The Determinants and Economic Effects of Defence Spending: The Case of Rwanda 1973-2020

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Abstract

There is a long and established literature – both theoretical and empirical – regarding the effects that a country's defence burden has on its growth prospects. However, the results remain inconclusive. Fewer studies consider the determinants of a government's defence spending decision, and many of these studies restrict their analysis to groups of countries, thus, failing to capture significant, country-specific features. Considering the high, and rising, instances of security concerns on the African continent, there is an imperative for economists to understand the demand and supply aspects of military spending by African governments. This dissertation advances the existing literature by providing empirical evidence on both the demand and supply issues affecting defence spending by focusing on Rwanda; an African country that is one of the continent's fastest growing economies, a significant trading partner with both Eastern and Western blocs, and a regional power that has experienced multiple conflicts over the past five decades. Employing the Autoregressive Distributed Lag (ARDL) approach to cointegration for the period 1973-2020, the study finds compelling evidence confirming the growth retarding effects of defence spending while also demonstrating that conflict and economic factors have been key determinants of the country's level of military expenditure. These findings are very important for policy makers that aim to facilitate the country's development processes – especially in a postconflict era.

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Dedication

Dedicated to the love, the support, and the memory of Lillian A. Ryhorski.

Declaration

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Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

ADF – Augmented Dickey-Fuller
AfDB – African Development Bank
ARDL – Autoregressive Distributed Lag
ATMOS – Advanced Technology Multiple Operating Systems
CAR – Central African Republic
CEPGL – Communauté Economique des Pays des Grands Lacs
COMESA – Common Market for Eastern and Southern Africa
DRC – Democratic Republic of Congo
DW – Durbin-Watts
EAC – East African Community
EADB – East African Development Bank
EU-15 – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, the UK
FAO – Food and Agricultural Organisational
FDI – Foreign Direct Investment
FLDR – Democratic Front for the Liberation of Rwanda
GMM – Generalised method of moments
HDI – Human Development Index
IAEA – International Atomic Energy Agency
IBRD – International Bank for Reconstruction and Development
ICAO – International Civil Aviation Organisation
ICJ – International Court of Justice
IDA – International Development Association
IFAD International Fund for Agricultural Development
IFC – International Finance Corporation
IFRCS – International Federation of the Red Cross and Red Crescent Societies
ILO – International Labour Organisation
IOM – International Organisation for Migration
ITU – International Telecommunications Union
ITUC – International Trade Union Confederation
LDC – Least Developed Country
MIC – Military Industrial Complex
MIGA – Multilateral Investment Guarantee Agency
MILEX – Military Expenditure/s
MINUSCA – United Nations Multidimensional Integrated Stabilisation Mission in the Central African Republic
MINUSMA – United Nations Multidimensional Integrated Stabilisation Mission in Mali
MINUSTAH – The United Nations Stabilisation Mission in Haiti
MLRS – Multiple Launch Rocket System
MRND – Mouvement Revolution National pour le Developpement
NAM – Non-Aligned Movement
OIF – Organisation Internationale de la Francophonie
OLS – Ordinary Least Squares
OPCW – Organisation for the Prohibition of Chemical Weapons
PARMEHUTU – Party of the Hutu Emancipation Movement
PVAR – Panel Vector Autoregression
RDF – Rwandan Defence Force
RPA – Rwandan Patriotic Army
RPF – Rwandan Patriotic Front
SEZ – Special Economic Zone
SIPRI – Stockholm International Peace and Research Institute
UAR– United Arab Republic
UAE – United Arab Emirates
UCDP – Uppsala Conflict Data Programme
UNAMID – United Nations-African Union Hybrid Operation in Darfur
UNCTAD – United Nations Conference on Trade and Development
UNESCO – United Nations Educational, Scientific and Cultural Organisation
UNHCR – United Nations High Commissioner for Refugees
UNIDO – United Nations Industrial Development Organisation
UNISFA – United Nations Interim Security Force for Abyei
UNMISS – United Nations Mission in South Sudan
UNSC – United Nations Security Council
UNWTO – United Nations World Tourism Organisation
UPU – Universal Postal Union
WCO – World Customs Organisation
WHO – World Health Organisation
WIPO – World Intellectual Property Organisation
WMO – World Meteorological Organisation
WTO – World Trade Organisation

Chapter 1: Introduction

The capacity to exert hard power underpins international geopolitical competition as well as domestic structures of governance. However, overreliance, or overinvestment, in a state's military may have negative long-run and short-run consequences for its economic prospects. In 1960, economist T.C. Schelling framed the issue acknowledging that *"economists have been closely associated with problems of defense for at least two decades"* (Schelling, 1960:3). Sixty years on, the debate regarding whether or not defence spending retards or facilitates growth continues. Appropriate military spending may decrease unemployment, increase technological growth, provide opportunities for gross capital formation, and even promote social cohesion. However, military spending may also have a crowding-out effect on private sector investment, decrease public trust in the government, scare off foreign investment, and divert resources away from vital sectors such as healthcare and education. This work looks at the effects, as well as the determinants, of military expenditure in Rwanda from 1973 to 2020. It builds a series of models to develop a demand function for Rwandan defence spending, then uses a Solow-Swann model with technological progress augmented by defence spending, to determine the effects that such spending has on patterns of Rwandan growth. As a case study, Rwanda has considerable economic and geopolitical significance in the African region.

As a pioneer scholar in the field, Benoit (1973a) argues that defence spending decisions are most important for Least Developed Countries (LDCs) – i.e., those economies typified by relatively low levels of existing capital and infrastructure and high reliance on a low-skilled labour surplus. Benoit (1973a; 1978) and Deger & Smith (1983) support this position by arguing that the potential marginal returns associated with an increase in public spending are higher in LDCs compared to those in the Developed world. This would also imply that the opportunity cost of public spending in any single sector is relatively higher in LDCs compared to developed economies. This line of thought led Benoit (1972; 1973b; 1978) and Deger & Smith (1983) to attempt to use econometric modelling to answer the question of what the economic effects of defence spending for developing countries would be. The resulting literature has proved indeterminate. Defence spending has direct effects on some countries but conflicting spinoff component effects overturn them in others (Deger & Sen, 1983). There is also a discrepancy between the short run and long run effects of defence spending on growth. In the short run, defence budgets are substitutes for other forms of public spending (D'Agostino et al., 2018 in Elveren, 2019:13). In the long run, defence spending may directly impact macro

factors that determine growth rates including labour productivity, capital accumulation, or employment (D'Agostino et al., 2018 in Elveren, 2019:13). Concurrently, defence spending tends to indirectly affect socio-political factors and conflicts that may constrain or facilitate economic development (D'Agostino et al., 2018 in Elveren, 2019:13).

A less recognised but equally important question that also emerged as the defence-growth nexus was increasingly scrutinised; was whether or not there is a recognisable set of factors that determine a government's defence spending decision. Again, the literature has shown high levels of variance between countries and the periods studied. Considering the widespread heterogeneity, it is worth focussing on country-level analysis that provide useful case studies. The exemplar of Rwanda, and more recent development successes and geopolitical flexing, provides an excellent basis for such work given its history of conflict.

The war in Ukraine, Chinese naval operations in the South Sea, and rising non-state militant action across the African continent (from Mali in the north west to Mozambique in the south east) all demonstrate that where soft power fails, there is ultimately a dependence on hard power or on the capacity to exert military force. As it is the role of the state to provide protection against external forces for its citizenry, then it follows that the state must have some capacity to exert hard power.

Traditional military science argues that the maintenance of a core standing army is the most efficient means of ensuring that a state possesses the capacity to exert hard power. Increasing geopolitical instability has had a varied effect on countries' budgeting choices. National security has broadened beyond traditional concepts of military force with far reaching consequences.

In peace time, states have also experienced the advantages of having an institution consisting of a large corps of skilled labour (working for a flat rate) to support key security, infrastructure, or even development roles. Therefore, it seems reasonable to think that some level of defence spending by states is necessary. An economics-based approach should consider both the potential marginal returns to a change in defence spending from current levels, and whether there is evidence of a causal relationship between defence spending and macroeconomic variables traditionally associated with increases in citizen welfare. Overall, the literature shows that confounding factors lead to heterogenous outcomes globally (Emmanouilidis & Karpetis, 2021). There remains no universally abstracted law describing the effects of defence spending on growth. Nor have the most suitable explanatory variables to model the demand for defence spending been identified. Much of the existing literature uses cross-country, or panel analyses that fail to account for the country-specific factors that have a

real-world impact on what the effects and determinants of military spending actually are. Relatively few country-specific studies focus on the African continent. The value of investigating the determinants and economic effects of defence spending by focussing on the case of Rwanda can be defended as follows:

Firstly, Rwanda is geographically situated in a part of East Africa which has witnessed a high level of insecurity. The study of a potential defence-growth relation is of particular relevance in areas characterised by relatively high risk to property rights and the rule of law.

Secondly, the country has a history of both internal and external conflict. Rwanda was involved in external wars with Uganda (2000), and the Democratic Republic of Congo (1996-1997; 1998-2002; 2009; and 2022). Rwanda was also embroiled in a civil war from 1990-1994 and suffered a genocidal conflict in 1994. Post conflict, defence spending continues to be relatively high due to security concerns along its borders with Uganda, Burundi and the DRC.

Thirdly, Rwanda has sought to market itself as a post-conflict development success and has used that image to push for greater political and trade influence on the African continent. Its growth and political successes make it an interesting African case to study. It lends weight to the increasingly popular conception of high growth potential in developing African states, while at the same time, Rwanda faces challenges common to many other Least Developed and Developing countries – particularly in a post-conflict setting.

Finally, even though it has garnered socio-political attention from both other African leaders and from competing European, American, and East Asian partners – no studies currently exist that look at Rwandan defence spending.

In the following chapter, this work provides an overview of the existing literature regarding the demand for, and effects of, defence spending worldwide. Chapter 3 comprises of a brief overview of Rwanda and its country specific factors. Chapter 4 consists of a data section and lays out the models and estimation techniques used. Chapter 5, then, presents the empirical results for the demand for defence spending in Rwanda, before continuing on to demonstrate the economic effects of such expenditures on the Rwandan economy. Finally, Chapter 6 concludes and provides some limitations and suggestions for future research.

Chapter 2: Literature Review

2.1. The Demand for Defence Spending

Different approaches appear in the literature regarding the best way to model the demand for defence spending. Where countries face specific strategic competition, an arms race model may be employed (Dunne et al., 2001; Yildirim & Ocal, 2007; Kollias & Paleologou, 2003; Amir-ud-Din, Waqi, & Aziz, 2020). Alternatively, positive spill-over security effects from friendly neighbouring countries may have an inverse effect on demand for defence expenditures as part of an ally-effect (Nikolaidou, 2008).

