazoarivo & Ravalison, 2016). Furthermore, Maizels and Nissake (2009) describe the strategic variables influencing ME as the extent to which a nation depends fully or in part to a superpower or regional/global

bloc, which may force it to strengthen or prioritise its military establishments. This results in elevated ME, not only due to pressure to adhere to allies' standards and policies, but also as a form of support in favour of their goals. Take for instance, the minimum 2 percent military expenditure recommended by NATO to all its member countries. In another view, Smith (1989) interprets the strategic components driving a country's ME as the longing to maintain or occupy a certain position of power in the international space. Therefore, encouraging a country to spend more on the military.

Although opponents of the neoclassical perspective have argued on the use of complex mathematical models (Yalta, 2022), the pros have seemed to outweigh the cons as discussed. For instance, there has been a wealth of knowledge in the literature to draw from the neoclassical perspective (formerly Classical realism). This is because several Nobel prize winners have endorsed or denounced the neoclassical view in their works. This study follows through by adopting a general model of demand derived from the neoclassical perspective in its analysis.

2.2 Empirical Literature

The preponderance of studies on the determinants of military expenditure in recent years, have centred around groups of countries employing panel data or cross-sectional methods. Furthermore, the empirical literature has provided an interplay of economic, political, strategic and security related factors which vary across countries and over time. Studies have been categorized based on cross country comparisons, variables, methodology, time spans, geography, level of economic growth, etc, (Kawamya, 2022). Proponents of panel studies that focus on groups of countries with similar characteristics, maintain that such studies are useful to control for the presence of unobserved heterogeneity and individual specific effects inherent in cross sectional studies. Additionally, panel studies may provide a thorough understanding of any intrinsic mechanism that underline the relationship among the variables. However, the findings of panel studies may not adequately reflect country-specific experiences. This is due to the heterogeneity of the countries which may affect the validity of the results (Mensah, 2018). Besides, the interplay of economic variables is likely to be country specific.

Panel studies utilize a variety of estimation techniques ranging from traditional methods such as pooled ordinary least squared (OLS), difference in difference method, to more popular methods such as general method of moments (GMM), fixed and random effects or more recent

approaches such as the autoregressive distributed lag (ARDL), seemingly unrelated regression, and panel vector autoregressive model. Employing the general model for the demand of ME and estimating it by the ARDL method, Odehnal et al. (2020) conducted a panel study to examine the determinants of military expenditure in Baltic States from 2001-2018. The variables employed included GDP per capita, government deficit/surplus, general government gross debt, inflation and the security environment, risk of cross-border conflict, and democratic accountability. The study found that GDP per capita, military threats, population size, significantly influenced military expenditure. The paper further established that military expenditure increases for countries that join NATO. According to the authors, NATO membership offers a sense of protection against potential external threats and acts as a powerful security signal. The study advanced the existing literature by employing a combination of economic, political and strategic variables to examine military expenditure determinants. However, the study is limited by its focus on Baltic States (Lithuania, Latvia, and Estonia) which has implications for generalizing the result to other countries. The use of the cross-sectional design by the authors further limits the ability to establish causality in the study. It was not clear whether the variables employed cause military expenditure even though the study documented correlations between the variables and military expenditure.

Focusing on a panel of 157 countries, Albalade et al. (2012) employed the pooled OLS regression to examine the determinants of military spending between 1988 to 2006. The study put emphasis on institutional variables as actors influencing the military expenditure of countries. According to the authors, institutional variables incorporate the effects of the form of government, electoral systems, concentration of the parliamentary parties and ideology on the defence burden. The results revealed a significant adverse influence of democracy on military expenditure. The study also found that countries practicing democracy spend more on defence compared to their parliamentary counterparts, due to the instability characterizing presidential systems. The addition of institutional variables may be essential in advancing the understanding of the drivers of military expenditure. Nonetheless, there is no clear theoretical support adduced by the study to support the inclusion of institutional variables. Also, a limited time span was utilised. The estimation method employed also failed to address the endogeneity between institutional variables and military expenditure which may affect the validity of the results.

Additionally, Solarin (2018) conducted a panel study focusing on 119 countries to examine the determinants of military expenditure. The study utilizes economic variables such as GDP, trade shares in GDP and the proportion of armed forces in the population. Other variables employed include dummies for military government and the existence of wars. Besides the economic and socio-political variables employed, Solarin (2018) also attempts to uncover strong evidence of the role of globalisation on military spending. The use of the GMM approach in his analysis instead of the traditional panel estimation techniques, helps to make provision for both heteroscedasticity and autocorrelation, as well as to deal with any potential endogeneity. The results convey real GDP, population and NATO membership to have positive effects on military expenditure. Nevertheless, the results above contradict the findings by Dunne and Perlo-Freeman (2003). The mixed results can be attributed to the difference in the methods of estimation and the countries included in the studies.

Another contribution of Solarin's (2018) study is the inclusion of globalisation to provide further insight on military expenditure determinants in a panel study. Solarin (2018) suggests that globalization is an important determinant of military expenditure. An explanation offered by the author, is that globalization fosters the transition to a more peaceful and prosperous world by producing various economic and sociocultural gains for all those involved. This has the tendency to reduce military spending. Contrastingly, previous studies such as that of Dunne et al. (2008) have maintained that globalization rather raises military expenditure - arguing that globalization may increase military spending by encouraging unrest, inequality, conflict, and ultimately war. Nonetheless, the problem of cross-section dependence, with the focus on 119 countries in Solarin's (2018) study potentially eliminates the merits of the panel data over time series or cross-sectional analysis.

Do's (2021) analysis of the determinants of military expenditure focused on the impact of natural resource rents. He covered the years 1966 to 2017 for a large sample of 163 countries worldwide, grouped into regions. The two-step General Method of Moments (GMM) was utilised in the study. Controlling for other determinants of military expenditure (real GDP per capita, GDP growth, trade, political stability, corruption, terrorist attacks), the study's results provide substantial evidence for the significant positive effect of natural resource rents on military expenditure. Specifically, for the Middle East, Sub-Saharan and North Africa. According to the author, natural resource rich countries are well able to use proceeds from natural resources to repress any oppositions. This in turn, accounts to expansions in defence

spending. Ali (2015) also states that the availability of natural resources (i.e., oil) in the Middle East and North Africa (MENA) lessens the opportunity cost of increasing defence spending. Similarly, a study by Ali and Adellatif (2015) also found natural resource rents to have a major impact on military expenditure for the oil rich MENA area. The findings are in line with the resource curse hypotheses which is indicative that the abundance of natural resources, particularly oil, encourages increments in defence spending (Ali, 2015; Do,2021). Although Do (2021) combined the natural resource rents in his analysis, Ali and Adellatif (2015) point out that the types of natural resources influence military expenditure differently, when examining the MENA region. All other things being equal, rents from oil and forestation were reported to cause a rise in defence spending whilst those from natural gas and coal decreased military expenditure. No impact was exacted by mineral rents on ME.

Khan et al. (2022) assessed the determinants of military expenditure for a select group of developing countries from 1991-2018. He utilised the panel bootstrap Granger causality method (which accounted for geopolitical risk and GDP growth rate) as well as a panel regression to support the results. Other variables included in the panel regression were ethnic tension, religious tension, internal conflicts, external conflicts and military politics. Consistent with the neoclassical perspective, Khan et al. (2022) finds geopolitical risk (i.e., border disputes, terrorism threats and wars) to be a key driver of rising military expenditure for China, India and Saudi Arabia. No causality was found for Russia, Brazil and Israel. Whilst a reverse causality existed for Turkey and South Korea. The authors suggest that countries' policies should be devised independent of external forces to avoid the strong impact of geopolitical risk on military expenditure. The use of the panel bootstrap Granger causality method in the study helps provide for more stable parameter estimates for which traditional methods fail (Hacker & Hatemi-J 2006; Khan et al., 2022). The above-mentioned estimation technique can capture the relationship among cross-sections by assuming heterogeneity. It also does not require tests for cointegration or unit roots which can controvert the results (Kar et al., 2011; Khan et al., 2022). The results from the panel regression revealed GDP growth, geopolitical risk, military politics, internal and external conflicts to positively influence military expenditure. In contrast, ethnic and religious conflicts emerged as a negative impact on military expenditure. Even though the authors provided convincing support on the impact of geopolitical risk on military spending, as evident from both estimation techniques, generalizing all the results of the panel regression for all the countries may be misleading.

The works of Smith (1980,1989), Dunne and Mohammed (1995), Dunne and Nikolaidou (2001), Nikolaidou (2008) and Harris (1986) are some of the earlier studies that have examined the determinants of military expenditure. They have been a good guide or point of reference for recent research. For instance, the present study draws considerably from the work of Nikolaidou (2008) in particular. This is because of the use of the general model of demand as well as the ARDL approach to cointegration also employed in the current study. Nikolaidou (2008) investigated the determinants of ME in EU-15 for the period 1961 to 2005. The results highlighted the diversity amongst countries in the factors that drive their respective defence expenditures. Similar conclusions were drawn for NATO, which just like the EU, consists of several countries (Odehnal & Neubauer, 2020). Therefore, amplifying the need for country specific studies.

A review of the literature on individual countries is essential to examine the determinants of military expenditure as an antidote to the predicament of panel studies. Some of the estimation methods utilized in individual country studies include the ARDL approach, OLS, fully modified OLS, Feasible Least Squares Estimator, etc. Neubauer and Odehnal (2018) examined the determinants of military expenditure in the Czech Republic for the period 2001–2015. Employing the ARDL approach, the study found real GDP to significantly influence military expenditure. Implying that economic growth is a direct cause of rising military spending. Also, d' Agostino et al. (2011) found comparable results for the USA. The key contribution of this paper is the use of the general model to establish the determinants of military expenditure. However, the study may be affected by omitted variable bias. Additionally, the study provides empirical evidence on Czech Republic, a high-income country, which may be a weak representation of the determinants of military expenditure for a developing economy like Rwanda, that has experienced conflict.

The study by Beyene et al. (2020) analysed the economic determinants of military expenditure focusing on Ethiopia for the years 2011-2019. Their results from the linear regression analysis found that government debt, GDP and foreign aid positively influenced military expenditure in Ethiopia, whereas trade openness and inflation adversely affect military expenditure. Evidence also found that political ideology largely influenced prioritizing of military spending by government over social spending. However, the study had a narrow focus on only economic variables even though the authors provided a country specific insight into military expenditure determinants. As such, other factors influencing defence spending in Ethiopia may be ignored,

since military spending is not just an economic issue; it also has political, strategic, psychological, and even moral components (Nikolaidou, 2008). Furthermore, the period of analysis is extremely short, which threatens the reliability and validity of the estimates.

Tambudzai (2011) demonstrates that internal political dynamics largely influence military expenditure as compared to economic factors in Zimbabwe. The internal variables identified include fear, elite rent-seeking and corruption, hangover from the liberation war ideology, and regime security. Nevertheless, the qualitative methods employed may not reflect the actual military expenditure, as there may be cases of underreporting and subjective views of the respondents. Besides, the applicability of these findings to the current period in Zimbabwe may be undermined by the study's time frame. This is due to the significant changes that have occurred in Zimbabwe's political space.

A study by Kollias et al. (2018) assessed the demand for military expenditure in Russia. The period 1992 to 2015 was covered. GDP growth, population, oil rents, democracy, and a strategic variable of the military expenditures of the USA and China were included in the OLS estimations to show that the ME of a country can be influenced by the defence spending of other nations. The generalized additive mixed models (GAMMs) were further used to capture the nonlinear relationship among variables (Baayen et al., 2016; Woods, 2006) and to account for the limitations of the OLS estimations. The results revealed that Russian military spending was mostly influenced by population, the military spending of the USA and oil rents. However, the findings showed mixed results for the effects of GDP growth as well as China's defence spending on Russian military expenditure. Equivalently, Khan et al. (2022) asserted the significant impact played by economic and strategic factors on Russia's high defence spending. The military power of the USA and emerging powers seems to be a major threat for Russia, and so long as funding from natural resource rents and the economy allow, Russia is likely to continuously spend more on the defence to maintain a strong military force.

A scrutiny from the literature has demonstrated that the use of economic, socio-political, strategic and institutional variables can be very useful in deepening the understanding of the determinants of military expenditure. However, it is evident that only a limited number of individual country studies consider the combined effect of economic, political and strategic variables in examining the determinant of military expenditure. Although, cross country and panel studies have provided evidence on the determinants of military expenditure, the unique

characteristics of individual countries warrant a specific focus on a single country in the literature. This is due to the problem of cross-section dependence as well as heterogeneity of the countries, which affects the validity of the results of panel studies. Hence, this study contributes to the literature by considering the combined influence of economic, political, strategic and country-specific factors on the determinants of military expenditure, providing empirical evidence for Rwanda. Rwanda is a country that has experienced civil wars and presently faced with rising military expenditure, but no studies on the determinants of ME in Rwanda had been published. Another noteworthy contribution of the study is that it refreshes the existing body of knowledge in the literature that centres around an empirical model that reflects the combined impact of economic, political and strategic variables.