Overall, modelling the demand for military expenditure should be an interdisciplinary venture (Nikolaidou, 2008: 278). Besides direct economic factors, a country's defence burden decision is contingent on both strategic and political concerns and decisions. For example, Mountjoy (1983) expresses that even the "*prestige value of armed forces*" may contribute to relatively high – or even increases in – sustained defence spending (Mountjoy, 1983). Nikolaidou (2008) asserts that decisions about the level of military expenditure may be further motivated by strategic considerations regarding conceptions of national security, ethical interpretation and psychological factors – all of which may affect both political leaders as well as civilian and military institutions. In particular, Arlinghaus (1984) considers those factors that determine African demand for defence spending. He firmly asserts that the push factors associated with demand for arms are fundamentally political in nature (Arlinghaus, 1984:28). Arlinghaus (1984) continues to argue that arms transfers (a significant component of public defence expenditure) play two important roles in the political economy of post-colonial African countries: Firstly, they form a reactive response to external threat and domestic discord. Secondly, even where there is no threat of conflict:

> *" […] the military plays a special role in reinforcing popular perceptions of independence and sovereignty. As president Hamani Diori stated at the inauguration of the new army of Niger, "henceforth in the eyes of the world and of the whole of our people you are the visible sign of our political independence and our proclaimed will to defend it against all aggression."* (Arlinghaus, 1984:29)

It follows, therefore, that with respect to competing conceptions of National Security, a government's bureaucratic positioning significantly affects its defence spending decision

(Sheikh & Chaudry, 2013). Hess (1989) argues that, for most countries, perceived threat and strategic factors tend to have the highest impact.

Along these lines of thought, some researchers approach the issue by looking for general, universal economic laws that determine demand for defence spending. This approach often uses panel data as a means to categorise countries (and their respective demand for defence spending) into political, regional, or income-level groups. Nikolaidou (2008) assesses the demand for military expenditure in the EU-15 in this manner. Taking a more, political approach, Bove & Brauner (2016) look at the demand for military expenditure in authoritarian regimes. Galvin (2010) and Dunne & Perlo-Freeman (2003) take an income-level approach by focussing on developing countries. Regional studies include those done on Latin American countries (Kollias et al., 2018), the Baltic states (Odehnal et al., 2020), the Gulf countries (Yalta & Yalta, 2021), and South-East Asia (Wang, 2013).

While these works are instructive, their assumption that some fixed universal grouping exist seems to limit the predictive capacity of the outcomes. No direct consensus can be found as to which factors to include and which factors to abandon in the empirical work of these studies. Their greatest contribution lies in identifying possible contributors to demand for defence spending in a number of different contexts. These works lay out a foundational guide for those looking to expand the incorporeal suggestions provided by panel data through the provision of robust case studies.

Most economists argue that income level and per capita income have a significant effect on military expenditure (Dunne & Mohammed, 1995; Nikolaidou, 2008; Sheikh & Chaudry, 2013; Oladotun & Gumede, 2019). Neoclassical methods tend to consider national security as an optimisation problem subject to fiscal constraints. In these cases, GDP forms a particularly important economic determinant of military expenditure in the literature. Such neoclassical attitudes are demonstrated in the recent work conducted by Oladotun & Gumede (2019). Nikolaidou (2008), however, argues that the wealth or poverty of a country can be misleading as an indicator of military expenditure. Increases in income associated with German industrial growth observed through the 2010s, for example, did not stimulate the country to increase its defence budget to the target rate of 2% set by NATO – despite pressure from the US to do so. Theoretically, but not necessarily, a country may experience an increase in income by increasing public spending through higher tax income or borrowing capability. This increase in spending may be distributed across all sectors, indirectly increasing demand for military spending. Considering that Least Developed and Developing countries are often faced with, and even characterised by, resource and liquidity constraints it follows that the opportunity cost

of defence spending – proxied by non-military governmental expenditure - may have a crowding out effect on defence spending (Dunne & Mohammed, 1995; Nikolaidou, 2008; Sheikh & Chaudry, 2013). Contrary to their expectations, Sheikh and Chaudry (2013) find that, for both Pakistan and India, an increase in non-defence government expenditures tend to be positively related with increases in defence spending. Sheikh and Chaudry (2013) suggest that this result may be explained by a government's decision to increase spending being applied to all sectors – meaning that non-defence spending does not necessarily have a crowding out effect on defence spending. Alternatively, perceived external or domestic threats to security may prompt legislators to divert increased revenue toward defence spending. This pathway is most likely stimulated either by direct conflict or by the emergence of an arms race (Dunne, Nikolaidou & Roux, 2001).

Nonetheless, it would be false to assume that GDP alone makes up the economic determinants of defence spending. General consensus amongst economists is that both population size and growth also have some significant effect on military expenditure (Dunne and Mohammed, 1995; Nikolaidou, 2008; Sheikh and Chaudry, 2013; Ecer and Veasey, 2015; Oladotun & Gumede, 2019). It is the direction of the effect that remains contentious. Oladotun & Gumede (2019) find a significant negative relation between a unitary increase in population and amount spent on defence. Dunne et al (2008) also find that countries with larger populations prefer directing resources toward consumption over defence. However, Dunne & Perlo-Freeman (2003) offer a contradictory explanation whereby they take the Neoclassical 'public good theory' to assert that the return to scale of military spending may be comparatively higher for countries with larger populations. Zuk & Thompson (1982), Nikolaidou (2008), and Ecer & Veasey (2015) use population data to create a benefit index that acts as a control variable within the econometric analysis. Although Nikolaidou (2008) theorises that an increase in population is unlikely to be a significant contributing factor to an increase in defence spending because the latter is a non-rival good – the empirical results for the EU-15 demonstrate that this is only true in some cases. Population size may have heterogenous effects on a country's demand for defence spending. Nikolaidou (2008) finds that for some countries in the EU-15, there is a significant positive relationship between increases in population and increases in military expenditure. This may be explained by high income elasticity of demand for military spending in those countries where increases in population have led to a relative decrease in tax burden held by the average citizen. The effect is most likely significant but indeterminate as the component effects of an increase in population on military expenditure operate in different directions.

Oladotun & Gumede (2019) relate that Maizels and Nissanke (1986) identified major aid as a stimulant of military expenditure for developing countries. Aid recipient-countries may have increased defence spending capabilities – i.e., provision of official development assistance may provide necessary liquidity to countries for arms procurement (Arlinghaus, 1984). In addition, foreign countries may be able to leverage provision of aid by creating an expectation for export of arms from donor countries to recipient countries or that recipient countries will use official development assistance for military expenditure in response to a common perceived threat.

Nikolaidou (2008) finds that trade balance is significant for some countries, but the direction is heterogenous amongst EU countries. She uses trade balance to proxy the openness of the economy. Variation in the direction of the variable amongst different countries makes sense in this context. Countries with hardy, developed, indigenous defence sectors may benefit from the competition and export potential that a very open economy may provide, while infant industry protection may assist self-reliance for countries with developing defence sectors. Alternatively, one country's imposition of sanctions on trade of arms to another country may have a negative political effect, leading to decreasing trade between the two.

Although more recent studies show high levels of heterogeneity in the statistical significance of common variables amongst groups of countries, many studies have concluded that the level of democratisation tends to have a significant effect on the level of military expenditures (Oladotun & Gumede, 2019). Dunne et al. (2008) incorporate a democracy index released by POLITY 1998 in estimating determinants of military spending for developing countries covering 1981 to 1997. Their investigation suggests a significant and negative effect of democracy on military expenditure for developing countries (Dunne et al., 2008). In contrast, work done by Oladotun & Gumede (2019) who find a highly significant positive causal relationship between the level of democratisation on military expenditure in South Africa. Sheikh and Chaudry (2013) note that the "*literature on the demand for military expenditures suggests […] the non-democratic countries spend more on defense as compared to the democratic countries.*" This study posits two potential reasons: Firstly, non-democratic countries may resort to appealing to a perceived elevation in external threats to legitimise increased use of mechanisms of state control. This may facilitate an increase in the demand for military spending. Secondly, such regimes may impose domestic control through the use of force – which also induces higher demand for military spending. The case of Rwanda is interesting in this regard.

Common strategic or military variables included in empirical studies include the presence of external war and civil war (Dunne and Mohammed, 1995; Nikolaidou, 2008; Oladotun, 2019). When a country is at war, it must seek to optimise and maintain high military capability. This stimulates demand for military expenditure as long as the government is able to function and execute budgetary decisions.

Nikolaidou stresses the importance of considering perceived external threat (Nikolaidou, 2016). This supports both Dunne & Mohammed (1995) and Sheikh & Chaudry (2013) who relate how the military spending of enemies (or potential enemies) and even of allies, may impact on a state's defence burden decision. In the case of an arms-race, Dunne & Mohammed (1995) and Sheikh & Chaudry (2013) argue that increases in military spending of a perceived threat will induce higher demand for arms and military capability in the index country. Ethnic tensions between Rwanda and Burundi, as well as uncontrolled and violent political and social unrest in DRC and Uganda, may all contribute to the demand for military expenditure in Rwanda.

This line of thought also leads to what Sheikh & Chaudry (2013) and Oladotun & Gumede (2019) refer to as a *security web*. Oladotun & Gumede relate the definition postulated by Rosh (1988):

> "*The concept refers to nation's X security web as all other countries capable of influencing country X's security both at national and regional level […] ascertained by country X's threats levels can be ascertained by average military expenditure of Gross Domestic Product of countries in the security web*."

In addition to domestic and external conflict, Oladotun & Gumede (2019) identify regional and international peace keeping missions and ad-hoc joint task forces operations as relevant factors that affect the level of demand for military expenditure. This is of particular relevance to Rwanda which, in 2017, was the 6th largest contributor to multilateral peace operations in the world (SIPRI, 2017). Peacekeeping efforts are likely to be significantly and positively linked to defence expenditure for similar reasons to conflict considerations. Therefore, it should be noted that part of the magnitude of the effect captured by the conflict variable in the case of Rwanda is resultant from its involvement in peacekeeping.

2.2 The Defence-Growth Nexus

Sørensen & Whitta-Jacobsen (2010:25) argue that macroeconomic analysis tends to relate to a framework that acknowledges some natural growth path along points of equilibria that exist in the long run. These dynamic equilibria are motivated with respect to dialectically-related changes in output (conventionally measured in terms of GDP) and changes in the factors of production – total factor productivity, labour (L), and capital (K). The expression of changes in these mechanisms is exhibited through prices, wages, human welfare, and consumption/saving behaviour. This conception seems to be empirically supported by economic arguments for 'convergence theory', whereby, as a result of decreasing marginal returns, comparatively rich or developed economies tend to grow at a similar pace over time (Sørensen & Whitta-Jacobsen, 2010: 39). Even taking natural structural, or resource, constraints into account it appears that like-economies tend to grow at like-paces (Sørensen & Whitta-Jacobsen, 2010: 42). Superficially, this view of growth seems satisfactory. However, the logical consequence of adherence to *conditional convergence theory* permits Malthus' dismal view of the rich specializing in being rich and the poor specializing in being poor. In the wake of the 2008-9 global financial crisis, Blanchard & Johnson (2014:658) argue that "*with respect to small shocks and normal fluctuations, the adjustment process works; but […] in response to large exceptional shocks, normal adjustment processes may fail, […] the priority is for […] policymakers to use, as best they can, the monetary and fiscal policy tools they have*". This conclusion supports the work of Abedian & Biggs (1998) who suggest that "*facilitated by technological advancements and reinforced by the rising universal quest for social and individual welfare improvement, globalization has, among other things, heightened need for globally competitive governance. […] There is an underlying but forceful quest for social justice permeating the reform processes of governance*" (Abedian & Biggs, 1998:509-512). Considering that Rwanda has historically been a poor country, its ability to increase its real GDP forms a critical component of its capacity to develop. Therefore, government spending *should* be primarily channeled towards those sectors that improve Rwandan growth prospects; and channeled *away* from growth retarding types of spending. It is vital, when considering how much to spend on the country's defence burden, that policy makers are able to make data driven decisions regarding the likelihood of expanding or restricting growth.

2.2.1 Introduction and Early Work

Interest in Political Economy and its relation to public defence spending should not be thought of as a novel science. In particular, theorists of what was to become the *human sciences* were concerned about the effects a defence-spending-political-economy connexion might have on inter-state conflict. The 19th century and first half of the 20th century[1] were marked by imperialism, colonial expansion, and increasingly unstable socio-political competition. If there was no direct cause (though many thought it likely that there was), then certainly it was widely accepted that defence spending must facilitate violent conflict.

Classical, and early neo-classical, economists expected defence spending to have the same (if not exacerbated) negative effects on growth as any other type of public spending. In part, the defence-growth nexus – for clearly there was *some* type of relationship – could be explained in simple economic terms: A change in militarism or imperialism seemed likely to stem from changes in population growth, surplus productivity, or diminishing returns in domestic markets. For classical economists, such forces were damaging enough without the inevitable reactionary state-policy that often followed to address these economic changes**.** Classical economists pointed out that increases in defence spending meant increasing public revenue through taxation, crowding out domestic investment, and distorting industrial markets by creating artificial demand for manufacture of military-related products. Before the First World War, the prevailing wisdom of political economists suggested that defence spending was a burden which, if overindulged would lead to costly conflict with disastrous economic consequences (Rötte in Brauer & Gissy, 1997:7). Following the end of the First World War, the validity of the classical argument was challenged. Nevertheless, there remains no academic consensus regarding the existence (or direction) of a systemic relationship between public defence expenditure and growth. Lack of reproducibility and replication has been one central factor associated with this controversy. Other diverging results are thought to be related to differences in approach (Blasko et al., 2007; Dunne, Smith & Willenbockel, 2005). Alternatively, it is possible that the use of different sample time periods or omitted variable bias may play a role in the lack of clear outcomes over different studies (Lai et al., 2005; Chowdhury, 1991:95; Kusi, 1994).

Few references to Benoit's 1973 work *Defence and Economic Growth in Developing Countries* can be found in the Defence-Growth nexus literature that do not also acknowledge

[1] Culminating in the advent of *two* World Wars.

this work as 'seminal' to the field[2] (Uk & Kwang-Hae,1998:29; Dunne, Nikolaidou & Roux, 2000:574; Dunne & Nikolaidou, 2001:55; Dunne & Nikolaidou, 2012:537; Umar & Bakar, 2015:21; Karadam, Öcal & Yildirim, 2021:1; Abura, 2021:2; Okwoche, 2022:216). In fact, Benoit (1972) was not the first economist to consider the role that a state's defence budget might play in the health of, or prospects for, that state's economy. Nevertheless, in the context of the greater literature Benoit's work remains critically important as a turning point in the way in which the field of economics approached the relationship between defence spending and the economy. The following section chronologically traces techniques and approaches to detecting the existence and qualifying the nature of the defence-growth nexus using the existing body of literature from the post-WWII period to the present day.

Almost twenty years before Benoit's 1973 publication, Hildebrand tackled the topic through a paper entitled *Defense Expenditures and the Problem of Deflation* (Hildebrand, 1954). Hildebrand (1954:411) argues that public expenditure on defence, foreign aid, and atomic energy were significant stimulators of American economic growth between 1951 and 1953. However, this analysis is largely regarded (including by Hildebrand himself) as an oversimplification. Hildebrand treats public defence spending as a type of normal good purchased solely by the government. Therefore, Hildebrand's consideration of defence spending is restricted to two levels of analysis: Firstly, whether public spending stimulates economic growth[3]. Secondly, whether defence spending offers relatively constant – or increasing – returns compared to other types of public spending[4]. This approach is severely limited in the information or policy guidance it reveals. There is no theoretical framework for the effects of defence spending according to this argument, and this argument has poor explanatory power. Furthermore, the approach ignores the potential for the existence of a military industrial complex (MIC) in which private-sector agents may hold a stake.

Hildebrand's early attempts are not the only of its kind. Dawson (1955) conceives of American defence spending in terms of the effect that such spending has on a state's balance of payments. His analysis operates through a rough, simple calculation of returns based on consideration of raw commodity-exchange dynamics, services, and provision of unilateral aid purchased as part of the national security budget (Dawson, 1955). Dawson's approach recognises that the U.S. was successfully able to use its national security budget to leverage a

[2] These are but a selection of sources that use this particular phrasing to describe the paper.
[3] This is a reframing of the Monetarist versus Fiscalist debate.
[4] Perhaps infrastructure, health or education spending, as well as private technological progress (Hildebrand, 1954:416).

clear trade advantage and political advantage – particularly in Western Europe – between 1937 and 1954; however, he concludes that this notion of a positive relationship between defence spending and growth is a result of framing bias and omission of high indirect costs (Dawson, 1955). Schelling (1960:3) asserts that, in times of conflict, American defence spending has a significant negative impact on taxation and debt management, price and wage controls, labour allocations, resource scarcity, trade, and more. He (Schelling, 1960) declines to apply economic tools to measure the overall relation he describes as "the impact of defence on the economy". Instead, he accepts defence spending as a necessary public expense and seeks to optimise ways of spending the money allocated to maximise defence capabilities (Schelling, 1960:4-5).

Throughout the 1960s, Clayton advanced an understanding of the economic effects of defence spending by tracing U.S. national defence spending through recipient American states, including California and Utah (Clayton, 1962; Clayton, 1967). By tracking money how flows from national, through state-level governments, and then on to private defence contractors, Clayton's work shows the economic effects (in terms of financial outlay) that defence spending has on domestic industry and manufacturing sectors (Clayton, 1962:286-289; Clayton, 1967:458-461). Therefore, the economic effects of defence spending, according to Clayton's argument, draw primarily from the impact such spending has on employment, industrial expansion, and population growth (Clayton, 1962:293). The early forms of defence-growth empirical work were largely studies in growth accounting. Without using tools sensitive enough to isolate different component effects, the empirical results tend to vary widely. For the most part, sensitive tools did not yet exist. Ghandi (1974) uses such a method to measure the effects of India's post-independence defence spending on the country's relative growth compared to geographically neighbouring economies[5]. The results of measuring Indian defence spending in comparison to the returns in growth are clearly negative – leading Ghandi (1974) to conclude that defence spending embodies a "defence burden" for Indian growth (Ghandi, 1974:1494). The study of India is interesting for a couple of reasons. Firstly, the case of India is later used by some of the most prominent economists in the literature. Both Benoit (1972, 1973a) and Deger & Smith (1985) use Indian data in their econometric specifications. Secondly, the case of India represents an example of the effects of defence spending during an arms race.

Overall, limitations associated with all these early approaches are relatively clear. Firstly, empirical methods employed were often not sensitive to different types of government

[5] Including Mainland China and Pakistan.

spending. Secondly, the estimation techniques utilised were only able to inform researchers about potential correlation but not causation. Finally, these early studies only focussed on the effects defence spending was likely to have on aggregate demand through the existence of a country's Military Industrial Complex (MIC). This narrow focus ignored potential returns to growth associated with increases in employment, productivity, or social cohesion. In fact, it is not until the end of the 1950s and 1960s that economists began to attempt to model a possible defence-growth relationship.

Econometric methods were used for the first time by, Daicoff & Macy (1968) to model a possible relationship between defence spending and regional (sub-state) growth by looking for the existence of differences in the size of regional multipliers that could be attributed to an association with defence spending. However, their work remained focussed on the single economic avenue of wage rates. Daicoff & Macy (1968:98-9) draw their conclusions based on regression of changes in county-level defence spending on change in total personal income. While the size of the effect tended to differ between counties, this investigation found a positive effect of defence spending on regional growth (Daicoff & Macy, 1968:100).

The first, and most influential, macro-statistical empirical models appeared through the published work of Emile Benoit. It is the persuasiveness of one of the first fully specified models, as much as his unexpectedly novel results, that galvanised economists. In 1972, Benoit used defence spending data from India to show that there may be some empirical evidence for the notion that defence spending may stimulate growth in certain circumstances (Benoit, 1972). This was surprising for two reasons. Firstly, defence spending had traditionally been thought of as a necessary burden on the economy. Secondly, if defence spending was to stimulate growth, then it was thought more likely to do so in developed rather than developing countries. While the book predominantly focusses on finding theoretical explanations for the empirical results found in his 1972 paper[6], Benoit includes a further five case studies to emphasise potential heterogeneity that might exist between developing countries with different economic constraints (Benoit, 1973a).

Benoit categorises types of economies and their likely defence-growth relationship based on structural correlation differences between the institutional structures within those states (Benoit, 1973a:221). He observes that South Korea maintains both high defence spending as a percentage of government budget, but that it also enjoys a high growth rate

[6] Expanding his work on the Indian case between 1950-1965 and 1960-1965 to include 34 other countries in his original samples.