3. COUNTRY OVERVIEW AND HISTORICAL BACKGROUND

Rwanda is a multiparty republic in the African continent, which officially gained independence in 1962 from Belgium colonies. It has since thrived in keeping its mandate of promoting national unity. Hence, more sentimental than Independence Day is the Kwibohora (Liberation Day), which Rwanda commemorates on the 4th of July each year. This day symbolises the annihilation of ethnic and regional divisions, after the Rwandan Patriotic Front's (RPF) victory over the Hutu-led 1994 genocide against the Tutsi (Lemarchand & Clay, 2023). After a turbulent history of civil wars and unrest, Rwanda has quickly managed to become one of the fastest growing nations in Africa (Seburanga et al., 2014). Although currently categorized as a low-income country, Rwanda is set on a 2035 vision of progressing to middle-income and achieving high income status by 2050 (World Bank, 2022).

The term genocide was not new when Rwanda experienced mass killings in 1994. It dates to the Ottoman empire, when over a million Armenians were killed from a planned destruction by Turkish authorities. Raphael Lemkin, a Jewish lawyer, coined the term, genocide, to denote race murder. This was after his dismay that the above-mentioned was not punishable by law. He then worked relentlessly to ensure that race murder was considered a crime (Anderton, 2010). The 1994 genocide is therefore an important historical event which has impacted the lives of Rwandan people. "Unity" being the biggest pro in the aftermath, whilst the post-traumatic experiences of survivors and raising children conceived from genocide rape have been a challenge (Mukamana & Brysiewicz, 2008; Denov & Piolanti, 2020). What is more, the genocide claimed thousands of lives, leaving behind a trail of orphans, widows and the

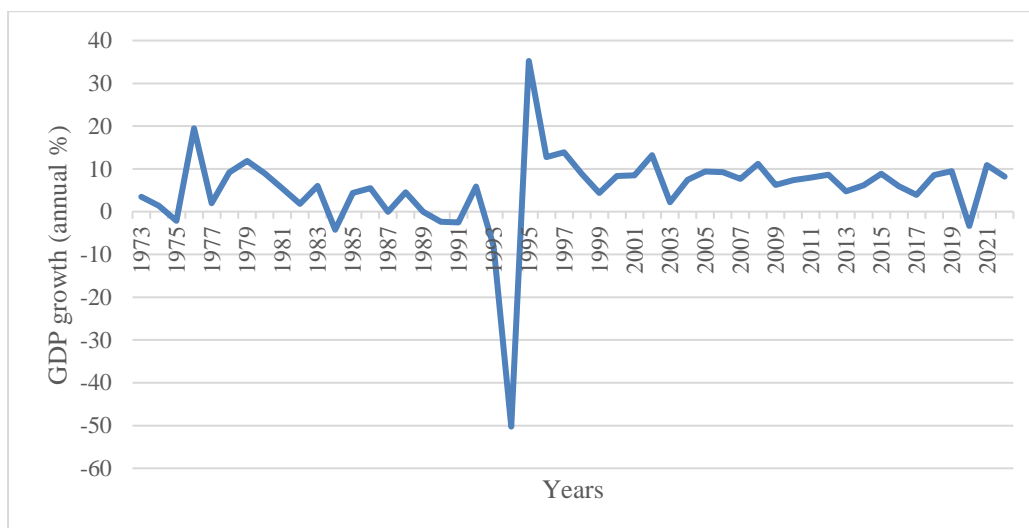
homeless. With over 70 percent of the Tutsi tribe massacred in 1994, the Rwandan genocide stands as one of the worst in history (Blouin & Mukand, 2022).

It is widely believed that the assassination of the Hutu leader and Rwandan president at the time, Juvenal Habyarimana, was the cause of contention (Newbury,1998). In April 1994, an airplane carrying President Habyarimana was targeted. This resulted to his demise as well as Burundi's president, Cyprien Ntaryamira, as one of the passengers on board and both of Hutu tribe. This incident was blamed on the Tutsi by the Hutu due to lingering tensions between the two tribes over the rule of Rwanda (see Lemarchand, 2009). Consequently, as a form of retaliation, the 1994 genocide ensued. Prior events such as the Arusha Accords of August 1993 passed down by the international community, which meant a transitional political and military sharing agreement between Rwanda's political parties (Anderton, 2010) also contributed to the tensiety. In understanding the rationale or motive behind an authority's choice to pursue a genocide, Anderton (2010) mentions four macro-perspectives from a bargaining model; prevention of loss of power, indivisibility, elimination of a persistent rival, and political bias which can be likened to the case of the 1994 Rwandan Genocide.

Fast forward to present time, Rwanda prides itself of maintaining national unity. Still, what entails as unity is subjective. This is because cooperation in fractured relations is difficult to amend due to underlying issues of mutual trust, suspicions and victimhood bias (greater tendency to blame negative economic outcomes onto those of the other ethnicity) post conflict (Fehr & Gächter, 2000; Blouin & Mukand,2022). Nonetheless, while the wounds of the past may be difficult to erase and have lasting effects in as far as cooperation is concerned; prioritising unity as a political cause in Rwanda helps lessen the chances of another genocide. For instance, the formation of the Gacagaca court system (ended in 2012) and the 1999 National Unity and Reconciliation Commission (NURC) have been some of the many political interventions to prevent a repeat of history and ensure national unity (United Nations, 2014). As argued, in the absence of appropriate political interventions, genocide has a higher likelihood of recurrence, as the choice to pursue a genocide by perpetrators is rational (Anderton, 2010). In addition to country specific policies to avoid mass atrocities, there have been various peacekeeping efforts by the United Nations. Also, even though implementation stands to be tested, the African Union has the right to intervene in the case of genocide, war crimes and crimes against humanity in each of its member states as ascribed in Article 4(h) and 4(j) of the Constitutive Act of 2000 (Kioko, 2003).

Decades of reforms in Rwanda’s political arena have dramatically transformed the economy, amalgamating it into the global economy. Rwanda has since adopted various economic policies in favour of free trade, that have enormously impacted the country’s economic standing (World Trade Organisation, 2019). Regardless, detrimental world events such as the Coronavirus pandemic or the global financial crisis have undermined Rwanda’s economic progress, thus derailing its efforts in reaching first world status. Compared to the 2.1 percent decline in Africa’s GDP growth rates in 2020, the East African region only witnessed an average 0.7 percent decline amidst the 2020 pandemic: making it the only African region to bypass a recession (African Development Bank Group, 2020). However, this was mostly attributed to the growth rates of only a select group of East African countries such as Tanzania and Kenya (World Bank, 2020). Rwanda on the other hand, experienced a 3.4 percent decline in GDP growth in 2020 (see Figure 1 below). Yet, the decrease in GDP growth rate in 2020 was not as large compared to the sharp decline (50.25 percent) experienced during the 1994 genocide. Nonetheless, 2021 came with a rebound, as Rwanda’s growth rate rose to a 10.9 percent high. Figure 1 below illustrates the overall trend in GDP growth in Rwanda for the 50 years under consideration.

Figure 1: Rwanda’s GDP Growth Rate for the Period 1973-2022



Source: World Bank Development Indicators

Furthermore, Rwanda is a landlocked country in Sub-Saharan Africa. It is eminent for its abundance of wetlands in the region, namely lakes (Vivi, Kivu, Bulera) and rivers (Akagera, Nyabarongo, Akanyaru) to highlight a few. In addition, Rwanda occupies shared water resources, such as river Nile. Utilisation of the shared resources, however, does pose a strain and tensions among the countries occupying the basin. Gbandi (2022) states that the rise in water demand worldwide is a critical concern and source of conflict. Growing tensions with neighbouring Congo (where a considerable number of Hutu fled following RPF's victory) have also been reported in 2022 (United Nations Affairs, 2022). In general, the escalation of conflict amongst countries can be costly, hence should be prevented.

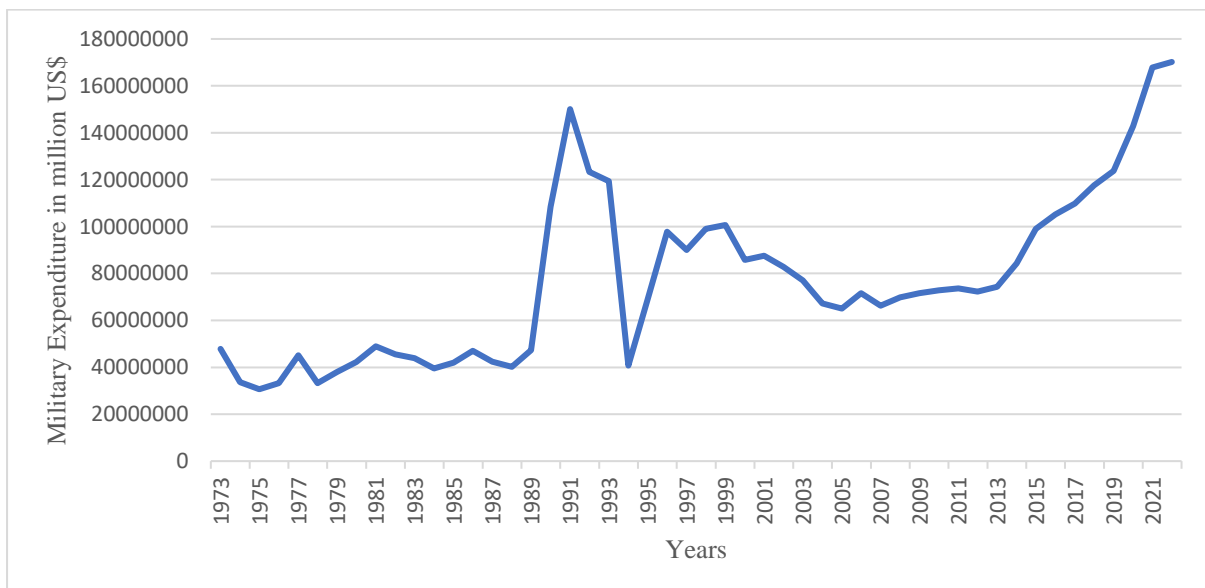
Sentiments surrounding the presidency and its implications for the country does raise eyebrows. The current president of Rwanda is presently serving his third term of office. This was made possible by the extension of the Rwandan constitution in 2003, to allow for a seven-year term, renewable only once. However, it did not end there, as whilst President Paul Kagame was serving his second term of office, a new amendment occurred in 2015 replacing the above to two five-year terms as of 2017 (Ayeni, 2022). It is worth noting that Kagame's second term on its own (as per the 2003 constitution) was sparked by controversy, as the electoral code which made reinstatement of the President plausible, had major shortcomings. These included inadequate time for opposition parties to adapt within its context and rules, after only being published later (Coffé, 2010). President Kagame's third term of office marks over 20 years of his rule, after being elected and officially assuming power in 2000 following his political party's hand in ending the Rwandan genocide of 1994. Critics have slammed this act as a complete travesty and tragedy in as far as Rwanda is concerned. Some have even likened the current regime to imitate that of an authoritarian rule (Coffé, 2010).

Fears over challenging the current government, lack of voter freedom and political dialogue have all been reported loopholes in Rwanda's political system (Beswich, 2010; Hintjens, 2008; Coffé, 2010). Altogether, Kiwuwu (2005) has interpreted elections in Rwanda as only a "legitimizing strategy" in favour of Kagame of the Rwandan Patriotic Front (RPF). On the other hand, President Kagame's bravery and bold stance has been praised on numerous occasions, especially on issues involving western countries who often pose superiority over least developed nations. As an example, when he stood against vaccine nationalism by North America and Europe during the World Economic Forum in 2021 (theGuardian, 2021).

President Paul Kagame’s many accolades, wealth of experience in leadership as former chairperson of the African Union (2018-2019) and East African Community (2018-2021) among others, and his stature as a national hero may make it difficult for Rwandans to see a more befitting successor to match his level of calibre as Rwanda’s next President. Of course, unless he willingly steps down (as was the case for South Africa’s Nelson Mandela) which also comes with its own repercussions.

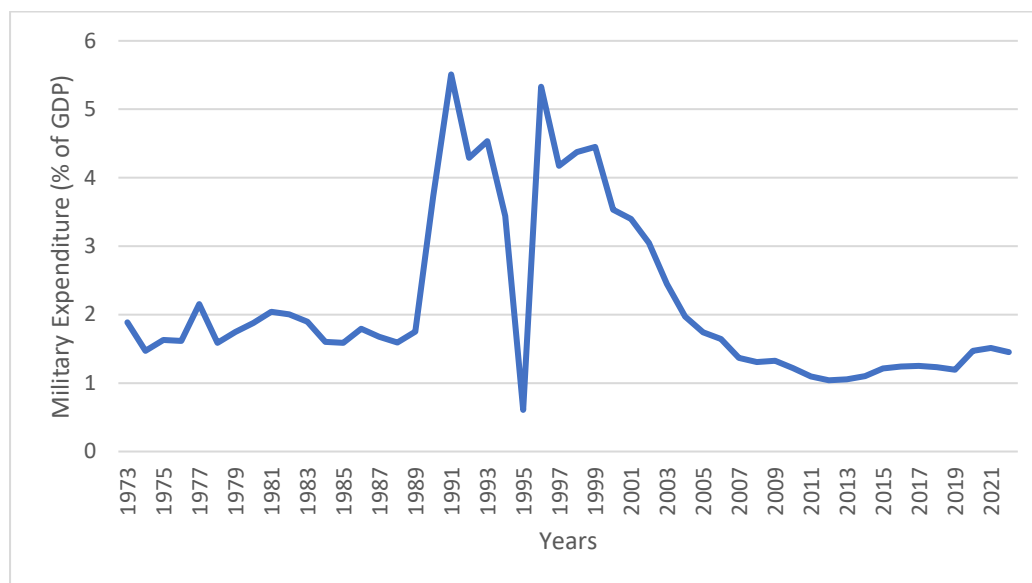
The trend in military expenditure in Rwanda has been characterised by several episodes of up and down turns, although the overall trend in ME has mirrored that of an upward movement (see Figure 2 below). Meanwhile, Rwanda’s defence industry is relatively recognized as underdeveloped in comparison to other Sub-Saharan African countries. Also, despite the high ME in Rwanda, the Rwandan Defence Force is not among the top 38 strongest military in Africa (Global Fire Power, 2023). Although it is important not to deduce that high military expenditure amounts to high defence strength as warned by Smith (2017), it still raises the question on the rising military spending and the need for a critical analysis on the drivers of defence spending in Rwanda. Rwanda’s ME stood at a record US\$47.82 million low in 1973 compared to the astounding U\$170.19 million high in 2022 (see Figure 2 below). Also, the 2022 figures are visibly the highest military spending that Rwanda has incurred in the last 50 years as portrayed by the Figure 2 below.