(Benoit, 1973a:221). In particular, due to the 1960s policies dedicated to boosting steel and other industrial sectors, Benoit argues that defence spending is strategically used toward development in South Korea (Benoit, 1973a:242). However, he also postulates that South Korea's military spending encouraged FDI and bilateral aid from the Unites States and Europe in support of their mutual foreign policy objectives against the threat of spreading communism in South East Asia (Benoit, 1973a: 249-251). This recalls Dawson's (1955) assertions regarding the effects that defence spending has on stimulating soft power – in the form of inter-state diplomatic relations.

Mexico, on the other hand, grew quickly economically over the sampled time period, but spent proportionately little on defence compared to the other countries examined (Benoit, 1973a:221). From this, Benoit suggests that its low defence burden benefits growth (Benoit, 1973a:222). Argentina throughout the 1950s and 1960s showed medium defence spending but noticeably low growth rates (Benoit, 1973a:221). Benoit considers this spending more a function of the country's internal political struggles than an economic mode of development (Benoit, 1973a:261-263). Yet, he insists that defence spending is unlikely to be the source of the retardation of growth over the examined period (Benoit, 1973a:263).

When it comes to the U.A.R., Benoit (1973a:258) clearly suggests that defence spending signals the government's commitment to militarism as political doctrine rather than as a pathway towards growth stimulation.

Despite having used quantitative modelling to show positive cross-country correlations between defence spending and economic growth in less developed countries (LDCs), he was wary of overstating the power of causation (Benoit, 1972; Benoit, 1973a). Benoit rejects any notion that defence spending should be used as a type of public spending that stimulates growth:

> *"[…] we need have no economic concerns in cutting the defense budget whenever we get a chance to do so. It remains as absurd today as it has always been to continue to spend a cent more on defense than we actually need for security reasons"*
>
> (Benoit, 1973b:79)

It is clear, even from the very first instance of defence-growth modelling, that interpretation of divided academic conclusions regarding the effect of defence spending should reject the notion that finding a positive relationship identifies defence expenditure as a legitimate public tool to increase economic activity.

In 1978, Benoit (1978) published a paper reiterating the results drawn from his 1973 book. In this work, Benoit uses a panel study of 44 LDCs (excluding Mainland China) over five-year and fifteen-year periods. Using Spearman rank order analysis and multiple linear regression, Benoit finds that LDCs with relatively high defence budgets also tend to be those with relatively high levels of economic growth (Benoit, 1978: 271).

Benoit (1978:276-279) suggests that LDCs may stimulate growth by increasing their defence spending as a result of five possible positive spinoff effects. Firstly, he (Benoit, 1978:276) suggests that the *real* opportunity cost associated with public spending on defence tends to be public consumption rather than spending on projects (or in sectors) that might yield higher marginal returns[7]. If this is the case, then there seems to be neither crowding out of private investment nor any reason for there to be a necessary trade-off between defence spending and more productive sectors. Secondly, Benoit suggests that defence spending might stimulate increases in economic output by "feeding, clothing, and housing numbers of people who would otherwise have to be fed, housed, and clothed by the civilian economy" (1978:277). Thirdly, Benoit postulates that when defence spending is used to maintain armed forces then such spending also assists in the provision of skills development, education, and medical care (Benoit, 1978:277). Fourthly, Benoit proposes that defence spending on professional armed forces may allow a military to expand its services beyond conventional national security (i.e., the threat or exertion of force). For example, armed forces may employ an engineering corps or provide personnel to assist with public works including public infrastructure; they may operate and maintain services such as lighthouses, border control, weather services, or disaster relief management (Benoit, 1978:277). Finally, Benoit (1978:277) acknowledges that a strong military might assist in 'nation building'. This final effect may indirectly stimulate increases in labour productivity and decrease transaction costs between citizens. The limited quality of data and the relatively few observations used in the regression calls into question the robustness of Benoit's empirical results.

[7] Such as infrastructure, education, or healthcare

2.2.2 Modern Theory

From the preliminary studies in the 1970s and 1980s, the literature expanded into relatively clear, divergent approaches to investigating the defence-growth relationship. These approaches differed with respect to theoretical attitude, models and types of data used, and estimation techniques employed. In effect, most of the literature can be considered within the Marxist, Keynesian, or Neoclassical framework (Dunne, 2015:445).

For Marxist scholars of peace and defence, the history of states is the history of class conflict. As such, within a Marxist structure, militarism and defence spending is essentially dynamic and historically determined (Elveren, 2019). States make defence spending decisions as part of socio-politically motivated strategic economic actions toward reinforcing capitalist systems and perpetuating the existing socio-economic hierarchy (Dunne & Nikolaidou, 2012:541).

Dunne (1990) suggests that for Marxists, the defence spending-growth nexus might be explained by the way in which such spending facilitates capitalist growth (by stimulating industrial expansion), the exertion of power in the international system, and by mitigating the size and length of economic crises.

Baran & Sweezy (1966) suggest that public defence spending may mitigate or avoid capitalist stagnation – referred to as underconsumption – by providing sustained industrial and R&D demand in the private sector. Dunne & Nikolaidou (2012) and Elveren (2019) explain how these models theoretically argue that the state-oriented markets created by an indigenous defence industry allow for capitalists to derive higher profit rates with lower levels of competition.

Such spending would, according to Baran & Sweezy (1966), ensure the growth potential of a state's economy beyond that necessary for household consumption or natural levels of investment. Marxist thinkers postulate that a capitalist economy always tends towards disequilibrium in the medium-to-long run, in part because of the tendency of profits to fall. However, defence spending may prolong sustained profit rates directly through increases in capital productivity, absorption of oversupply, or organisational structure of labour-capital relations; alternatively, it may indirectly facilitate expansion into overseas markets, for example through colonisation and imperialism (Smith, 1977, 1983 in Elveren, 2019). Military operations in non-conflict national security sectors may also increase levels of state control at lower prices than would be offered by the private sector.

Even so, Elveren (2019) is quick to point out that Marxist approaches do not implicitly predict unlimited, positive growth returns to defence expenditure. Increases in M.I.C. output,

for example, experiences decreasing employment opportunities as the labour market in the defence sector saturates (Baran & Sweezy, 1966:215). Increasing capital intensity in the M.I.C. may well, therefore, lead to the inevitable decreases in profit rates predicted by Marxist economists. This hinders economic growth potential over time.

There are significant criticisms associated with the Marxist approach to the defence spending-growth nexus. Baran & Sweezy (1966) fail to consider the competitive nature of domestic MICs in the developed world (such as the U.S.) (Elveren, 2019). Likewise, the model strongly implies a form of economic determinism dependent on a passive working class. This seems both historically inaccurate and fundamentally anti-Marxist (Elveren, 2019). Lastly, Baran & Sweezy (1966) ignore the means by which governments finance defence spending, leading to a gap in explanatory power for how sustained defence spending might affect the economy through indirect means.

Overall, there is clearly some value in using Marxist material-historicism to supplement understanding of patterns in defence spending and growth. However, there is a lack of validity and too much inconsistency in the empirical models and pure-theoretical explanations to rely on this approach. An alternative conceptualisation proposed in the literature suggests adoption of a Keynesian model of growth adapted to account for defence expenditures. The Keynesian school of thought incorporates demand-side growth modelling as a means of determining the possible effects of defence spending. Demand-side models aim to increase output through multiplier effects when aggregate demand is ineffective (Dunne & Nikolaidou, 2012:540-541). Dunne & Tian (2013 in Elveren, 2019:27) uses this reasoning to suggest that a Keynesian position might incorporate a "*policy of using milex [military expenditure] as a counter-cyclical economic tool*". Dunne et al., (2005:450) suggest that the level and composition of expenditures determined through the Keynesian multiplier effects has an effect on demand – and, therefore, on growth. As such, exogenous increases in defence spending tend to increase demand (Dunne et al., 2005:450). This process has growth stimulating effects when growth rates are below their steady-state levels as a result of underemployment of existing resources (Dunne et al., 2005:450). Smith's (1980 in Elveren, 2019) demand-side model proved too simplex to fully capture the defence-growth nexus. Likewise, the original model was criticised for presupposing a negative effect. Critics suggested that Smith (1980 in Elveren, 2019) was merely affirming the consequent. Therefore, Smith & Deger turned to using simultaneous equations estimation techniques to consider both demand and supply-type effects. Deger & Smith (1984) use this type of model to consider both the direct and indirect effects of defence spending on the civilian sector. When empirically tested, Keynesian models tend to find negative effects of defence

spending on growth (Deger & Smith, 1983; Deger & Sen, 1984; Deger, 1985; Deger, 1986). Overall, in the long run, Keynesian models predict that defence spending effects are implicitly associated with the performance of the M.I.C. (Elveren, 2019:27).

The most influential empirical studies throughout the 1980s suggesting that, rather than a positive or insignificant relation, defence spending retards growth in LDCs was the work of Deger (1983; 1984; 1985; 1986). However, Deger & Sen (1983) identify three possible channels by which defence spending could theoretically, positively affect growth. Firstly, Deger & Sen (1983) argue that defence expenditures might be a tool to employ "underutilised capacity and under-employment of capital" (1983:68). Essentially, this component effect would move a country toward its productivity possibility frontier by increasing aggregate demand (stimulated by government spending within the MIC). It should be noted that significant effects of this nature should primarily appear in countries with indigenous defence industries; Deger & Sen (1983:68) refer to potential increases in industrial output. Secondly, Deger & Sen (1983:68) suggest that defence spending may create some positive spinoff effect in terms of factor productivity. This may arise through money channelled toward research and development programmes that improve capital productivity[8]. Alternatively, defence spending used to increase the number of defence personnel or the quality of defence personnel can have positive spinoff effects with respect to skills development[9]. Lastly, Deger & Sen (1983:68) postulate that defence spending used to expand military enrolment may act as an external shock stimulating a shift away from traditional modes of life toward "a more industrialised environment"[10].

The Neoclassical school considers supply-side factors of growth. It recognises traits in defence and security as non-rival and non-excludable goods provided by the state (Rosen, 2005:55-56). This may suggest that public defence spending constitutes a 'pure public good' (Stiglitz, 1986:311) and implies that national security can be supplied by the state through government allocation of defence spending (Jung in Cawthra, 2001:8; Dunne & Nikolaidou, 2012:540). As such, Stiglitz (1986:313-323) argues that the effects of defence spending should be considered by optimising marginal cost-effectiveness based on a government's level of risk

[8] In the form of technological invention, industrial capacity of substitutable civilian/military products, or export potential (for countries with defence manufacturing capabilities).
[9] Managerial, vocational, or simply an effective tool for increasing social coherence and personal discipline.
[10] Though the focus of Deger & Sen's (1983) empirical work is largely comprised of Neo Classical (supply-side) and Keynesian (as it considers the empirical evidence regarding the potential effects of defence spending on stimulating aggregate demand) approaches, it should be noted that this last theoretical argument provides grounds for a Marxist approach to the field. The argument is Marxist in its assertion of the use of defence expenditures as a tool to change social attitudes and relations toward a capitalist mode of production.

preference. Such an approach requires the ability to account for two factors often defying measurement: Firstly, it requires a well-defined conception of national interest or national security. Secondly, it requires empirical calculations of opportunity costs and security benefits of military expenditure (Dunne & Nikolaidou, 2012:540). Ultimately, the significance and direction of the effect of empiric Neoclassical models for defence spending on growth, is derived from the effects such spending has on the aggregate production function (Dunne & Nikolaidou, 2012:540).

2.2.3 Empirical Studies

The most effective method of identifying the appropriate manner to consider the role of defence spending lies in rigorous empirical testing, with the aim of obtaining consistently robust results over time and between states. The predictions based on a wide set of economic theory could then be translated into stylised facts for generalised use.

Looney (1983) extend Benoit's work, using the same data and basic models, by introducing a country's financial constraint to determining the defence-growth nexus. This argument proposes that the lack of a consistent, systematic relationship between defence spending and economic growth results from previous studies' neglect of the real financial constraints experienced by governments when making defence spending decisions. Frederiksen & Looney (1983:636, 642) interpret their positive, significant findings as evidence that: there are both positive and negative spinoff effects associated with defence spending[11], and that defence spending only tends to crowd out public development spending in LDCs – but not in countries with developed economies. Therefore, Frederiksen & Looney's (1983) work seems to imply that the effect of public defence spending on an economy is dependent on the existence of a domestic MIC. This would imply a modified neoclassical model in which developmental industrialisation is maximised in the private sector. Frederiksen and Looney's (1983) work gives rise to a subset of the literature categorised as the Liberal approach.

Empirically, Deger & Sen (1983:77-79) conducted OLS regressions to explore the sectoral relationship between defence spending and industrial output in India over two decades[12]. It is important to note that these models considered both current and lagged defence

[11] It should be noted that this paper is of particular importance as it is also the first mention that possible spinoff effects associated with defence spending may operate in different directions at different times. This possibility is accounted for in later estimation techniques which consider both the long run and short run effects of defence spending – including the ARDL model used in this study.
[12] To be specific, the study accounted for the years 1951-1971.

spending. In fact, Deger & Sen (1983:78) find that the only statistically significant variables[13] are a positive relation between *lagged defence spending* and increases in *metal product* output. However, overall results show no significant evidence of the existence of a statistically significant relationship between defence spending and industrial output. In an appendix, Deger & Sen (1983:81,82) suggest the further use of a simultaneous equations model to econometrically investigate theoretical interrelations between investment, growth, and military spending on a macro level. Deger (1986) adds to this body of work. It is Deger's 1986 paper that (i) confirms the primary direction of correlation and (ii) provides both empirical and theoretical evidence for the opposing component spinoff effects of defence spending (Deger, 1986). She (Deger, 1986) uses a simultaneous-equation system using savings-income ratio, military spending, and economic growth as the considered dependent variables. To empirically test her theory, Deger (1986:194) uses a cross section of 50 LDCs, with values calculated as the average over the period 1965-1973. Ultimately, this work concludes that LDCs are more likely to experience a net negative growth effect associated with increases in defence spending because of the effect such spending is likely to have on a country's savings rate (1986:194). In effect, Deger's work may be regarded as a sound theoretical and empiric rejection of the conception of the relationship between defence spending and growth as universally, systemically constant. Rather, the direction of effect is determined by opposing component forces. Deger (1983;1986) argues that countries[14] are more likely to face a trade-off between increases in defence budgets and economic growth. Nevertheless, the potential heterogeneity between economies and the effects of defence spending led economists to postulate alternative groupings of countries[15] and demonstrate the value in using time-series data for the study of single economies[16]. Deger's approach to the defence-growth nexus accepts a Keynesian, demand-side, approach to measuring potential interrelations between savings rate and defence spending.

Klein (2004) uses a Deger-type model to account for both supply-side and demand-side effects of defence spending in Peru between 1970 and 1996. Klein considers the relationship between growth rate, level GDP, savings rate, inflation, military spending, and the current account (Klein, 2004:282). However, he also considers the possibility of an arms race with

[13] Of those considered in the sectoral models: Independent variables - *military spending, lagged military spending,* and dependent variables - production of *non-ferrous metals, metal products, machinery (non-electrical), electrical machinery, shipbuilding and repairing, and motor vehicles.*

[14] Particularly economies marked by severe resource (or liquidity) constraints such as LDCs.

[15] Widening groupings from simple income-level comparisons to consideration of region, regime, etc.

[16] Though it should be noted that this was not so much Deger's own conclusion so much as a takeaway from her work.

neighbouring Ecuador and Chile, as well as considering dummy variables accounting for "years of great macroeconomic disorder" and "annual number of terrorist acts" (Klein, 2004:277). Overall, Klein (2004) finds no statistical evidence of a supply-side relationship between defence spending and growth but does find a negative net effect of defence expenditure on Peruvian growth (Klein, 2004:286-287). However, it should be noted that this study relied on a relatively small sample size of a mere 26 observations. However, it is also one of very few Keynesian-style studies in the literature. Dunne, Nikolaidou, & Roux (2000) use a Keynesian simultaneous equation model to investigate the existence of a supply and demand model for South Africa between 1961 and 1997. Their results show few statistically significant results, from which they infer that the country could reduce defence budgets without causing macroeconomic harm (Dunne, Nikolaidou & Roux, 2000:581, 583). Finally, Narayan & Singh (2007) find unexpectedly positive significant results for the effects of defence spending on growth across the Fiji Islands between 1970 and 2002. The bulk of the literature employs a number of Neoclassical growth models in search of a defence-spending growth relationship.

One particularly popular growth model considered by defence economists throughout the final decades of the 20th century was the Feder-Ram model (Dunne & Nikolaidou, 2012:540; Elveren, 2019:13-15). In this model, growth is determined by capturing the effects of imports and exports. Defence spending is considered an exogenous variable and uses timeseries or pooled cross-sectional data to estimate its real effects on total output (Elveren, 2019:14).

Biswas & Ram (1986) apply this model to a sample of 58 LDCs for the periods 1960-1970 and 1970-1977 and find a negative relationship between defence spending and growth. However, in a follow up study applying a sample of 74 countries between 1981-1989, Biswas (1992) infers a positive relationship from the results of the model. Heo Uk (1998) uses a non-linear, three sector defence-growth model with technological progress, applied to 80 countries worldwide. While the results show widespread heterogeneity based on country specific factors, Uk (1998:652) finds that a negative relationship exists for two thirds of the countries investigated. However, just under a third of countries included in the study may find increases in defence spending has a positive effect on their short-term growth rate (Uk, 1998:652). The remaining 7% of the original 80 countries considered show no statistically significant evidence of defence expenditures having any influence on growth (Uk, 1998:652). The early promise shown by this model was soon noted to be unfounded (Dunne et al., 2005). If the Feder-Ram-type model was to accurately capture the effect of defence spending on growth, then it would theoretically do so by shifting resources away from inefficient sectors toward more efficient

sectors (Dunne et al., 2005:455). However, the model does not account for intra-sectoral inefficiencies (Dunne et al., 2005:455). This is the primary reason for economists to reject such studies since the emergence of Dunne et al.'s (2005) comprehensive rebuttal.

Another early Neoclassical approach seeks to explain the defence-growth nexus by employing an endogenous growth model. The most prevalent in defence literature is a Barro-style model for growth. Essentially, the model accounts for either a positive or negative relationship by treating defence spending as a form of tax-funded public spending (Pieroni, 2009 in Elveren, 2019). In other words, the assumption for Barro-type approaches theorise that the relationship between growth and defence spending is non-linear (Dunne et al., 2005:458). As such, changes in defence spending can have spinoff effects on macroeconomic variables that determine growth, but also directly impact levels of social welfare (Pieroni, 2009 in Elveren, 2019). This suggests a non-linear relationship between defence and growth, as an economy experiences the trade-offs between productivity boosts associated with increasing social welfare and an increasing tax burden (Pieroni, 2009 in Elveren, 2019). Citing omitted variable biases as a reason for previous contention, Mylondis (2008) uses the Barro-type growth model to investigate the defence-growth nexus in the European Union between 1960 and 2000. He recognises that developing countries often claim to use defence spending to boost social infrastructure and human capital enhancing activities (Mylondis, 2008:267). However, he (Mylondis, 2008:267) also suggests that sustained high levels of defence spending may crowd out both public and private investment, exacerbate trade deficits or adverse balance of payments, or even draw high-skilled labour out of the private sector labour market. Therefore, he predicts a non-linear relationship between defence spending and growth consistent with this study's expectation this overspending on defence causes decreases in output growth (Mylondis, 2008:268). The results for the European Union show a consistent negative effect of defence spending on growth, however it also indicates that the magnitude of the negative relation grows over time (Mylondis, 2008:271).

Employing a Barro-type model for China between 1952-2010, Dimitraki & Menla Ali (2015:323) find empirical results that show no causal effect of defence spending on growth; a result contrary to most empirical studies of its type in the literature. Rather, their study implies an inverse direction of effect, i.e., that an economy's growth rate is a key determinant of defence spending (Dimitraki & Menla Ali, 2015:321). If correct, this would imply that growth positively affects defence spending. This contrasts with the Dunne, Nikolaidou, & Vougas (2001:22-23) Granger causality of findings that show defence spending negatively affects growth in Turkey and also shows a short-lived positive effect on growth in Greece. They do

not find any evidence that growth in either Greece or Turkey affects defence spending for those two countries (Dunne, Nikolaidou, & Vougas (2001:23). It may be that the case of China differs from other economies or that defence spending over the specified time period had separate effects from those used in other investigations (Chen, 1993; Masih et al., 1997). It may also be that the discrepancy arises from their choice of included variables (Blasko et al., 2007; Dunne & Nikolaidou, 2012:540-542). In addition to percentage of MILEX and log-level GDP, Dimitraki & Menla Ali (2015) consider log governmental investment, logged non-defence government spending, and population growth in their model. It is possible that a failure to consider socio-political, or private economic factors explains the disparity in their empirical results.