Figure 2: Rwanda’s Military Expenditure Constant (2021) US\$.



Source: Stockholm International Peace Research Institute (SIPRI)

Figure 3: Rwanda's Military Expenditure as percent of GDP.



Source: Stockholm International Peace Research Institute (SIPRI)

The 1973-1989 period highlights defence spending in Rwanda to be somewhat stable at an average of around 40 million as shown in Figure 2. This period falls under the Cold War between the USA and Soviet Union (USSR) which included different actors, bystanders and pawns (Hager, 2019). Conversely, the inception of the 90's came with a drastic rise in ME in Rwanda, with an estimated 108.5 million spending in 1990 and 150.15 in 1991. The sharp increase in ME in the above period can be attributed to the denouncement of the Cold War which lasted from 1945-1991, resulting to military build-ups (Dunne et al., 2008). More so, third world nations regarded the dire need of a strong military, as most of the cold war took place in the third world (Hager, 2019). Post-cold war, ME decreased sharply to 40.81 million in 1994. However, this was short-lived as the effects of the 1994 Rwandan genocide resulted to a rise in ME, with 97.86 million recorded in 1996. Figure 3 shows military expenditure as a share of Rwanda's GDP. The highest shares of GDP devoted to defence was in 1991 (5.5 percent) and 1996 (5.3 percent) as shown in Figure 3 above. These years marked a period of great uncertainty in Rwanda (i.e., in 1991 just prior to the 1994 Rwandan genocide and soon after in 1996), resulting to high defence spending. Similarly, Armev and McNab (2017) found that the level of ME increases both during and in the short term after a civil war. Also, other world events such as the global financial crisis (2007-2009) and Covid-19 pandemic (2020) were followed by slight and major increments in military expenditure in Rwanda, as displayed by Figure 2. Thus, negative shocks appear to raise ME in East African Rwanda.

It becomes obvious from this brief overview of Rwanda's economic and political background that the rise in ME may not necessarily be attributed to a single factor. However, it is because of the interplay of several factors which has led to an overall increase in defence spending in the long run. Therefore, it is crucial to understand these factors which instigate the rise in defence spending in Rwanda, if they are to be controlled for.

3. MODEL SPECIFICATION, DATA, METHODOLOGY

3.1 Model Specification

The theoretical model to be estimated for the determinants of military expenditure in Rwanda is the general model of demand stemming from the neoclassical perspective (see Smith, 1984; Nikolaidou, 2008). As stated in prior sections, the neoclassical perspective as applied in the defence literature is concerned with maximizing social welfare. Oligarchy, public choice, arms race, bureaucratic or interest group frameworks (Sandler & Hartley, 1995; Smith, 1995) have been used in explaining different facets of military demand. However, the general model of demand for military expenditure adopts a host of economic, political and strategic factors to examine the determinants of military expenditure (Dunne, 1996; Nikolaidou, 2008). Given the premise of the dynamics of Rwanda's economy, data accessibility and the general model of demand for military expenditure, this study follows the works of Dunne, 1996; Yildirim and Sezgin, 2002; Collier and Hoeffler, 2007; Nikolaidou, 2008; Dunne et al., 2008, 2011.

As a result, the functional form of the model of the determinant of military expenditure is specified as:

$$ME = f(Y, P, S) \quad (1)$$

Where *ME* is the military expenditure which is a function of economic factors (*Y*), political factors (*P*) and strategic factors (*S*). The economic variables are captured in *Y* which includes gross domestic product per capita, foreign direct investment, trade openness, inflation and population. As for political variables, the study includes a dummy for genocide and democracy index. Finally, the strategic variable is captured as security web.

The study transmits the focus on its empirical rigor, which starts with a baseline model that captures a few variables on the determinants of military expenditure. The baseline model is specified as:

$$LME_t = \phi_0 + \beta_1 LGDPC_t + \beta_2 FDI_t + \beta_3 LTO_t + \beta_4 INFL_t + \varepsilon_t \quad (2)$$

Then, an expanded model which is dependent apart from economic variables also includes political and strategic variables and is specified in Equation (3) as:

$$LME_t = \phi_0 + \beta_1 LGDPC_t + \beta_2 FDI_t + \beta_3 LTO_t + \beta_4 INFL_t + \beta_5 LPOP_t + \beta_6 DEMO_t + \beta_7 GENO_t + \beta_8 LSW_t \varepsilon_t \quad (3)$$

Where: *LME* represents military expenditure, *LGDPC* is per capita gross domestic product, *FDI* is foreign direct investment, *LTO* is trade openness, *INFL* is inflation, *LPOP* is population, are the economic variables. *DEMO* is democracy index, *GENO* is Dummy for genocide, which are the political variables. Finally, *LSW* is Security web, which represents the strategic variable in this context (see detailed description of all variables on pages 23-26). ϕ_0 , $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ and β_9 are parameters, and ε_t is the stochastic error term. The natural logs of LME, LGDPC, LTO, LPOP and LSW are taken during the estimation to control for extrema and allow elasticity interpretations.

3.2 Data

This study utilizes secondary data ranging from 1973 to 2022. The study specifically makes use of annual time-series data on the following variables: military expenditure, GDP per capita, FDI, trade openness, inflation, population, democracy, security web and genocide. The sources of the data include the World Development Indicators (WDI), the Stockholm International Peace Research Institute (SIPRI) and Polity IV database. Table 1 presents a summary of the measurement and sources of the variables.

3.2.1 Variable Description and Sources

Table 1: Summary Description of Variables and Data Sources

Variable	Notations	Measurement	Source
Military Expenditure	LME	Military expenditure (constant US\$)	SIPRI
Gross Domestic Product (P/C)	LGDPC	Real GDP per capita (Constant US\$)	WDI
Foreign Direct Investment	FDI	FDI net inflows (% of GDP)	WDI
Trade Openness	LTO	Trade % of GDP	WDI
Inflation	INFL	Consumer price index	WDI
Population	LPOP	A country's overall population.	WDI
Democracy	DEMO	The difference between a country's democracy and autocracy score.	Polity IV
Genocide	GENO	A dummy variable that takes the value of 1 in 1994 during the genocide and 0 otherwise.	
Security web	LSW	Average of the military expenditure of select countries in East Africa.	SIPRI

Military expenditure as a dependent variable is characterized as all spending on armed forces, composed of expenses for peacekeeping forces, defence ministries, governmental entities involved in defence initiatives, paramilitary forces capable of military operations, and military space activities. The expenses include both military and civilian personnel, encompassing retirement pensions for military personnel, social services for personnel, operation and maintenance costs, procurement, military research and development, and military aid provided by donor countries. However, this definition excludes spending associated with civil defence and the ongoing costs related to previous military actions, such as demobilization, conversion, and weapon destruction (SIPRI, 2014). This measurement of military expenditure was adopted

since the definition is consistent with the NATO definition and employed by several studies in the literature (Bel & Elias-Moreno, 2009; Albalade et al., 2012; Solarin, 2018).

With respect to the independent variables, GDP per capita measures gross domestic product divided by mid-year population (WDI, 2023). The inclusion of GDP per capita captures the level of economic activity following the works of Barro (1979) and Easterly (2001). The use of real GDP per capita has been justified by the fact that economic factors and the broader economic climate could potentially limit the military budget over a given period (Collier & Hoeffler, 2007). GDP per capita is expected to have a positive and major influence on military expenditure. This is consistent with the assertion of the conventional public finance theory that views defence as a public good, and it is generally expected that military spending levels will exhibit a positive correlation with income (Dunne et al., 2003).

Likewise, Foreign Direct Investment (FDI) is considered as an important economic variable influencing military expenditure, especially given the historically large amounts of FDI inflows into Rwanda (Olorogun, 2022). This variable is defined as the net investment inflows for acquiring a long-term management stake in a company operating in a different economy than the investor. In terms of the balance of payments, it is the total of equity capital, reinvestment of earnings, other long-term capital, and short-term capital. A recurring argument specific to Africa is that, instead of utilizing FDI for necessary reforms (such as technological and infrastructural development), governments are more likely to use FDI for militarization to protect their own interests (Khishi et al., 2017). In that case, as funds from FDI are directed towards the defence sector, it allows for more military spending. Furthermore, a positive influence of FDI on military expenditure in the regression could be attributed to the fact that FDI inflows necessitates the capacity to provide enhanced military expenditures to ensure the safeguarding of investments across a wider geographical scope worldwide. Whilst a negative impact of FDI on ME could be argued on the basis that impoverished countries already have more needs dependent on the limited FDI inflows (de Soysa, 2020). Thus, either a negative or positive influence of FDI on military expenditure can be expected.

Trade openness was included to capture the importance of trade in the model. Trade openness measures the degree to which both local and foreign businesses may engage in trade with each other, without encountering arbitrary costs imposed by the government, as well as delays and unpredictability. It is typically calculated as exports plus imports divided by GDP. The

inclusion of trade openness is due to its effect on military expenditure via budget balances. Besides, military spending is expected to rise when trade routes must be protected because of increased commercial openness (George et al., 2019). However, it is possible that if countries within a region increasingly rely on each other, the demand for defence decreases because of greater trade openness. Therefore, the expected sign of this variable is not clear, *a priori*.

Inflation was also included in the model to capture the importance of macroeconomic uncertainty (Nguyen, 2015), which has the potential to affect government revenue and spending. The variable is expected to have a positive sign in the regression. The likelihood of this expectation stems from the proposition that during times of moderate to high inflation, governments enhance military spending efforts to boost its purchasing power (Odehnal & Neubauer, 2020). Consequently, this results in an increase in military expenditure in the country (Holcner & Neubauer, 2015).

The model also includes population, which is based on the de facto population definition which includes all residents. The impact of population on military expenditure is mixed in the literature. Studies such as that of Nikolaidou (2008) find that a rise in population increases military expenditure. Likewise, Solarin (2018) supports the positive relationship between ME and population. His analysis draws from the perspective that larger populations may be more expensive to defend, especially if the military is tasked with maintaining internal security. As a result, population may have a positive impact on military spending. Equivalently, Rwanda houses a large population of over 13 million inhabitants in its small 24,670 km² land (World Bank, 2020), which can arguably play an influential role in the high ME. Although in a counter argument, Collier and Hoeffler (2007) and Dunne et al. (2008) claim that countries with a relatively high population density feel more secure than smaller nations. Dunne et al. (2008) argued that there could be a decrease in military spending due to the intrinsic security that a large population provides, forcing small nations that cannot rely on large armies to spend more money on high-tech weapons. Hoeffler (2000) also put forth that countries with larger populations are less susceptible to external attacks, resulting in a reduced necessity for extensive military spending. Based on the above arguments, the population variable is either positively or negatively related to military expenditure.

Democracy was also controlled through a measure from the Polity IV database to proxy the regime type in a country. Democracy computed from the polity score is determined by

subtracting the score of institutionalized democracy from the score of institutionalized autocracy. This computed value produces a unified polity scale that ranges from a perfect autocracy score of -10 to a perfect democracy score of +10. The study adopted this measure since the Polity IV democracy definition considers factors such as the level of competition in political participation, the regulations surrounding political participation, the level of competition in executive recruitment, the openness of executive recruitment, and the limitations imposed on the chief executive. Additionally, the measure is widely adopted in literature by several studies (Collier & Hoeffler, 2007; Dunne et al., 2011). It is expected that democratic regimes will exhibit reduced levels of military spending.

Security web captures the influence of strategic variables on military expenditure. The variable is computed as the average of military expenditure of neighbouring countries following the works of Batchelor et al. (2002) and Solarin (2018). With regards to the present study, the security web variable utilizes a select group of East African countries based on data availability and proximity to Rwanda. These consist of Ethiopia and countries in the East African Community (EAC) regional bloc (Kenya, Tanzania, Rwanda, Uganda, Burundi, Democratic Republic of Congo, South Sudan). Among the EAC countries, Rwanda was obviously excluded, together with South Sudan. South Sudan, which only gained independence from Sudan in 2011, was dropped from the dataset due to data inconsistencies. Military expenditure in constant US\$ was used for each country in the computation. It is widely recognized that the military expenditures of numerous countries are influenced by the spending patterns of other nations, particularly those in proximity (Solarin, 2018). Rosh (1988), who popularized the idea of security web, made an early attempt to describe this problem. Neighbours are among the web's members and can have an impact on a country's security strategy. Flores (2011) maintained that the military spending of a country's neighbours appears to have a stronger positive effect on its own military expenditure compared to the spending of its alliance partners. Kollias et al. (2018) added that if a country is a follower, a rise in the military spending of its alliance partners can result in an increase in its own defence spending. Whilst a decrease in defence spending can be followed if the country is a free rider (i.e., dependent on the military power of alliance partners). The defence spending of adversary nations raises a country's ME (Nordhaus et al., 2012). Thus, the sign of the security web variable can either be positive or negative.

Finally, genocide was captured as a dummy variable in the model. This variable takes the value of 1 in the years of genocide which only applies to 1994 in this study, as the Rwandan genocide only lasted for 100 days. Whilst it assumes the value of 0 in the years where genocide was absent. Genocide can be expected to have a positive effect on military expenditure. Intuitively, the need for weaponry and added expenses to enhance military capabilities during the period of genocide would most likely cause military expenditure to rise. In another view, the international community might place a strong emphasis on preventing conflicts and finding diplomatic solutions. In that case, foreign assistance may lessen the immediate need for significant military expenditures (Nordhaus et al., 2012).

3.2.2 Descriptive Statistics

Table 2 on the next page shows the descriptive statistics illustrating the statistical characteristics of the variables used in the study across the sample period using EViews 10 statistical software. Following the work of Droff and Malizzard (2022), the variables in the descriptive statistics were not presented in logged form for simpler interpretation. The statistics reveal that the study employed 50 observations. There is a minimum deviation of the variables from their average values, and all the variables except for democracy had positive mean values. The descriptive statistics reveal a small variation between the minimum and maximum values of military expenditure within the study period. However, the difference between the minimum and maximum values of foreign direct investment (FDI) is quite substantial. These variations may be attributed to the historically enormous amounts of FDI inflows in Rwanda (Olorogun, 2022).

Table 2: Descriptive Statistics of the Variables

	ME	GDP	TOP	FDI	INFL	POP	DEMO	GENO	SW
Mean	77146663	475.944	36.372	1.231	8.052	8247447.	-5.1600	0.020	410.837
Median	71946179	402.206	33.472	0.891	7.212	7909693.	-6.000	0.000	399.710
Maximum	1.70E+08	890.187	71.096	3.813	31.088	13461888	-3.000	1.000	700.580
Minimum	30650502	190.234	19.684	0.000	-2.406	4259484.	-7.000	0.000	204.207
Std. Dev.	36105493	181.372	10.826	1.090	6.790	2672012.	1.822	0.141	111.681
Skewness	0.788	0.959	1.091	1.017	1.379	0.371	0.158	6.857	0.341
Kurtosis	2.977	2.743	3.859	2.961	5.849	2.064	1.180	48.020	3.004
Jarque-Bera	5.177	7.806	11.463	8.621	32.769	2.977	7.112	4614.414	0.967
Probability	0.075	0.020	0.003	0.013	0.000	0.226	0.029	0.000	0.617
Sum	3.86E+09	23797.18	1818.594	61.558	402.613	4.12E+08	-258.000	1.000	20541.84
Sum Sq. Dev.	6.39E+16	1611901.	5743.157	58.189	2259.311	3.50E+14	162.720	0.980	611162.3
Observat.	50	50	50	50	50	50	50	50	50

Source: Author's Calculations Using EViews 10

3.3 Method

3.3.1 Estimation Technique

The Autoregressive Distributed Lag (ARDL) approach to cointegration developed by Pesaran et al. (2001) was used to examine the determinants of military expenditure in Rwanda. Certain co-integration procedures, like the Engel and Granger (1987) approach, have faced criticism due to their inability to examine hypotheses related to the estimated coefficients in long-term relationships as well as the presence of small sample bias caused by the exclusion of short-term dynamics. Although efforts have been made through the Phillips and Hansen (1990) study to address the above-mentioned shortcomings, those methods still demand the integration of all variables in the model at order one $I(1)$. In contrast, the ARDL technique offers distinct benefits compared to these approaches.

To begin with, the ARDL approach is reliable and effective in small sample data (Pattichis & Pattichis, 1999; Mah, 2000). The present study covers the period 1973 to 2022 inclusively. Thus, the total observations amount to 50, which is relatively small. In addition, the ARDL

technique is applicable whether the model's variables are simply $I(0)$, purely $I(1)$, or mutually cointegrated. Nevertheless, the procedure will crash when the variables are integrated of order two (i.e., $I(2)$). This study employed a mix of variables that are integrated of order zero $I(0)$ and order one $I(1)$, making the ARDL approach to cointegration a suitable choice for this analysis. Also, the ARDL approach can facilitate simultaneous testing for both short-run and long-run relationships, in turn providing unbiased and efficient estimates. Moreover, whilst conventional co-integration techniques may encounter issues related to endogeneity, the ARDL technique can differentiate between dependent and explanatory variables effectively. Thus, addressing concerns associated with autocorrelation and endogeneity.

A further advantage of using the ARDL estimation technique lies in its reliance on a single equation framework. This approach incorporates an adequate number of lags and directs the data generating process within a general-to-specific modelling framework (Harvey, 1981). A concern, however, is the sensitivity of the ARDL estimate to the choice of lag length. For the ARDL procedure, selecting the right number of lags is essential for obtaining accurate results, but there is no established way of figuring out the ideal lag length. The wrong lag duration choice can lead to skewed estimates and suboptimal model accuracy (Narayan & Smyth, 2005). Nevertheless, certain statistical software packages offer the convenience of suggesting a suitable lag length by utilizing information criteria like the Akaike information criterion (AIC) and the Schwartz/Bayesian information criterion (SBIC), or by conducting multiple simulations.

The ARDL technique's vulnerability to multicollinearity, particularly when dealing with finite distributed lag models that have stationary regressors may be a major drawback. In such cases, it may be necessary for the researcher to impose restrictions on the β coefficients to ensure compliance with prior assumptions of smoothness or economic theory, as pointed out by James (1994). Additionally, an alternative approach involves examining autocorrelation in the residuals to determine the optimal fitting model or estimation technique (James, 1994).

3.3.2 Unit Root Tests

The unit root test was conducted to check for the stationarity of each of the variables included in the model. Both the Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) tests were employed in the study. Although these tests share similarities, they differ in terms of how they handle autocorrelation in the residuals. The PP nonparametric test extends the ADF procedure

and permits less stringent assumptions for the examined time series. The ADF test's sensitivity to lag selection makes the PP test a valuable supplementary tool for drawing conclusions about unit roots. The number of lags utilized for the test was based on the Schwartz/Bayesian information criterion (SBIC). The justification for using the SBIC criterion is that it minimizes the sum of residual squares in the test equations, similar to Akaike information criterion (AIC) but has stricter penalties.

3.3.3 Cointegration / Bounds Test

The cointegration analysis enables us to check for the long-run relationship among the variables included in the model. Some non-stationary time-series data exhibit cointegration as a property. Two variables are said to be cointegrated if their linear combination is stationary even though neither of them is stationary individually (Engle & Granger, 1987). Further, series are cointegrated if there exists a well-established long-run relationship or a common trend. The study employs the bounds testing approach to test for the presence of a long-run relationship (cointegration) among the variables. It is crucial to examine whether there is a long-term equilibrium relationship between the variables within the confines of the cointegration boundaries test. A long-run relationship between variables from a statistical perspective indicates that those variables move together over time so that short-term disturbances resulting from the long-term trend are corrected. Theoretically, the existence of an error correction system is implied when two or more variables have a cointegrating relationship. The bounds test was used to determine whether there was cointegration among the dependent and explanatory variables under the null hypothesis that there were no long-run relationships between the predictor and outcome variables. In other words, the test's F-statistics reveal whether all the explanatory variables are significant when considered together in relation to the dependent variable. As a result, it makes it clear whether the coefficients of the relevant variables are equal to zero. The computed F-test statistics are evaluated against the lower and higher critical bounds proposed by Pesaran et al. (2001) and Kripfganz & Schneider (2018), respectively.

3.3.4 Long Run Estimates

The long run estimates provide the long run coefficients once cointegration has been determined using the ARDL approach to cointegration. The long-run estimates reveal the steady, equilibrium interaction of variables across time.

3.3.5 Error Correction Model (ECM) / Short Run Estimates

The ECM is estimated following a long run relationship among the variables. The ECM estimates capture short-run modifications that take place to return to equilibrium, when there is a departure from this state.

The error correction model that captures the short run dynamics of the baseline and expanded model from equations (2) and (3) is specified as:

$$\Delta LME_t = \sum_{i=1}^{\rho} \alpha_1 \Delta LME_{t-i} + \sum_{i=1}^{\rho} \alpha_2 \Delta LGDPC_{t-i} + \sum_{i=1}^{\rho} \alpha_3 \Delta FDI_{t-i} + \sum_{i=1}^{\rho} \alpha_4 \Delta LTO_{t-i} + \sum_{i=1}^{\rho} \alpha_5 \Delta INFL_{t-i} + \omega ECT_{t-1} + \varepsilon_t \quad (4)$$

$$\begin{aligned} \Delta LME_t = & \sum_{i=1}^{\rho} \alpha_1 \Delta LME_{t-i} + \sum_{i=1}^{\rho} \alpha_2 \Delta LGDPC_{t-i} + \sum_{i=1}^{\rho} \alpha_3 \Delta FDI_{t-i} \\ & + \sum_{i=1}^{\rho} \alpha_4 \Delta LTO_{t-i} + \sum_{i=1}^{\rho} \alpha_5 \Delta INFL_{t-i} + \sum_{i=1}^{\rho} \alpha_6 \Delta LPOP_{t-i} \\ & + \sum_{i=1}^{\rho} \alpha_7 \Delta DEMO_{t-i} + \sum_{i=1}^{\rho} \alpha_8 \Delta GENO_{t-i} + \sum_{i=1}^{\rho} \alpha_9 \Delta LSW_{t-i} \\ & + \omega ECT_{t-1} + \varepsilon_t \quad (5) \end{aligned}$$

Where Δ is the first difference operator, ω is the speed of adjustment, and ECT_{t-1} is the error correction term that measures the speed of adjustment of the model to long run equilibrium following a shock in the economy.

3.3.6 Diagnostic and Stability Tests

Diagnostic and stability tests were carried out to determine the suitability of the ARDL estimation technique. The diagnostic tests evaluated the selected estimation technique's serial correlation, functional form, normalcy, and heteroskedasticity. To assess the stability of the parameters, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) were utilized. If the cumulative sum of the model lies between the two critical lines of the CUSUM and CUSUMQ tests, then the model is said to be stable.

Testing the statistical properties of variables is crucial when working with time series data. It is uncommon for time series data to exhibit stationarity in their raw form. When conducting regression analysis with non-stationary time series, there is a high likelihood of encountering spurious regression issues. This situation arises when the regression outcomes indicate a strong and statistically significant relationship between variables, even though there is no actual relationship present. Accordingly, the following chapter presents results for the various test statistics explained above for each of the variables employed.

4. RESULTS AND DISCUSSION

4.1 Unit Root Test Results

The Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) unit root test results (see Table A.1 in the appendix) indicate that the variables are a mix of I(0) or I(1). Most of the variables are first difference stationary in both tests, which generally yield identical results. There are, however, a few instances of inconsistent results; Military expenditure is I(1) in the ADF test but I(0) in the PP test. Overall, the test outcomes are consistent with the estimation method that is used, which stipulates that the variables may only be a combination of I(0) and I(1).

4.2 Bounds Test Results for Cointegration

The next step in the study entails determining whether there is a long-run relationship between military expenditure and the variables employed once it has been determined via the unit root tests that there are no I(2) variables in the models. Table 3 below presents the results of the cointegration test for the variables.

Table 3: Bounds test results for cointegration.

Baseline Model				Expanded Model			
90% Level		95% Level		90% Level		95% Level	
Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
2.2	3.09	2.56	3.49	1.85	2.85	2.11	3.15
Calculated F-Statistics: 5.42 (0.00)				Calculated F-Statistics: 6.25 (0.00)			

Source: Author's calculations using EViews 10

The bounds test results presented in Table 3 indicate that variables are cointegrated at the 5% significance level, as the calculated F-statistics are greater than the upper bound critical values at 95% levels for both the baseline and expanded models. Thus, the null hypothesis that there is no cointegration between military expenditure and its determinants is rejected. Consequently, there is a long-run relationship among the variables employed in the study.

4.3 Estimation results of the ARDL model

The estimated long run and short run results of the linear ARDL model are provided and explained in this section.

4.3.1 Baseline Model Results

Table 4 presents the results for the long-run and short-run estimates of the baseline model.