Wang & Wang (2016) consider an often-overlooked aspect of the defence-growth nexus during an arms race: they account for the spinoff implications of trade between the involved economies (Wang & Wang, 2016:738). As such, Wang & Wang (2016) formulate defence spending within an optimisation problem through employment of a competitive, endogenous, stochastic, economic growth framework. The empirical robustness of such measures still remains untested.

From this body of work, there is a clear need for complex models that can account for a number of socio-political variables within an overall economic framework. This model appears in the form of the augmented Solow model presented by Mankiw et al. (1992). The augmented Solow-model with Harrod-neutral technical progress employs the widely-recognised Cobb-Douglas production function but also includes defence spending (often in logarithmic form) as an explanatory variable (Elveren, 2019). As Dunne et al. (2005:456) neatly explain, the effect defence spending has on growth rests on "*the key assumption […] that the military spending share m: = M/Y affects factor productivity via a level effect on the efficiency parameter that controls labour-augmenting technical change*". The most significant drawback to these models is that they lack rigorous and robust theoretical reasoning for why they may work so well. In fact, Dunne et al., (2005) suggest that the model[17] tends to be rather "ad hoc" (Dunne et al., 2005:458). Despite these setbacks, the model has proven popular in modern defence-growth studies. This may be because these models are relatively easy to interpret and often seem to lead to robust results.

Dunne & Nikolaidou (2012:542) apply panel data from the EU-15 to estimate an augmented Solow-Swan model with Harrod-neutral technical progress. Their reported results

[17] Including its error terms or the interactions between changes in defence spending and the savings rate

imply that there is heterogeneity in the effects of defence spending in EU-15 countries on the growth rates associated with those economies (Dunne & Nikolaidou, 2012:546). However, countries with a statistically significant defence-growth relationship tend to find their growth potential hindered by increases in defence spending (Dunne & Nikolaidou:546).

Uk & Ye (2016:783) use an augmented Solow Defence-Growth model to look for a relationship between investment, employment, growth, and defence spending in 161 countries over a 22-year period (1990-2012). Their findings show a negative relationship between private investment and defence spending (Uk & Ye, 2016:786). However, employment rates seem positively related to defence expenditure in most countries (Uk & Ye, 2016:786). It must be noted that the magnitude of the employment effects is reportedly small on average (Uk & Ye, 2016:788). Importantly, overall, Uk & Ye's (2016:788-9) results show that defence spending has a significantly negative short-run effect on growth that is offset by positive effects accumulated over lagged defence spending within two years. Again, the net magnitude of the effects on growth associated with defence expenditure appears to be small. Perhaps this implies that, for some countries at least, there is no necessary gun-butter trade-off with respect to development. There seems a clear need for further country-specific research.

Using a neoclassical framework, Saba & Ngepah (2022**)** employ a homogeneous panel vector autoregression (PVAR) model in a generalized method of moments (GMM) estimation framework to investigate the interrelations between defence spending, growth, and development. Using the Human Development Index (HDI) as a proxy for aggregate living standard (country development) and real GDP (the standard measure for growth in the literature), Saba & Ngepah (2022:145-146) find empirical evidence of a tri-variate relationship whereby defence spending hinders both growth and development. Their results represent the statistical evidence for a panel of 72 countries over a twenty-eight-year period, 1990-2018. While a promising preliminary investigation, there seem to be drawbacks associated with elements of the study. Homogenous PVAR estimation is useful in that it accounts for some heterogeneity within the panel of included countries; however, it only presents the average policy effects, potentially masking country specific effects (Georgiadis, 2012 in Kabashi, 2017:45-46).

Using a range of specification and estimation techniques, Desli et al. (2017:523) find that out of a sample of 138 countries, only developing countries experience a growth-defence spending relationship that is statistically significant – and even then, these effects are only experienced in the long run. Desli et al. (2017) find no evidence of a short run or long run relationship for developed economies. It seems that long-run effects in developing countries

may stem from increases in long-run growth leading to public fund surpluses which allow for more efficient spending on National Security (Desli et al., 2017:523). Even these results seem inconclusive. In a follow up study, Desli & Gkoulgkoutsika (2021) seek to establish a model that includes worldwide effects of defence spending on growth between 1960 and 2017. Overall, there seems to be a systemically negative effect of defence spending on growth (Desli & Gkoulgkoutsika, 2021: 802-803). However, they (Desli & Gkoulgkoutsika, 2021: 802-803) interpret their results as suggestive that such effects are spatio-temporally linked to the cold war era. Puzzlingly, their results show no empirical evidence of a relationship between defence expenditures and growth for the mid-to-late post-cold war period (Desli & Gkoulgkoutsika, 2021: 802-803). In fact, country specific investigation continues to show a level of marked heterogeneity between different countries (Desli & Gkoulgkoutsika, 2021:788-9, 792). For example, Desli & Gkoulgkoutsika (2021:792) find that Australia and Senegal both experience a consistently positive, significant effect of defence spending on economic growth. France and India, however, display a significantly negative relationship over the entire period 1960-2017 (Desli & Gkoulgkoutsika, 2021:792). All other countries considered seem to have no significant relationship over time, or to have a spatio-temporally linked relationship – often a negative one (Desli & Gkoulgkoutsika, 2021:794). These recent results should show, if nothing else, the value in pursuing country-specific time-series analyses that can account for socio-political factors as well as macroeconomic variables in both the long run and the short run. This requirement can be met by using autoregressive distributed lag (ARDL) estimation (Naryan & Singh, 2007; Umar & Bakar, 2015; Desli et al., 2017; Abura, 2021; Maher & Zhao, 2021; Emmanouilidis & Karpetis, 2021).

Umar & Bakar (2015) apply the ARDL technique to a defence-growth model for Nigeria between 1980 and 2013. Their results show a positive relationship between Nigerian defence spending and the country's economic growth in the long run – interpreted as confirmation that defence expenditure in the presence of threats can stimulate growth (Umar & Bakar, 2015:28). Such results should not be considered representative of all cases. Using the ARDL technique to seek out the growth effects of Egyptian defence spending between 1982 and 2018, Maher & Zhao (2021) find that while empirical effects of political instability does negatively affect growth rates in Egypt, there is no statistically significant effect on economic growth in either the long run or the short run. Therefore, it can somewhat surprisingly be implied that Egyptian defence spending has little bearing on the provision on economic growth.

While the literature surrounding the possibility and the direction of a relationship between economic growth and public defence spending is extensive with widespread focus, it remains inconclusive. Overall, the existing literature demonstrates the heterogeneity experienced by countries globally. Political economists must focus on country specific factors with large samples to build accurate models capable of dealing with the complexities surrounding their own spatio-temporally linked, complex factors. For most countries, defence spending may be considered a burden, on average, to countries looking to stimulate growth. However, there is sufficient evidence to accept that countries – particularly those facing national security threats – may be able to shift their economies on to a more rapid long-run growth path by providing higher levels of national security through increases in defence spending. Therefore, the existing literature reinforces the need for more case studies, rather than ad hoc groupings of panel data. The case of Rwanda, for example, seems likely to provide policy makers with more information than a general panel study covering the entire continent of Africa. Assumptions of homogeneity rarely lead to improved empirical results. The theoretical and empirical literature on both the demand *for*, as well as the effects *of,* defence spending demonstrated heterogeneity over time and geographical space. Additionally, the literature implies that there is a multiplicity of country-specific factors that determine both what the state *should* and what it *does* consider relevant when making defence spending decisions.

Chapter 3: The Case of Rwanda – A Contextual Analysis:

This section explores the existing socio-political, economic, and national security factors in Rwanda. By contextualising Rwanda's domestic and global positioning, it is possible to consider a full range of the country-specific items that must be accounted for in the empirical model in order to maximise the persuasiveness of any econometric test.

The Republic of Rwanda is a geographically small, landlocked country[18] in what is today considered, politically and geographically, Africa's Great Lakes Region. Around its borders lie Burundi, Tanzania, Uganda, and the Democratic Republic of Congo (DRC). Rwanda itself is made up of four administrative provinces which fall under the authority of the federal government and its executive branch, the presidency.

3.1. A Recent History of Rwanda

Rwanda has a history of projecting power beyond its borders since before European colonisation in 1898 (CIA World Factbook, 2022). During a period of European expansion toward the end of the 19th and the beginning of the 20th Century known as the *Scramble for Africa,* what was then the Kingdom of Ruanda[19] was taken over by the German empire. However, German colonisation was not to last. Less than two decades later, Belgium wrested Ruanda from German administration during WWI. From 1922 until Independence in 1962, the Belgians administered the centralised state – first as a League of Nations mandate and then as a trusteeship territory for the United Nations. This process tied its governance with what has become neighbouring Burundi until the overthrowing of the Tutsi monarchy in 1961 (CIA World Factbook, 2022).

Colonial administration provided the country with increasingly entrenched ethnic identities between the Hutu and the Tutsi peoples. Belgian policies tied political and religious status to ethnic identity, at first favouring a ruling Tutsi class before ultimately giving self-determination of an independent Ruandan state to a Hutu-led government. Such divisive political strategies were not only the preserve of the Belgians, but also formed the basis for

[18] At 26, 338 km^2, the entire country is just larger than the American state of Vermont and is almost 5 000 km^2 smaller than its former colonial administrator, Belgium.

[19] Although many spellings of Rwanda were used in the late 19th and early 20th century, most commonly the kingdom and its territory were referred to as Ruanda until the 'w' began to take preference over the 'u' in government documents around 1970.

political (and violent) competition between nationalist organisations and political parties[20]. Therefore, it should be noted that socio-political and economic factors[21] in and around Rwanda are inexorably linked to a complex network of demographic concerns. Such tensions enabled the 1973 coup d'état led by President Juvenal Habyarimana – who reinforced a strategy of Hutu-led development through single party rule until 1990.

Between 1990 and 1991, Habyarimana was pressured into trying to initiate a democratic transition. However, conceptions of nationalism and a history of ethnic prejudice also formed the basis for a predominantly Tutsi-led civil war against Habyarimana's government from 1990 to 1993. In particular, a rebel movement led by the Rwandan Patriotic Front – a Tutsi militia movement based in Uganda - forced Habyarimana into a tenuous power-sharing agreement with Tutsi moderates under the Arusha Accords from the 4th of August 1993 until Habyarimana's assassination on the 6th April, 1994[22].

The assassination of Habyarimana[23] triggered 100 days of violence during which the Rwandan government collapsed, paving the way for Hutu extremists and military members under a communal militia movement called the *Interahamwe* to execute a genocide against Tutsis, Twa, and Hutu moderates (Reyntjes in Khadiagala, 2006). A United Nations (UN) response proved largely ineffective, however a UN Security Council (UNSC) resolution – resolution 918 – one month into the genocide imposed an arms embargo on the sale or supply of arms to the territory of Rwanda and established a Security Council Sanctions Committee to monitor its enforcement (SIPRI Arms Embargoes Database, 2022).

In total, the CIA World Factbook (2022) estimates that up to three-quarters of the Tutsi population living in Rwanda were killed. It was Tutsi rebel groups, consolidated into a general RPF-led coalition, that invaded Rwanda from neighbouring Uganda, Burundi, and the DRC which eventually put an end to the genocide and established law and order once more. In June 1995 Security Council resolution 997 and 1011 extended the embargo to non-governmental

[20] This includes, but is not limited to Grégoire Kayibanda's Hutu nationalist PARMEHUTU movement, President Habyrimana's MRND, as well as current President Paul Kagame's Rwandan Patriotic Front (RPF). The latter is a Tutsi-dominant organisation whose army, the Rwandan Patriotic Army, was instrumental in ending the 1994 genocide and establishing the current ruling Tutsi elite in Rwanda (Reyntjes in Khadiagala, 2006:26-7).

[21] Including unemployment, inequality, institutional strength, and governance – all of which contain relevant (and complex) ethnic, linguistic, and religious dimensions.

[22] Habyarimana was killed after his presidential plane was shot down over the Rwandan capital, Kigali. Also on board was the Burundian Hutu President Cyprien Ntaryamira.

[23] While both Tutsi and Hutu nationalist movements, when politically expedient, blame each other or claim responsibility for the assassination – the perpetrators have never been officially discovered.

forces in the states neighbouring Rwanda (UNSC, 1995). However, in August of that same year the UNSC lifted the arms embargo on the RPF government, while extending it to all non-state factions within Rwandan borders or in neighbouring countries intending to use such arms within Rwanda. These resolutions also required that exporters of arms (or arms-related materiel) to Rwanda notify the UN if and when selling and sending such equipment to the country. At the same time, the Rwandan government was ordered to notify the UN about any arms purchases it made. These resolutions appeared to ignore allegations of war crimes committed by the RPF against civilians during their push to stop the *Interahamwe* as well as after 'peace' had ostensibly been restored.

Certainly, the ruling RPF used the recent genocide (as well as the guilt associated with letting it happen that was clearly felt by the international community) as a means to deflect responsibility for the "*violent mode of management and discriminatory practices*" it used against its own citizens over the following decade (Reyntjes in Khadiagala, 2006:17). When the RPF took control of Rwanda on 19 July 1994, it introduced a strong executive presidency and amended the fundamental laws of Rwanda in a bid to consolidate the its newfound hold on political power (Reyntjes in Khadiagala, 2006:17). Such actions were largely interpreted by the international community as strategic decisions aimed at maximising governmental efficiency and the rule of law, subject to widespread resource constraints. However, Reyntjes (Khadiagala, 2006:19) demonstrates the complex nature of the new political reality in Rwanda:

> *"From early 1995 on, Hutu elites became the victims of harassment, imprisonment, and even physical elimination. Provincial governors, local mayors, headteachers, clerics, and judges were killed in increasing numbers; in most cases, the responsibility of the Rwanda patriotic army (RPA, the army of the RPF, which had become the National Army) was well documented" (Reyntjes in Khadiagala, 2006:19).*

While the capacity to enact violence was being recouped by organs of the state rather than its people, President Bizimungu (in office from 1994-2000) rechannelled aggression beyond Rwandan borders. In 1996, as part of the First Congo War Rwandan troops joined the Ugandan and Tanzanian[24] militaries in an invasion of the DRC (then known as Zaire) to oust

[24] Eventually more countries would join in the fight against Mobutu, including Angola, Burundi, and Eritrea.

President-cum-dictator Mobutu Sese Seko from power[25]. Following the fall of Mobutu Sese Seko and Zaire, the RPF was able to successfully install their preferred candidate, Laurent-Désiré Kabil, as president of the newly constituted DRC. The resulting peace was not to last. Tensions arose between the RPF government in Rwanda and Kabila's government in the DRC – nominally over Rwandan security concerns regarding refugee and rebel groups living within the Congolese border. The relationship deteriorated even further when Kabila began to fire high ranking Rwandan members of the Congolese government in preference of Congolese citizens. The culmination of diplomatic disputes, failed coup attempts, and persistent civil unrest led to the beginning of the Second Congo War in 1998. Rwanda has always asserted that armed intervention in the Congo was necessitated by security concerns (Reyntjes in Khadiagala, 2006:30-2). However, there is some evidence to support the idea that economic exploitation of the DRC's mineral wealth may have been a primary strategic concern for the Rwandan government's commitment to maintaining influence and personnel in Eastern Congo (Reyntjes in Khadiagala, 2006:30-2). Nevertheless, in March of 2007 the UN Security Council lifted the requirement for states to notify the UN of arms deliveries to the Rwandan government[26], and in 2008 it ended both the arms embargo on non-governmental forces in Rwanda, and the prohibition on re-transfers and exports of arms and related materiel from Rwanda established in 1995[27] (SIPRI Arms Embargoes Database, 2022). The freedoms won through these UN resolutions did not mean that Rwanda was no longer involved in international dispute with its neighbouring countries.

Reyntjes reports that a UN panel investigating the illegal exploitation of resources in the Congo found that the continued presence of Rwandan military forces in the Congo was to secure mineral resources rather than to reinforce security (Reyntjes in Khadiagala, 2006:31). He (Reyntjies in Khadiagala, 2006) suggests that Rwanda's continued military presence in DRC after the end of the Second Congo War[28] formed part of a strategy of defence budgeting through military commercialism:

> *During a hearing before a Belgian Senate Commission, former MP Deus Kagiraneza mentioned "accounts parallel to the national accounts" as well as "a system of*

[25] Reyntjes (in Khadiagala, 2006:30-2) reinforces that Rwandan action across the border also targeted fleeing Hutu-rebels, refugees, and even some Tutsi survivors who opposed (or thought to oppose) the ideology of the RPF, claiming the conflicts in the DRC formed a continuation of the civil war beyond Rwandan borders.
[26] Through the passing of resolution 1749
[27] Through the passing of resolution 1011
[28] Rwanda withdrew *most* of its troops by the end of 2002 and officially signed a peace treaty ending the Second Congo War on the 18th of July 2003.

fictitious billing"; with regard to operations in the DRC, he added that "we thus profit from the seizure of weapons, the impounding of stocks, the exploitation of mines 'at a rebate' and the rebudgeting of war bounty" (Reyntjes in Khadiagala, 2006:23).

Officially, Rwanda has been conflict free following an alleged full withdrawal of all Rwandan personnel from all territories belonging to the DRC in 2009. Rwandan troops are now mainly deployed as part of peacekeeping missions under the authority of the UN. Approximately 3000 Rwandans are currently serving (as soldiers as well as police) in South Sudan as part of UNMISS (SIPRI, 2022). Another 1700 military personnel and police are operating in the CAR as part of MINUSCA, with an additional thousand sent to the CAR as a result of a bilateral agreement (SIPRI, 2022). The CIA World Factbook (2022) estimates that just over 1000 troops have been deployed against Islamist insurgents in Mozambique. Furthermore, Rwanda has provided troops, military experts, and military police to additional peacekeeping missions including MINUSTAH and UNAMID (Martin & Kruger, 2013). In 2017 SIPRI included Rwanda as the 6th largest contributor to multilateral peacekeeping operations in the world (*SIPRI Multilateral Peace Operations Database*, 2018).

This involvement in peacekeeping clearly serves the interests of all involved parties. Rwanda is able to project a visible manifestation of its power, influence, and development beyond its borders. This may raise the country's profile with respect to foreign investors, as well as signal to foreign governments that *good* international relations with Rwanda matter. The UN and foreign governments in Europe and the United States of America (US) need the support of African partners as growth rates fall and geopolitical instability rises in the Northern hemisphere. Europe and the US may also seek good relations with Rwanda due to their declining soft power on the African continent. Each partner sees joint security operations as a signal of committed, good relations. It should be noted that the evidence for this is tenuous. Arlinghaus (1984:31) points out that "*there is no way of assuring stability, supporting friendly regimes, or irrevocably winning the support of the military in Africa".* What is also true, however, is that host countries of Rwandan troops are very dependent on peacekeeping forces to alleviate some of the burdens associated with constant (and expensive) fighting of rebel groups and insurgency movements.

3.2. Rwanda today: Economy, Politics, and Military

3.2.1. Economy

Economic policy in Rwanda is largely shaped by the *Vision 2020* established in 2000 (Smart Rwanda 2020 Master Plan, 2015:6). This document laid out *"an economic blueprint to achieve a knowledge-based economy and become a middle-income country by 2020"* (Smart Rwanda 2020 Master Plan, 2015:6). This ambitious aspiration was followed by two consecutive five year plans outlined as the *Economic Development and Poverty Reduction Strategy*[29](Smart Rwanda 2020 Master Plan, 2015:6). These plans have seen some real successes. For example: As of 2020, the World Bank estimates that 46,6% of the total population has access to electricity compared to just 6,2% of the population in 2000 and 17,5% of the population in 2012 (World Bank Development Indicators, 2022). Similarly, total natural resource rents have decreased as a percentage of total GDP from 16% in 1994, to 5,03% in 2000 and then again down to 3,9% in 2020 – a sign of diversification away from overreliance on primary natural resource extraction (World Bank Development Indicators, 2022). At the same time, life expectancy has risen in Rwanda from 48 in 2000 to just over 69 years in 2020 (World Bank Development Indicators, 2022). Average GDP growth in the country has settled around 7,9% between 2009 and 2021 – making Rwanda Africa's second fastest growing country in terms of increases in GDP after Ethiopia (World Bank Development Indicators, 2022). Even inequality has declined somewhat, from a Gini coefficient of 48,5 in 2000 to 43,7 in 2016 (the last year for which data exists) (World Bank Development Indicators, 2022). Figure 1 traces the evolution of GDP growth in Rwanda from 1974 to 2020. From Figure 1 it is possible to see the significant fall in growth experienced as a result of the civil war and subsequent genocide, when there was no effective government mechanism in operation. The graph also shows the rapid recovery in economic growth from 1995, as well as a trend toward stable growth at a higher level in the 2000s and 2010s compared to the 1974-1989 period. Finally, Figure 1 captures the beginning of the COVID-19 pandemic and the rapid negative effect the pandemic had on Rwandan growth.

[29] Consisting of the EDPRS I and EDPRS II. The first EDPRS covered planned growth between 2007 and 2012, the second from 2013-2018.