Table 4: Determinants of Military Expenditure Baseline Model Results

Variables	Coefficients	Standard Error
Long Run Estimates		
C	-19.503***	2.765
LGDPC	1.430***	0.156
FDI	-0.285***	0.056
LTO	-1.256	0.859
INFL	0.268*	0.148
Short Run Estimates		
C	-3.692**	1.369
LME (-1)	-0.189***	0.063
LGDPC	0.271***	0.091
FDI	0.013	0.015
FDI (-1)	-0.054**	0.024
LTO	-0.239***	0.129
INFL	0.051***	0.029
ECM	-0.189***	0.031

***, **, and * signifies significance at 1%, 5%, and 10% respectively

Source: Author's Calculations Using EViews 10

The estimated results of the baseline model for the determinants of military expenditure are presented in Table 4. From the results in both the long run and short run, military expenditure is significantly boosted by GDP per capita. The coefficient highlights that a 1% increase in GDP per capita will boost military expenditure by 1.43% and 0.27% in the long run and short run, respectively. These findings could explain that higher government surpluses (which signify a better fiscal situation for the government) result from increased income which enhances military expenditures. Further, an increase in GDP per capita helps in a larger budget allocation for military expenditure, which permits a country to keep an equipped military base.

With respect to other explanatory variables, military expenditure is significantly and positively impacted by a rise in inflation. Thus, demonstrating that enhanced military expenditure is linked to increased inflation in Rwanda. Specifically, a 1% rise in inflation increases military expenditure by 0.27% and 0.05% in the long run and short run respectively, over the study period. A probable reason for this result is that rising inflation can be an indicator of high government revenues, thus necessitating government fiscal expansion to boost military expenditures. This result concurs with the findings of Holcner and Neubauer (2015) who found inflation to be a military expenditure enhancer.

Foreign Direct Investment has a negative influence on military expenditure. Thus, a 1% increase in foreign direct investment results in a 0.28% decline in military expenditure in the long run, which is significant at 1%. However, in the short run, foreign direct investment boost military expenditure in Rwanda by 0.024% and it is significant at 1%. The lag impact of an increase in Foreign Direct Investment will result in military expenditure shrinkage, much like its long-term effect. The long run results could be explained by the fact that foreign direct investment deepens international and economic linkages among countries in various activities in response to economic growth. This has the potential to reduce military expenditure through peaceful resolution of disputes among countries. Contrastingly, in the short run, the international and economic linkages created by foreign direct investment would not have deepened or developed enough to foster diplomatic initiatives and peaceful conflict settlement that can reduce military expenditure. This finding of the long run supports the assertion of Polachek et al. (2007), that FDI inflows lessen the level of global conflict, encourage cooperation, and as a result reduce military spending.

Finally, trade openness has an adverse influence on military expenditure, but this effect is only statistically significant in the short run at 1%. That is, a 1% rise in trade openness will reduce military expenditure by 0.24% in the short run. This result aligns with the findings of George et al. (2019). Lastly, in accordance with the error correction term (ECM) which assesses the rate of adjustment, a shock to the economy results in a 19% correction toward long-run equilibrium.

4.3.2 Expanded Model Results

The long-run and short-run results of the expanded model are presented in Table 5 and Table 6, respectively.

Table 5: Long-run estimates for the determinants of military expenditure

Selected Model: ARDL (1, 1, 0, 0, 1, 1, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDPC	0.0926**	0.037	2.497	0.017
FDI	-0.268**	0.113	-2.379	0.023
LTO	-3.064*	1.537	-1.994	0.054
INFL	0.043*	0.024	1.762	0.087
LPOP	2.900***	0.936	3.099	0.004
DEMO	-0.475***	0.165	-2.868	0.007
GENO	4.342*	2.172	1.999	0.053
LSW	0.925	0.639	1.446	0.157
C	-49.205***	16.978	-2.898	0.006

Note, ***, **, * indicates 1%, 5% and 10% significance level.

Source: Author's Calculations Using EViews 10

The results in Table 4 indicate that real GDP per capita exerts a positive influence on military expenditure and is statistically significant at the 5% significance level. This implies that increases in real GDP per capita will lead to increases in military expenditure. All other things being equal, military expenditure in the long run would rise by 9.26% if real GDP per capita in Rwanda increased by 1%. The result provides convincing evidence that economic growth is a

key determinant of military expenditure in Rwanda. Intuitively, Rwanda's ability to afford defence increases with income. This is consistent with the findings of Dunne et al. (2003), Dunne & Mohammed (1995) and Solarin (2018) but inconsistent with the findings of Dunne and Smith (2008) who found a negative and significant effect of GDP on military expenditure. The authors supporting the positive association between GDP and ME documented that higher income could lead to an increased military burden given that military spending is a normal good. The positive influence of economic growth can also be argued from the perspective of the standard public finance theory which maintained that military expenditure should be positively correlated with income since defence is seen as a public good (Dunne et al., 2003).

Trade openness had a significant negative effect on military expenditure. The results indicate that all other things being equal, a 1% increase in trade openness in Rwanda, is expected to decrease military expenditure by 3.06% in the long run, which is statistically significant at 10%. This result provides compelling support for the argument that if countries within a region increasingly rely on each other, the demand for defence decreases because of greater trade openness. This relationship highlights the intricate interactions between security objectives and economic integration, showing that when nations open their trade markets, they may put more emphasis on economic growth and collaboration than on military expansion. However, this result contradicts the findings of George et al. (2019) who found that military spending rises when trade routes must be protected because of increased commercial openness.

At the 5% level of significance, it was also discovered that foreign direct investment (FDI) had a negative coefficient of 0.268. Just like how trade influences global interactions, so does foreign direct investment. The inflow of FDI lowers the intensity of global conflict, promotes cooperation and consequently reduces military expenditure (Polachek et al., 2007). Additionally, FDI inflows encourage trade between countries, which increases the national wealth of each trading partner. This result supports the findings of de Soysa (2019) who argued that FDI may result in a decrease in militarization and an increase in social security that goes beyond the mere absence of armed conflict. This result, however, is inconsistent with the positive expectation of studies that argue that FDI inflows necessitate the capacity to provide enhanced military expenditures to ensure the safeguarding of investments across a wider geographical scope worldwide.

Inflation has a significant and positive effect on military expenditure in Rwanda. This indicates that all things being equal, for every unit increase in inflation, Rwanda's military expenditure increases by approximately 4.30% in the long run. This relationship suggests that there is a noticeable increase in the allocation of funds to the military sector as national inflation rates rise. This is consistent with efforts to enhance military spending to boost a country's purchasing power during times of moderate to high inflation. Thus, demonstrating the awareness of the government to adjust military spending in response to inflationary pressures, assuring the preservation of national security interests and the defence of the entire country. This finding also corroborates with previous studies including Holcner & Neubauer (2015) and Odehnal & Neubauer (2020).

According to the results in Table 4, population positively impacts military expenditure at the 1% level of significance. With a positive coefficient of 2.90, an implication is that in the long run, a 1% rise in population causes an approximately 2.90% increase in military expenditure, all things being equal. This result is consistent with the findings of Solarin (2018), who asserted that larger population may be more expensive to defend, especially if the military is tasked with maintaining internal security, so population may have a positive impact on military spending.

With respect to democracy, the results provide convincing evidence of its significant role on military expenditure in Rwanda. The negative coefficient of 0.475 significant at 1% level in the long run implies that a unit increase in democracy causes an approximate 0.48% fall in military expenditure, all things been equal. The result confirms the expected negative and statistically significant impact of democracy that supports the notion that democratic regimes exhibit reduced levels of military spending. The implication of this finding is that democratic nations invest less in their military spending than non-democracies (Solarin, 2018). Contrastingly, Abdelfattah et al. (2014) posited that an authoritarian government typically maintains an excessive and ineffective level of military spending to serve the vested interests of a public elite rather than the national interest. The result of the present study corroborates with the findings of Dunne et al. (2011) and Dunne & Perlo-Freeman (2003) who found that democracy exhibits a negative influence on military expenditure.

With regards to the genocide dummy, results strongly support the anticipated positive and statistically significant impact of genocide in driving up military expenditure in Rwanda. Thus,

confirming the assertion that genocide would most likely cause military expenditure to rise due to the need for weaponry in times of conflict. Specifically, in the long run, genocide recorded a 4.34 positive effect on military expenditure in Rwanda, all things being equal. This result supports the findings of Nordhaus et al. (2012).

Finally, the results show that a 1% increase in security web in the long run results in a 0.93% increase in military expenditure in Rwanda, but it is insignificant. This implies that the dynamics of the entire military expenditure of Rwanda cannot be fully explained by its alliance structure. One possible explanation is that every country usually has its own priorities and budgetary allocations. Therefore, decisions about military spending may be based on internal factors and financial constraints as opposed to neighbouring countries' military spending. The insignificant influence of security web on military expenditure in Rwanda is consistent with the findings of Dunne and Perlo-Freeman (2003). Nevertheless, the results show the expected positive impact of security web which supports the general tenet that many countries' military spending is influenced by other nations, particularly those closest. Thus, a country is impelled to raise their military spending to maintain their own security when neighboring countries increase their military expenditure. This result aligns with the findings of Solarin (2018) and Dunne et al. (2003). Arvanitidis and Kollias (2016) further opined that the pursuit of status has always been a potent driver of governmental behaviour. Most governments make decisions based on the behavior of their neighbours when there is no clear military need, and mimicry may explain what might otherwise be considered rivalry. Several studies including those of Dunne & Perlo-Freeman (2003), Flores (2011) and Solarin (2018) provide significant support for this finding that military operations of one nation have an impact on its neighbours military operations during times of peace. The finding on security web supports the idea that a country's level of interconnection influences its defence spending priorities.

After it was established that the variables exhibit cointegration, or a long run relationship, the error correction model was utilized to investigate the short-run dynamics.

4.3.2.2 Short Run Results / ECM Estimates – Expanded Model

Modeling the short-run dynamic relationship among the variables within the ARDL framework comes after establishing the long-run relationship between military expenditure and its determinants by estimating the long-run cointegration model. The estimated error-correction model for the expanded model is presented in Table 5 along with the associated findings.

Table 5: Short-run estimates for the determinants of Military Expenditure-expanded model

Selected Model: ARDL (1, 1, 0, 0, 1, 1, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15.471***	3.706	-4.174	0.000
LME (-1)	0.686***	0.079	8.700	0.000
LGDPC	0.005	0.005	0.885	0.382
LGDPC (-1)	0.024***	0.004	6.538	0.000
FDI	-0.084*	0.042	-2.024	0.051
LTO	-0.963**	0.435	-2.216	0.033
INFL	0.006	0.005	1.049	0.302
INFL (-1)	0.008*	0.005	1.713	0.096
LPOP	3.749***	1.251	2.997	0.005
LPOP (-1)	-2.837**	1.221	-2.324	0.026
DEMO	-0.149***	0.034	-4.391	0.000
GENO	1.365**	0.590	2.315	0.027
LSW	-0.045	0.242	-0.185	0.855
LSW (-1)	0.335	0.210	1.601	0.118
ECM (-1)	-0.314***	0.035	-8.864	0.000

Note, ***, **, * indicates 1%, 5% and 10% significance level.

Source: Author's estimates using EViews 10

The results in Table 5 above show that the speed of adjustment to equilibrium is -0.314. This suggests that following a shock to the model, around 31% of deviations from long-term economic development induced by disturbances in earlier times will eventually return to long-

term equilibrium in the current period. It is evident from the results that any deviation (disequilibrium) that occurs in the short run will be corrected in the long run in less than a year. The error correction term's negative and significant coefficient indicates and further supports the co-integration relationship between military expenditure and its determinants.

The coefficient of past military expenditure is statistically significant and positive at 1% level. The Rwandan economy will experience a 0.69% increase in military expenditure in the short run when its military expenditure rises in the previous year, all things being equal. This suggests that Rwanda's current military expenditure values are influenced by its past values. This is expected in that previous year's increments in military spending have the capacity to enhance military spending in the current period. This result is in line with the findings of Odehnal and Neubauer (2020), who found a positive relationship between current military spending and that of the previous years.

Further, consistent with the long run results, the coefficient of real GDP per capita emphasizes the key role of income in determining military expenditure. The results imply that in the short run, an increase in real GDP per capita that Rwanda experiences is followed by a rise in military expenditure, all things being equal. However, this effect is statistically insignificant in the short run. A likely reason is that budget constraints may prevent governments from immediately increasing military spending significantly in response to changes in GDP. Social welfare programs or infrastructure development may be placed higher on the list of priorities. Further, in several countries, military expenditure is kept at a certain baseline level regardless of short-term changes in real GDP. The minimum level of defence competence is therefore maintained. This result corroborates with the findings of Yildirim and Sezgin (2002) who examined the demand for military expenditure in Turkey. Also, increases in real GDP are expected to result in increases in military expenditures, as shown by the fact that the change from the prior year's real GDP per capita is both positive and significant. This result is in contrast with the findings of Dunne and Nikolaidou (2001) who found that the previous year's income would probably not result in increases in defence budgets.

Foreign direct investment recorded a negative influence on military expenditure in the short run. All things being equal, a unit increase in foreign direct investment would result in an 8.4% decline in military expenditure in the short run at 5% significance level. This outcome is consistent with the negative results shown for foreign direct investment in the long run.

Over the study period, inflation had a positive effect on military expenditure as shown by the positive coefficient of 0.006, although insignificant in the short run. The positive result is consistent with that of inflation in the long run. Also, an examination of previous (lag) inflation reveals that inflation had a statistically significant positive effect on military expenditure. In that regard, increases in inflation may result to increases in military expenditures in Rwanda, as the change from the prior year's inflation is positive and significant.

The population variable also maintained its long run results. Specifically, military expenditure increases by 3.74% in the short run for every 1% rise in population ration in Rwanda. However, the lagged value of population is negative and significant, implying that increases in the previous year's population can lead to a decrease in military expenditure. Thus, it may allow government to place higher priority on other sectors such as infrastructural development, healthcare, or education.

In contrast with the long-term results, security web recorded a negative and statistically insignificant effect on military expenditure. The coefficient of the current value of security web shows that an increase in security web will result in a decrease in military expenditure. The reason could be that elevated military spending of neighbouring countries may result in cooperative security measures if they are members of regional alliances (as the case for Rwanda being part of the EAC). In such circumstances, Rwanda may rely on its partners to bear the burden of regional security, resulting to a decrease in their own military expenditure. The lagged value of the change in the security web of Rwanda has a positive but insignificant impact. Similarly, trade openness and democracy recorded a negative effect consistent with the long run result, significant at 5% and 1% levels, respectively.

In line with the long-run results, genocide also recorded a positive and statistically significant effect on military expenditure in the short run. The results indicate that the rise in military spending happens quite rapidly after a genocide. Security worries, the need to regain stability, or other considerations relating to the aftermath of a genocide might add to the rise in ME in the short run. This result seems intuitive and tends to show that at the initial stage of the genocide, the need for weaponry causes a rise in military expenditure.

4.4 Diagnostics and Stability Test Results

The results (see Table A.2 of the Appendix) demonstrate that both the baseline and expanded model are unaffected by problems with the non-normal distribution of parameter estimates, serial correlation, heteroskedasticity, and model misspecification. Hence, the classical linear regression model's assumptions are met. The results also indicate that the model estimates are stable, and this was corroborated by both CUSUM and CUSUMSQ (see figure 3 and 4 of the appendix) test results that were significant at 5% level and fell within the critical regions.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Undoubtedly, the crucial role of the military in a country cannot be underplayed. Without the protection of a strong military base, economic and social growth can be worthless. Consequently, military expenditure has been characterized as a critical component of every nation's central government budget. This further reinforces the subject of this study in examining the determinants of military expenditure in Rwanda. The main argument is that the inclusion of economic factors, socio-political, strategic or institutional variables is particularly useful in deepening the understanding of the determinant of military expenditure.

This study employed a general model of demand for military expenditure and estimated it using the Autoregressive Distributed Lag (ARDL) approach, owing to its benefit over other estimation techniques. The baseline and expanded model results were presented. The study contributed to the literature by combined influence of economic, political, strategic and country specific factors on the determinant for military expenditure and provides empirical evidence for Rwanda. There are some essential and logical conclusions from the empirical study of military expenditure in Rwanda. The baseline results from the ARDL regression revealed that there exist a positive and significant relationship between military expenditure and real GDP per capita, both in the long-run and short run. In the expanded model, it was discovered that increases in real GDP per capita will lead to increases in military expenditure in the long run. However, in the short term, while the impact on military expenditure was positive, it was found to be insignificant. An observation from the literature is that real GDP as an economic variable was employed in most of the studies due to its relevance in explaining military spending. According to Solarin (2018), a country's capacity to pay for its military expenditure depends

on its level of income. Similarly, Dunne and Mohammed (1995) documented that it is intuitive that higher income would lead to increased military burden given that military spending is a normal good. Apart from Solarin (2018) or Dunne and Mohammed (1995) studies, a study by Dunne et al. (2003) also corroborates with the findings of the current study on the positive effect of GDP on military expenditure.

The empirical findings of the current study further demonstrated the negative and statistically significant association between trade openness and military spending, in both the long and short terms. This outlines the effect that trade openness has in reducing Rwanda's military spending. The outcome, however, contradicts the findings of George et al. (2019) who found trade openness to rather lead to an increase in defence spending. The study also found a positive and statistically significant relationship between inflation and military expenditure both in the long-run and the short run. The positive coefficient shows that the government is cognizant of the need to modify military spending in response to inflationary pressures to ensure the protection of national defence interests. Furthermore, for both the short and long-run, the study found a statistically significant relationship between military spending and foreign direct investment. This indicates that future military spending will be greatly reduced due to increased foreign investment in businesses, corporate governance and infrastructure, as supported by the findings of de Soysa (2019).

To no surprise, a positive and statistically significant association between military spending and genocide was found in both the short and long run for the case of Rwanda. The result is in line with the findings of Ali (2013) who found evidence that wars, civil unrest or genocides would stimulate more spending on the military to ensure national security. The study further revealed that security web had a positive relationship with military expenditure for both the short run and the long run. This implies that military expenditure would see growth owing to increases in security web. The notion that a country's military actions during times of peace affects those of its neighbours is strongly supported by several studies, including Solarin (2018), Flores (2011) and Dunne & Perlo-Freeman (2003). Although positive, the security web variable was statistically insignificant, undermining its effects in influencing defence spending for the case of Rwanda. According to the present study, population had a long-term and short-term positive and statistically significant link with military spending. This indicates that military spending is positively impacted by population in Rwanda. Finally, democracy was found to be negative and statistically significant. This goes to buttress the assertion that

democratic regimes have lower levels of military spending by confirming the predicted negative and statistically significant influence of democracy. This result is consistent with the findings of Solarin (2018) who maintained that democratic countries spend less on their military than non-democratic nations.

All things being equal, the study discovered convincing evidence that real GDP per capita, democracy, trade openness, inflation, genocide, population and foreign direct investment play a crucial part in determining military expenditure in Rwanda. However, the impact of security web was insignificant. According to the conclusions drawn from the study, government initiatives aiming for reduced levels of government spending on military expenditure, should prioritize trade openness to free up funds for other government projects. Again, efforts to attract FDI should be intensified since FDI inflows may lower the intensity of global conflict, promote cooperation and consequently reduce military spending (Polachek et al., 2007). Overall, it can be said that economic and political factors influence defence spending in Rwanda.

The study draws attention to the following limitations and suggestions for further study. The key limitation is lack of data to increase the study sample. The study used a reduced sample size from 1973 to 2022, since there were not enough data points for all the variables employed. Thus, a drawback is the number of variables in the expanded model of the ARDL framework for the limited time frame. Results of the expanded model should therefore be taken with caution. There is also the possibility of errors inherent in the measurement of military expenditure (SIPRI, 2022). This, however, does not invalidate the findings of this research. It is crucial that future research focuses on the possible non-linear relationship among the determinants of military expenditure. Future research could also increase the sample size given the availability of data.

REFERENCES

- Abdelfattah, Y. M., Abu-Qarn, A. S., Dunne, J. P. & Zaher, S. 2014. The demand for military spending in Egypt. *Defence and Peace Economics*, 25(3), 231-245. <https://doi.org/10.1080/10242694.2013.763454>
- Abura, E. 2021. An application of the augmented Solow model to measure the impact of military spending on economic growth in Uganda for the period 1962-2018. *Faculty of Commerce, School of Economics*. <http://hdl.handle.net/11427/35581>
- Albalade, D., Bel, G. & Elias, F. 2012. Institutional determinants of military spending. *Journal of comparative economics*, 40(2), 279-290. [Google Scholar](#)
- Ali, H. 2013. Estimate of The Economic Cost of Armed Conflict: A Case Study from Darfur. *Defence and Peace Economics*, 24(6), 503-519. <https://doi.org/10.1080/10242694.2012.723154>
- Ali, H. 2015. Defense Spending, Natural Resources, and Conflict. *Defence and Peace Economics*, 26(1), 1-3, <https://doi.org/10.1080/10242694.2013.848581>.
- Ali, H. & Abdellatif, O. 2015. Military Expenditures and Natural Resources: Evidence from Rentier States in the Middle East and North Africa. *Defence and Peace Economics*, 26(1), 5-13. <https://doi.org/10.1080/10242694.2013.848574>
- Anderton, C.H. 2010. Choosing Genocide: Economic Perspectives on the Disturbing Rationality of Race Murder. *Defence and Peace Economics*, Vol. 21(5–6), October–December, pp. 459–486. <https://doi.org/10.1080/10242694.2010.513478>
- Andriamahazoarivo, A. & Ravalison, F. 2016. Military Expenditures and Economic Development Concepts and Models: A Literature Review Utilizing Competitive Intelligence. *Journal of Systems and Industrial Project Engineering* 2(1), 77-91.
- Arif, 2012. Determinants of Military Expenditure in Developing Countries and Their Effects on the Economy. *International Journal of Research in Commerce, Economics & Management*, 2(1), (January) ISSN 2231-4245. <https://www.researchgate.net/publication/342571540>
- Armev, L.E. & McNab, R.M. 2019. What Goes Up Must Come Down: Military Expenditure and Civil Wars. *Defence and Peace Economics*, 30(5), 570-591. <https://doi.org/10.1080/10242694.2017.1405235>
- Arvanitidis, P. & Kollias, C. 2016. Zipf's law and world military expenditures. *Peace Economics, Peace Science and Public Policy*, 22(1), 41-71.

- Avramides, C. 1997. Alternative Models of Greek Defence Expenditure. *Defence and Peace Economics*, 8(2), 145–187. <https://doi.org/10.1080/10430719708404874>
- Ayeni, T. 2022. Rwanda: President Kagame says he may run for fourth term in 2024. *the Africa report*, 12 July 2022. <https://www.theafricareport.com/222337/rwanda-president-kagame-says-he-may-run-for-4th-term-in-2024/>
- Bae, J.S. 2004. An Empirical Analysis of the Arms Race Between South and North Korea, *Defence and Peace Economics*, 15(4), 379-392. <https://doi.org/10.1080/1024269032000155785>
- Ball, N. 1985. Defense Expenditures and Economic Growth: A Comment. *Armed Forces and Society*. 11(2).
- Barro, R. J. 1979. On the determination of the public debt. *Journal of political Economy*, 87(5, Part 1), 940-971.
- Batchelor, P., Dunne, P. & Lamb, G. 2002. The demand for military spending in South Africa. *Journal of Peace Research*, 39(3), 339-354.
- Bel, G. & Elias-Moreno, F. 2009. Institutional determinants of military spending. *Research Institute of Applied Economics, Working Papers*, 22.
- Benoit 1973. Defence and Economic Growth in Developing Countries. D.C. Heath, Boston, [Google Scholar](#).
- Benoit 1978. Growth and defence in developing countries. *Economic Development and Cultural Change*, 26(2). [Google Scholar](#).
- Beswick, D. 2010. Managing dissent in a post-genocide Environment: the challenge of political space in Rwanda. *Development and Change*, 41, 225–251.
- Beyene, M. Y., Srinivasan, S. & Andavar, V. 2020. Economic Determinants of Military Expenditure in Ethiopia during 2011–2019: A Panel Analysis. <https://scope-journal.com/assets/uploads/doc/86cd1-99-106.23330.pdf>
- Blouin, A. & Mukand, S.W. 2022. Mistaking noise for bias: Victimhood and Hutu–Tutsi Reconciliation in East Africa. *Journal of Development Economics*. Vol. 158, 102943, ISSN 0304-3878. <https://doi.org/10.1016/j.jdeveco.2022.102943>.
- Chan, S. 1988. Defense burden and economic growth: Unraveling the Taiwanese enigma. *American Political Science Review*, 82, 913-920.

- Chalmers, M. 2007. Spending To Save? The Cost-Effectiveness of Conflict Prevention. *Defence and Peace Economics*, 18(1), 1-23. <https://doi.org/10.1080/10242690600821693>
- Choulis I., Mehrl, M. & Ifantis, K. 2022. Arms Racing, Military Build-Ups and Dispute Intensity: Evidence from the Greek-Turkish Rivalry, 1985-2020. *Defence and Peace Economics*, 33(7), 779-804. <https://doi.org/10.1080/10242694.2021.1933312>
- Coffé, H. 2010. The 2010 presidential elections in Rwanda. *Electoral Studies*, 30(3), 581-584. <https://doi.org/10.1016/j.electstud.2011.05.007>.
- Collier, P. 2000. Policy for post-conflict societies: Reducing the risks of renewed conflict. In *Economics of Political Violence Conference* (pp. 18-19).
- Collier, P. & Hoeffler A. 2002. Military Expenditure: Threats, Aid, and Arms Races. *World Bank Policy Research Working*.
- Collier, P. & Hoeffler, A. 2004. Unintended consequences: does aid promote arms races? *Oxford Bulletin of Economics and Statistics*, 69(1), 1–27. [\[Google Scholar\]](#)
- Collier, P. & Hoeffler, A. (2007). Military spending and the risks of coups d'etats. [Google Scholar](#)
- Corr, P. J. 2013. Approach and Avoidance Behaviour: Multiple Systems and their Interactions. *Emotion Review*, 5(3), 285–290. <https://doi.org/10.1177/1754073913477507>
- Corr, P., DeYoung, C. & McNaughton, N. 2016. Motivation and Personality: A Neuropsychological Perspective. *Social and Personality Psychology, Compass* 7/3, 158–175. <https://doi.org/10.1111/spc3.12016>
- d'Agostino, G., Dunne, J.P. & Pieroni, L. 2011. Optimal military spending in the US: a time series analysis. *Economic Modelling*, 28, 1068–1077. <https://doi.org/10.1016/j.econmod.2010.11.021>.
- d'Agostino, G., Dunne J.P. & Pieroni, L. 2017. Does Military Spending Matter for Long-run Growth? *Defence and Peace Economics*, 28(4), 429-436. <https://doi.org/10.1080/10242694.2017.1324723>
- Deger & Sen 1995. Military expenditure and developing countries. *Handbook of Defense Economics, Chapter 11, Elsevier*, Volume 1, 275-307. [https://doi.org/10.1016/S1574-0013\(05\)80013-4](https://doi.org/10.1016/S1574-0013(05)80013-4).

- Deger, S. & West, R. 1987. Introduction: Defense Expenditure, National Security and Economic Development in the Third World. *Defense, Security and Development* (London: Francis Pinter, 1987).
- Denov, M. & Piolanti, A. 2020. “Though My Father was a Killer, I Need to Know Him”: Children born of genocidal rape in Rwanda and their perspectives on fatherhood. *Child Abuse & Neglect*, Volume 107, 104560, ISSN 0145-2134. <https://doi.org/10.1016/j.chiabu.2020.104560>.
- de Soysa, I. 2019. Does Foreign Direct Investment Encourage State Militarization and Reduce Societal Security? An Empirical Test, 1980–2017. *Peace Economics, Peace Science and Public Policy*, 26 (1), 20190011.
- de Soysa, I. 2020. Does Foreign Direct Investment Encourage State Militarization and Reduce Societal Security? An Empirical Test, 1980–2017. *Peace Economics, Peace Science and Public Policy*, 26(1), pp. 20190011. <https://doi.org/10.1515/peps-2019-0011>
- Dizaji, S. F. 2019a. Trade openness, political institutions, and military spending (evidence from lifting Iran’s sanctions). *Empir. Econ* 57, 2013–2041. <https://doi.org/10.1007/s00181-018-1528-2>
- Dizaji, S. F. 2019b. The Potential Impact of Oil Sanctions on Military Spending and Democracy in the Middle East. *ISS Working Paper*, No. 644. [\[Google Scholar\]](#)
- Dizaji, S. F., Farzanegan, M.R. & Naghavi, A. 2016. Political Institutions and Government Spending Behavior: Theory and Evidence from Iran. *International Tax and Public Finance* 23(3), 522–549. [\[Google Scholar\]](#)
- Dizaji, S.F. & Farzanegan, M.R. 2023. Democracy and Militarization in Developing Countries: A Panel Vector Autoregressive Analysis. *Defence and Peace Economics*, 34(3), 272-292. <https://doi.org/10.1080/10242694.2021.1957191>
- Do, T.K. 2021. Resource curse or rentier peace? The impact of natural resource rents on military expenditure. *Resources Policy*, Volume 71, 101989, ISSN 0301-4207. <https://doi.org/10.1016/j.resourpol.2021.101989>.
- Dunne, J. P. & Mohammed, N. A. 1995. Military spending in Sub-Saharan Africa: Some evidence for 1967-85. *Journal of Peace research*, 32(3), 331-343.
- Dunne, P. 1996. Economic effects of military expenditure in developing countries: a survey. In *The Peace Dividend*, edited by N.P. Gleditsch, O. Bjerkholt, A. Cappelen, R. Smith and P. Dunne. North Holland, Ch.23, 439–464.

- Dunne, P. & Nikolaidou, E. 2001. Military expenditure and economic growth: A demand and supply model for Greece, 1960–96. *Defence and Peace Economics*, 12(1), 47-67. <https://doi.org/10.1080/10430710108404976>
- Dunne, P. & Perlo-Freeman, S. 2003. The Demand for Military Spending in Developing Countries: A Dynamic Panel Analysis. *Defence and Peace Economics* 14(6), 461-474. <https://doi.org/10.1080/1024269032000085224>
- Dunne, P., Nikolaidou, E. & Mylonidis, N. 2003. The demand for military spending in the peripheral economies of Europe. *Defence and Peace Economics*, 14(6), 447-460. <https://doi.org/10.1080/1024269032000085215>
- Dunne, J. P., Perlo-Freeman, S. & Smith, R. P. 2008. The demand for military expenditure in developing countries: hostility versus capability. *Defence and Peace Economics*, 19 (4), 293-302. <https://doi.org/10.1080/10242690802166566>
- Dunne, J. P., Perlo-Freeman, S. & Smith, R. P. 2011. Determining military expenditures: Dynamics, spillovers and heterogeneity in panel data. In *Economic society South Africa conference at the University of Stellenbosch* (Vol. 1, p. 21).
- Dunne, J. P. & Tian, N. 2020. Military Expenditures and Economic Growth. In *Oxford Research Encyclopedia of Politics* (Oxford University Press. UCT Macroeconomics Discussion Paper). Discussion Paper). [\[Google Scholar\]](#)
- Easterly, W. 2001. The middle-class consensus and economic development. *Journal of economic growth*, 6(4), 317-335.
- Engerer, H. 2011. Security as a Public, Private or Club Good: Some Fundamental Considerations. *Defence and Peace Economics*, 22(2), 135-145. <https://doi.org/10.1080/10242694.2011.542333>
- Engle, R. F. & Granger, C. W. 1987. Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.
- Fehr, E. & Gächter, S. 2000. Cooperation and punishment in public goods experiments. *American Economic Review*, 90 (4), 980-994. [Google Scholar](#)
- Firoozabadi J. & Ashkezari, M. 2016. Neo-classical Realism in International Relations. *Asian Social Science*; Published by Canadian Center of Science and Education. 12(6), ISSN 1911-2017 E-ISSN 1911-2025. <http://dx.doi.org/10.5539/ass.v12n6p95>
- Flores, A.Q. 2011. Alliances as contiguity in spatial models of military expenditures. *Conflict Management and Peace Science*, 28 (4), 402-418.

- Fontanel, J. 1990. The Economic Effects of Military Expenditure in Third World Countries. *Journal of Peace Research*, 27(4), 46-66. <https://www-jstor-org.ezproxy.uct.ac.za/stable/424268?seq=6>
- Frederiksen & Looney 1983. Defense Expenditures and Economic Growth in Developing Countries. *Armed Forces Soc.*, 9, 633-645. <http://hdl.handle.net/10945/40625>
- Gbandi 2022. This water is all ours: Water demand and civil conflicts. *Research in Economics*, 76(2), 120-130. <https://doi.org/10.1016/j.rie.2022.06.003>.
- George, J., Hou, D. & Sandler, T. 2019. Asia-Pacific demand for military expenditure: spatial panel and SUR estimates. *Defence and Peace Economics*, 30(4), 381-401.
- George & Sandler 2022. African Union defense demand and spatial spillovers. *Political Geography*, Volume 99, 102789, ISSN 0962-6298. <https://doi.org/10.1016/j.polgeo.2022.102789>.
- Global Fire Power. 2023. African Military Strength. [African Military Strength \(2023\) \(globalfirepower.com\)](https://www.globalfirepower.com)
- Hacker, R. S. & Hatemi-J. 2006. Tests for Causality between Integrated Variables Using Asymptotic and Bootstrap Distributions: Theory and Application. *Applied Economics* 38: 1489–1500. <https://doi.org/10.1080/00036840500405763>
- Hager, R.P. 2019. The Cold War and Third World revolution. *Communist and Post-Communist Studies*, 52(1), 51-57. <https://doi.org/10.1016/j.postcomstud.2019.02.001>.
- Harris, G. 1986. The determinants of defence expenditure in the ASEAN region. *Journal of Peace Research*, 23 (1), 41-49.
- Harvey, A.C. 1981. *The Econometric Analysis of Time Series*. New York: John Wiley and Sons.
- Hill, W. 1992. Several sequential augmentations of Richardson's arms race model. *Mathematical and Computer Modelling*, 16(8–9), 201-212. [https://doi.org/10.1016/0895-7177\(92\)90096-4](https://doi.org/10.1016/0895-7177(92)90096-4).
- Hintjens, H. 2008. Post-genocide identity Politics in Rwanda. *Ethnicities*, 8, 5–41.
- Holcner, V. & Neubauer, J. 2015. Modelling expected defense specific inflation. In *AIP Conference Proceedings*. Vol. 1648, No. 1. AIP Publishing. 2015, March.

- Josselin, D. & Malizard, J. 2022. Determinants of Defense Spending: The Role of Strategic Factors in France. *Defence and Peace Economics*, 33(8), 938-955. <https://doi.org/10.1080/10242694.2021.1907985>
- Kar, M., Nazlıoğlu, S. & Ağır, H. 2011. Financial Development and Economic Growth Nexus in the MENA Countries: Bootstrap Panel Granger Causality Analysis. *Economic Modelling*, 28 (1–2), 685–693. <https://doi.org/10.1016/j.econmod.2010.05.015>, [Google Scholar]
- Kamlet, M.S. & Mowery, D.C. 1987. Influences on Executive and Congressional budgetary priorities 1955-1981. *American Political Science Review*, 81, 155-178.
- Karadam, D.Y., Yildirim, J. & Öcal, N. 2017. Military Expenditure and Economic Growth in Middle Eastern Countries and Turkey: a non-linear panel data approach. *Defence and Peace Economics*, 28(6), 719-730. <https://doi.org/10.1080/10242694.2016.1195573>
- Khan, Su. & Rizvi 2022. Guns and Blood: A Review of Geopolitical Risk and Defence Expenditures. *Defence and Peace Economics*, 33(1), 42-58. <https://doi.org/10.1080/10242694.2020.1802836>
- Kishi, R., Maggio, G. & Raleigh, C. 2017. Foreign Investment and State Conflicts in Africa. *Peace Economics, Peace Science and Public Policy*, Vol. 23 (Issue 3), pp. 20170007. <https://doi.org/10.1515/peps-2017-0007>.
- Kioko, B. 2003. The right of intervention under the African Union's Constitutive Act: From non-interference to non-intervention. *International Review of the Red Cross*, 85(852), 807-826. https://www.icrc.org/en/doc/assets/files/other/irrc_852_kioko.pdf
- Kiwuwa, D.E. 2005. Democratization and ethnic politics: Rwanda's electoral legacy. *Ethnopolitics* 4, 447–464.
- Kagame. 2023. <https://www.paulkagame.com/biography/>
- Kawamya, A. 2022. The effect of financial development on economic growth: the case of South Africa. *UCT Faculty of Commerce, School of Economics*. Retrieved from <http://hdl.handle.net/11427/36612>
- Kripfganz, S. & Schneider, D. C. 2018. ardl: Estimating autoregressive distributed lag and equilibrium correction models. In *Proceedings of the 2018 London Stata conference* (Vol. 9). (2018, September).
- Kollias, C., Palaiologou, S.M., Tzeremes, P. & Tzeremes, N. 2018. The demand for defense spending in Russia: Economic and strategic determinants.” *Russian Journal of Economics*, 4(3), 215-228. <https://rujec.org/article/27086/download/pdf/>

- Landau, D. L. 1993. The economic impact of military expenditures (Vol. 1138). World Bank Publications. Policy, Research working papers; no. WPS 1138. Public economics Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/979471468766166484/The-economic-impact-of-military-expenditures>
- Langlotz & Potrafke 2019. Does development aid increase military expenditure? *Journal of Comparative Economics*, 47(3), 735-757. <https://doi.org/10.1016/j.jce.2019.05.002>
- Lemarchand, R. 2009. The 1994 Rwandan genocide. In *Century of Genocide: Critical Essays and Eyewitness Accounts*, Edited by: Totten, S., and Parsons, W.S. 483–504. New York: Routledge. [\[Google Scholar\]](#)
- Lemarchand, R. & Clay, Daniel. 2023. Rwanda. *Encyclopedia Britannica*. February 15, 2023. <https://www.britannica.com/place/Rwanda>
- Lichterhan, A. 2022. The Peace Movement and the Ukraine War: Where to Now? *Journal for Peace and Nuclear Disarmament*, 5(1), 185-197. <https://doi.org/10.1080/25751654.2022.2060634>
- Looney, R.E. 1986. The Political Economy of Latin American Defence Expenditure: Case Studies of Venezuela and Argentina. p4, USA: Lexington Books. [\[Google Scholar\]](#)
- Looney, R. E., & Frederiksen, P. C. 1990. The economic determinants of military expenditure in selected east asian countries. *Contemporary Southeast Asia*, 265-277.
- Luterbacher, U. 1975. Arms race models: Where do we stand? *European Journal of Political Research*, 3, 199-217.
- Mah, J. S. 2000). An empirical examination of the disaggregated import demand of Korea—the case of information technology products. *Journal of Asian economics*, 11(2), 237-244.
- Maizels, A. & Nissanke, M.K. 1986. The determinants of military expenditures in developing countries. *World Development*, 14(9), 1125-1140. [https://doi.org/10.1016/0305-750X\(86\)90115-4](https://doi.org/10.1016/0305-750X(86)90115-4).
- Majeski, S. J. & Jones, D. L. 1981. Arms race modeling: Causality analysis and model specification. *Journal of Conflict Resolution*, 25(2), 259-288.

- Mensah, S. 2018. Effects Of Remittances and Infrastructure on Private Investment: Evidence from Ghana. *AERCA Africa*. University of Cape Coast. Available at: <https://publication.aercafricalibrary.org/items/22b2f2d9-ffa-437a-9140-af38b8c4862a/full>
- Morrow, J. D. 1989. A Twist of Truth: A Reexamination of the Effects of Arms Races on the Occurrence of War. *The Journal of Conflict Resolution*, 33 (3), 500–529. [[Google Scholar](#)]
- Mukamana, D. & Brysiewicz, P. 2008. The Lived Experience of Genocide Rape Survivors in Rwanda. *Journal of Nursing Scholarship*, 40, 379-384. <https://doi.org/10.1111/j.1547-5069.2008.00253.x>
- Narayan, P. K. & Smyth, R. 2005. The residential demand for electricity in Australia: an application of the bounds testing approach to cointegration. *Energy policy*, 33(4), 467-474.
- Neubauer, J. & Odehnal, J. 2018. Security and economic determinants of the demand for Czech military expenditure: ARDL approach. In *AIP Conference Proceedings* (Vol. 1978, No. 1, p. 090004). 2018, July, AIP Publishing LLC. <https://doi.org/10.1063/1.5043741> Available at: <https://doi.org/10.1063/1.5043741>
- Newbury, D. 1998. Understanding Genocide. *African Studies Review*, 41(1), 73–97. <https://doi.org/10.2307/524682>
- Nikolaidou, E. 2008. The Demand for Military Expenditure: Evidence from the EU-15 (1961–2005). *Defence and Peace Economics*, 19(4), 273-292. <https://doi.org/10.1080/10242690802166533>
- Nordhaus, W., Oneal, J. R. & Russett, B. 2012. The effects of the international security environment on national military expenditures: A multicountry study. *International Organization*, 66(3), 491-513.
- Ocal, N. & Yildirim, J. 2009. Arms Race between Turkey and Greece: A Threshold Cointegration Analysis. *Defence and Peace Economics*, 20(2), 123–129. <https://doi.org/10.1080/10242690801962254>
- Odehnal, J. & Neubauer, J. 2020. Economic, security, and political determinants of military spending in NATO countries. *Defence and peace economics*, 31(5), 517-531. <https://doi.org/10.1080/10242694.2018.1544440>

- Odehnal, J., Neubauer, J., Dyčka, L. & Ambler, T. 2020. Development of Military Spending Determinants in Baltic Countries—Empirical Analysis. *Economies*, 8(3), 68. <https://doi.org/10.3390/economies8030068>
- Olorogun, L. A. 2022. Revisiting the nexus of FDI-led growth hypothesis and economic development in Rwanda: A Johansen-ARDL approach to cointegration. *Journal of the Knowledge Economy*, 13(4), 2695-2717.
- Ortiz-Villajos J.M. & Martos-Gómez J.J. 2023. Military Technology, Defense Spending and Modernization of the Armed Forces: The Case of Spain, 1891-1935. *Defence and Peace Economics*. <https://doi.org/10.1080/10242694.2023.2198912>
- Pattichis, C. S. & Pattichis, M. S. 1999. Time-scale analysis of motor unit action potentials. *IEEE Transactions on Biomedical Engineering*, 46(11), 1320-1329.
- Pesaran, M. H., Shin, Y. & Smith, R. J. 2001. Bounds testing approaches the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289-326.
- Phillips, P. C. & Hansen, B. E. 1990. Statistical inference in instrumental variables regression with I (1) processes. *The Review of Economic Studies*, 57(1), 99-125.
- Polachek, S., Seiglie, C., & Xiang, J. 2007. The impact of foreign direct investment on international conflict. *Defence and Peace Economics*, 18(5), 415-429.
- Richardson, L.F. 1960. *Arms and Insecurity: A Mathematical Study of the Causes and Origins of War*. (Chicago: Quadrangle). Pittsburgh: Boxwood. [\[Google Scholar\]](#)
- Rosh, R.M. 1988. Third world militarisation: security webs and the states they ensnare. *Journal of Conflict Resolution*, 32(4): 671–698. [\[Google Scholar\]](#)
- Russett, B. M. 1969. Who Pays for Defense? *American Political Science Review*, 63, 412–426. doi:10.1017/S0003055400262308. [\[Google Scholar\]](#)
- Saba, C.S. & Ngepah, N. 2019. Military expenditure and economic growth: evidence from a heterogeneous panel of African countries. *Economic Research-Ekonomska Istraživanja*, 32(1), 3586-3606. <https://doi.org/10.1080/1331677X.2019.1674179>
- Sandler, T. & Hartley, K. 1995. The economics of defense. *Handbook of Defence Economics*, Vol.1. Amsterdam: North-Holland.
- Seburanga, Kaplin, Zhang & Gatesire 2014. Amenity trees and green space structure in urban settlements of Kigali, Rwanda. *Urban Forestry & Urban Greening*, 13(1), 84-93. <https://doi.org/10.1016/j.ufug.2013.08.001>.

- Sivard R, L. 1983. *World Military and Social Expenditures*. (Washington, DC: World Priorities 1983).
- Skogstad, K. 2016. Defence budgets in the post-Cold War era: a spatial econometrics approach. *Defence and Peace Economics*, 27(3), 323-352. <https://doi.org/10.1080/10242694.2015.1034911>
- Smith, R. P. 1980. The demand for military expenditure. *The Economic Journal*, 90(360), 811-820.
- Smith, R. P. 1980. Military Expenditure and Investment in OECD Countries, 1954-1973. *Journal of Comparative Economics*, Vol. 4.
- Smith, R. 1989. Models of military expenditure. *Journal of Applied Econometrics*, 4(4), 345–359, [\[Google Scholar\]](#)
- Smith,R. 1995. The demand for military expenditure. *Handbook of Defense Economics*, Vol. 1, 69-87, edited by K. Hartley and T. Sandler. Amsterdam: North-Holland. [https://doi.org/10.1016/S1574-0013\(05\)80006-7](https://doi.org/10.1016/S1574-0013(05)80006-7).
- Smith, R., Sola, M. & Spagnolo, F. 2000. The Prisoner’s Dilemma and Regime-Switching in the Greek-Turkish Arms Race. *Journal of Peace Research*, 37 (6): 505–531. <https://doi.org/10.1177/0022343300037006005>
- Smith, R. 2017. Military Expenditure data: Theoretical and Empirical Considerations. *Defence and Peace Economics*, 28(4), 422–428.
- Solarin, S. 2018. Determinants of military expenditure and the role of globalisation in a cross-country analysis. *Defence and Peace Economics*, 29(7), 853-870. <https://doi.org/10.1080/10242694.2017.1309259>
- Tambudzai, Z. 2011. Determinants of military expenditure in Zimbabwe. *The Economics of Peace and Security Journal*, 6(2). <http://dx.doi.org/10.15355/epsj.6.2.41>
- Tian, N., da Silva, Béraud-Sudreau, Liang, Scarazzato & Assis. 2023. Developments in Military Expenditure and the Effects of the War in Ukraine. *Defence and Peace Economics*, 34(5), 547-562. <https://doi.org/10.1080/10242694.2023.2221877>
- TheGuardian. 2021. Until Africans get the Covid vaccinations they need, the whole world will suffer: Paul Kagame. Available at: <https://www.theguardian.com/commentisfree/2021/feb/07/africans-covid-vaccinations-pandemic-paul-kagame>

- United Nations, 2022. DR Congo President denounces ‘aggression’ by Rwanda, calls on UN to support African-led mediation. *UN Affairs*, 20 September 2022. <https://news.un.org/en/story/2022/09/1127271>
- United Nations, 2014. The Justice and Reconciliation Process in Rwanda. Department of Public Information, March 2014, <https://www.un.org/en/preventgenocide/rwanda/backgrounders.shtml>
- United Nations Development Programme, 2023. What are the Sustainable Development Goals? [Sustainable Development Goals | United Nations Development Programme \(undp.org\)](https://www.undp.org/sustainable-development-goals)
- Ward, M.D. 1984. The political economy of arms races and international tension. *Conflict Management and Peace Science*, 7(2), 1-23. <https://doi.org/10.1177/073889428400700201>
- Waszkiewicz, G. 2016. Drivers of Greek and Turkish Defense Spending. *International Journal of Management and Economics*, 51, 33–46. [\[Google Scholar\]](#)
- World Bank (Various years). <https://www.worldbank.org/en/country/rwanda/overview#1>. <https://data.worldbank.org/country/rwanda>. <https://data.worldbank.org/region/heavily-indebted-poor-countries-hipc>
- World Trade Organization, 2019. 2 Trade and Investment Regimes. *WTO*, 192-196. https://www.wto.org/english/tratop_e/tpr_e/s384-03_e.pdf
- Yalta, A.T. & Yalta, A.Y. 2022. The Determinants of Defense Spending in the Gulf Region. *Defence and Peace Economics*, 33(8), 980-992. <https://doi.org/10.1080/10242694.2021.1918857>
- Yildirim, J. & Sezgin, S. 2002. Defence, Education and Health Expenditures in Turkey, 1924-96. *Journal of Peace Research*, 39, 569–580. [\[Google Scholar\]](#)
- Yildirim, J., Sezgin, S. & Öcal, N. 2005. Military Expenditure and Economic Growth in Middle Eastern: A Dynamic Panel Data Analysis. *Defence and Peace Economics*, 16(4), 283-295. <https://doi.org/10.1080/10242690500114751>
- Yildirim, J. & Öcal, N. 2006. Arms Race and Economic Growth: The Case of India and Pakistan. *Defence and Peace Economics*, 17 (1), 37–45. <https://doi.org/10.1080/10242690500369231>

APPENDIX

Table A.1: Unit Root Test

Variable	Level		First difference		Order of Integration
	Constant	Trend	Constant	Trend	
ADF TEST					
LME	-1.490	-3.043	-7.121***	-7.036***	I(1)
LGDPC	-0.199	-1.605	-7.387***	-7.340***	I(1)
FDI	-1.225	-1.692	-12.394***	-12.261***	I(1)
LTO	-1.713	-4.084**	-11.13***	-7.432***	I(0)
LPOP	-0.949	-2.479	-7.343***	-7.304***	I(1)
INF	-4.187***	-4.735***	-10.375***	-10.523***	I(0)
DEMO	-0.630	-2.003	-7.084***	-7.010***	I(1)
GENO	-7***	-6.936***	-8.124***	-8.034***	I(0)
LSW	-1.663	-2.389	-4.933***	-4.973***	I(1)
P-P TEST					
LME	-1.159	-3.199*	-8.264***	-8.163***	I(0)
LGDPC	-0.199	-1.568	-7.387***	-7.340***	I(1)
FDI	-2.044	-2.995	-12.717**	-12.478**	I(1)
LTO	-3.200**	-4.267***	-12.368***	-12.946***	I(0)
LPOP	-1.174	-2.625	-7.521**	-8.352*	I(1)
INF	-4.072***	-4.728***	-12.057***	-12.609***	I(0)
DEMO	-0.600	-2.027	-7.084***	-7.010***	I(1)
GENO	-7***	-6.936***	-11.747***	-48.374***	I(0)
LSW	-1.083	-1.233	-4.096***	-4.004**	I(1)

Note ***, ** and * denotes the rejection of the null hypothesis at 1%, 5% and 10% significance level.

Source: Author's Calculations using EViews 10

Table A.2: Diagnostics Tests

	Baseline Model	Expanded model
Test Statistics	Probability value	Probability value
Normality	0.193	0.242
Serial Correlation	0.266	0.139
Heteroskedasticity	0.164	0.425
Functional form	0.69	0.165

Source: Author's calculation using EViews 10

Figure A.1: Plots of Cusum and Cusumsq for Baseline model

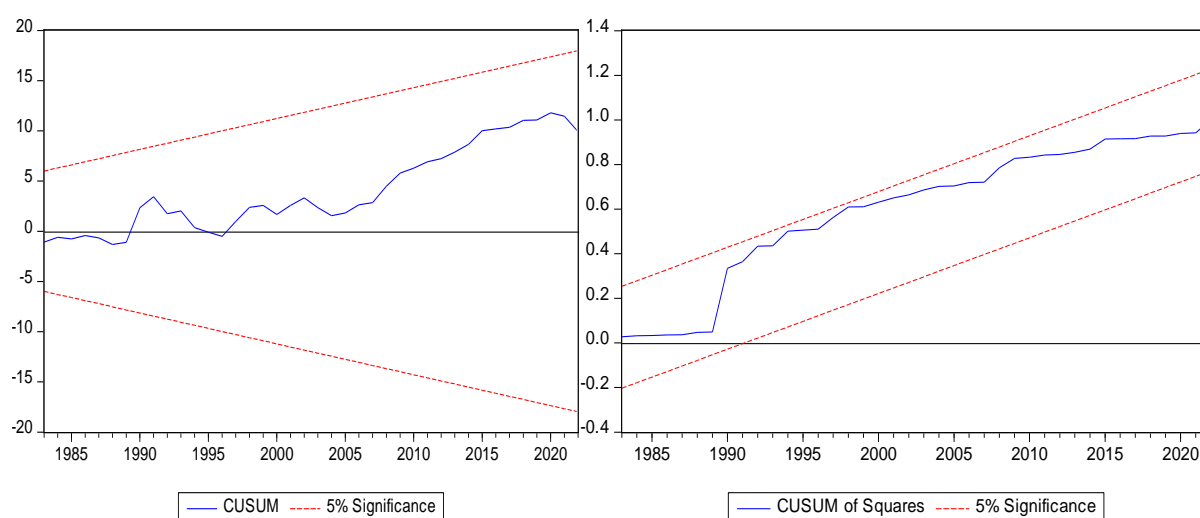


Figure A.2: Plots of Cusum and Cusumsq for expanded model