Figure 1:

Source: Data calculated using the World Bank Development Indicators, 2022

Like many African countries, Rwanda's economy is predominantly export-oriented with a focus on primary commodity sectors. Agriculture accounts for 74,5% of the country's land use, employs approximately three quarters of the labour force, and makes up approximately 63% of total export sales (CIA World Factbook, 2022). The agricultural sector makes up approximately 30,9% of Rwandan GDP (CIA, World Factbook, 2022). Despite the COVID-19 pandemic, Rwanda exported US$ 902 million worth of goods (OEC, 2022). The country's four largest exports consisted of gold (US$ 644 million), coffee (US$ 66 million), tea (US$ 54,7 million), and metal ores[30] (US$ 66,6 million) (OEC, 2022). Its largest export recipients include the UAE, Turkey, the US, China, and Pakistan (OEC, 2022). Overall, Rwanda maintains a negative trade balance. Imports primarily come from China, Kenya, India, the UAE, and South Africa. These imports include broadcasting equipment, health care related goods[31], food, and oil and petroleum.

In Rwanda, industrial production only makes up approximately 17,6% of GDP; however, at an average of 4,2% the growth rate of the sector is relatively high compared to

[30] These consisted of niobium, tantalum, vanadium, and zirconium ore exports worth US$ 46,4 million as well as tin ores worth US$ 20,2 million.
[31] Including packaged medicaments, vaccines, blood, etc. (OEC, 2022).

developed economies including the US, EU, and the UK (CIA World Factbook, 2022). This may be explained by increasing returns to scale in what has been a neglected sector until a deliberate change in focus by government was adopted in 2012 (Perkins, et al., 2013; Rwanda Vision 2020, 2012). With a high labour surplus potential, returns to capital may be higher with respect to infrastructure and investment increases. The country has also sought to promote industrial growth by establishing a series of Special Economic Zone (SEZ) projects, with the first being the Kigali SEZ set up in 2010 (Ministry of Trade & Industry, 2018:1). The Rwandan Ministry of Trade and Industry has set out a target, in line with the economic *Vision 2020*, for the industrial sector to contribute 20% of GDP (Ministry of Trade & Industry, 2018:5). Of the eight planned SEZs for Rwanda, thus far only the Kigali SEZ is fully operational. The Kigali SEZ aims to channel foreign and domestic private sector investment, both directly and indirectly stimulate employment and income generation prospects, encourage export diversification and improve terms of trade, and increase the countries production possibilities frontier through skills upgrade and technological transfer (Ministry of Trade & Industry, 2018:4). In particular, President Kagame's government seeks to use Kigali's SEZ to attract investment, agribusiness, information and communications, trade and logistics, mining, and construction (Ministry of Trade & Industry, 2018).

The CIA World Factbook estimates that the services sector contributed as much as 51,5% of total GDP in 2017 (CIA World Factbook, 2022). Furthermore, in 2015 Rwanda is estimated to have exported US$ 493 million worth of services in the form of government services, business travel, air transport, communications services, and construction abroad (OEC, 2022).

While the government has undertaken policies to encourage urbanisation as a means of encouraging development and employment through expansion of industry and service sectors, as of 2022 just 17,7% of the population was classified as 'urban' (CIA World Factbook, 2022).

As of 2021, the World Bank reports that the Rwandan population exceeds thirteen million people, approximately two fifths of whom were estimated in 2017 to be under the age of 15 (World Bank Development Indicators, 2022; Republic of Rwanda, 2012; Statistical Yearbook, 2017:p xiii).). As such, Rwanda is expected to maintain high levels of labour supply but faces the risk of increasing underemployment. Almost one fifth of the youths between the ages of 15-24 in the country are currently unemployed (CIA World Factbook). Overall, the 2021 National Statistical Yearbook reports the unemployment rate at 17,9% for 2020 (Statistical Yearbook, 2021:4). It should also be made clear that national estimates of unemployment do not align with ILO estimates. Whereas Rwanda estimated that 13% of the

total labour force was unemployed in 2020, the ILO figure reported by the World Bank is just 1,49%. This is a significant discrepancy and should be looked into further. Overall, the country remains poor in absolute terms. Although development processes and economic growth have facilitated a 19.8 percent decline in poverty levels between 2001 and 2014, the poverty gap at US$ 5.50 a day, 2011 PPP, was around 60 percent in 2016 (Statistical Yearbook, 2017; World Bank, 2017).

As characterises many African states, the country's debt burden remains high: the CIA World Factbook (2022) estimated public debt levels to be approximately 40,5% of Rwandan GDP with over US$ 3, 258 billion of external debt. Nevertheless, the IMF seems to consider debt management in Rwanda as sustainable (Louis, 2021). In terms of credit ratings, since 2014 Rwanda has had a B+ Fitch rating and since 2019 the Standard & Poors rating has been the same. This generally positive rating is central to Rwanda's development plans: its economic strategy depends on attracting investment in ICT, infrastructure, and capital from both China and Europe (Republic of Rwanda, 2012).

Ultimately, Rwanda represents something of a post-conflict African success story. It has made enormous progress over the past two decades with respect to economic growth, cultivating investment, and human development improvements. However, it is clear that the country remains constrained with respect to liquidity and a rapidly rising population which it must find ways to upskill and employ.

3.2.2. Political Relations

Since 1996, the Rwandan government has been nominally democratic. However, its vocal support for free and neo-liberal institutions with a strong civil society contradicts the practical running of the state. Sitting President Paul Kagame has served as the country's president since 2000 following his instalment as Vice-President from 1994 (Fisher and Anderson, 2015). In 2017, Kagame amended his 2003 constitution to allow himself to run for a third term in 2017 – which he is currently serving. President Paul Kagame and other government officials are accused of the widespread repression of critics through intimidation, and the disappearances of critics is often not investigated (*Human Rights Watch*, 2020).

Furthermore, although the new constitution rejects any notion of ethnicity in both public and private spheres, a number of accusations have been levelled against the government for reserving access to power, wealth, and knowledge to Tutsis over the Hutu majority (Reyntjes in Khadiagala, 2006:21). In 2006, Reyntjes estimated that over 80% of elite positions -

including mayoral, university or tertiary educated students – in Rwanda were held by Tutsi (Reyntjes in Khadiagala, 2006:21-2). This seems incongruous with a fair distribution of power where 85% of the population was estimated to be Hutu (Reyntjes in Khadiagala, 2006:22). This is not to say that Rwanda's political demography is essentially and absolutely unfair or even conservative. 61% of Rwandan parliamentary positions are filled by women and 50% of cabinet positions are served by women (Rwandan Development Board, 2022). This makes the Rwandan political sphere the most gender-balanced in the world.

According to its Ministry of Foreign Affairs and International Cooperation Rwanda's foreign policy consists of objectives derived from two basic pillars: Firstly, to contribute to the attainment of peace, security and stability in Rwanda, the region, the continent, and globally by establishing and maintaining good relations with all countries (MINAFFET, 2022). Secondly, to promote regional integration and international trade through the facilitation of wealth creation through cooperative development, investment, tourism, technology, and knowledge transfers (MINAFFET, 2022). As such, Rwanda is also a participating member of a number of regional and international organisations[32]; Kagame even served as the chairman of the African Union from 2018-2019 (AU, 2022). Such associations and activities consolidate Rwanda's legitimacy and place as a relevant actor on the global stage.

Such a willingness to participate in world affairs also draws European and American support in the form of official development assistance and preferential trade agreements. Furthermore, Rwanda holds bilateral investment agreements with a number of politically powerful states in Europe, East Asia, the US, and the Middle East[33]. At the same time, the country has cooperated with the Chinese Belt and Road Initiative and used Chinese loans as part of its budgeting for road infrastructure expansion. Importantly, Rwanda has not made any declarations with respect to Article 36(2) of the ICJ. This means that the country does not formally recognise the compulsory jurisdiction of the ICJ. Rwanda is also not a party to the ICC.

[32] Including the following list: ACP, AfDB, AU, C, CEPGL, COMESA, EAC, EADB, FAO, G-77, IAEA, IBRD, ICAO, ICRM, IDA, IFAD, IFC, IFRCS, ILO, IMF, Interpol, IOC, IOM, IPU, ISO, ITSO, ITU, ITUC (NGOs), MIGA, MINUSMA, NAM, OIF, OPCW, PCA, UN, UNAMID, UNCTAD, UNESCO, UNHCR, UNIDO, UNISFA, UNMISS, UNWTO, UPU, WCO, WHO, WIPO, WMO, and the WTO.
[33] Including but not limited to: the US, UAE, Turkey, Singapore, Qatar, and Morocco.

Since 2004, Rwanda has been documented peddling influence[34] in Eastern Congo through the financial and resource support of "*alternative allies on the ground and autonomous movements to consolidate its long-term influence in eastern Congo*" (Reyntjes in Khadiagala, 2006:30-32). Rwanda and the DRC continued to lodge disputes with each other with the UN and in 2005 the two countries held a dispute over the established border verification mechanism (CIA World Factbook, 2022). In 2007, Rwanda and Uganda established a joint technical committee to negotiate and settle ownership and safety along their borders. In addition, both Rwanda and Burundi hold an official dispute over a two squared-kilometre area of agricultural land between Rwanda's Butare province and Burundi's Ngozi province.

3.2.3. Military

The Rwandan Defence Force (RDF) constitutes the country's military forces. It was formed from the Rwandan Patriotic Army, the RPF's armed forces, and which was renamed by Presidential order number 19/2002 of 17 May, 2002 (Law Establishing the Rwandan Defence Force). Currently, it is subject to *law no 044/01 of 14/02/2020 presidential order establishing special statute governing Rwanda Defence Force* and pursuant to the Constitution of the Republic of Rwanda of 2003 revised in 2015. As such the organisation falls under the direct purview of the President and comprises the (i) the Army, (ii) the Air Force, and (iii) the Reserve Force (Chapter 3 Article 17 Law n°10/2011 of 13/05/2011 determining missions, organisation and powers of the Rwanda Defence Forces). Its mission[35] includes the defence of Rwanda's territorial integrity and national sovereignty, but it also holds the mandate to cooperate with other security organs with respect to *"safeguarding public order and […] compliance with laws"* as well as to "*participate in humanitarian activities in case of disasters in the country* […and…] *to contribute to the development of the country"*. As such, its obligations and responsibilities are wide-reaching and open to interpretation. The mandate of country-wide development is markedly different from most countries, including the South African constitution. The RDF not only defends Rwanda's borders, but also operates beyond its borders, and also contributes to domestic development projects. This includes mobilising the

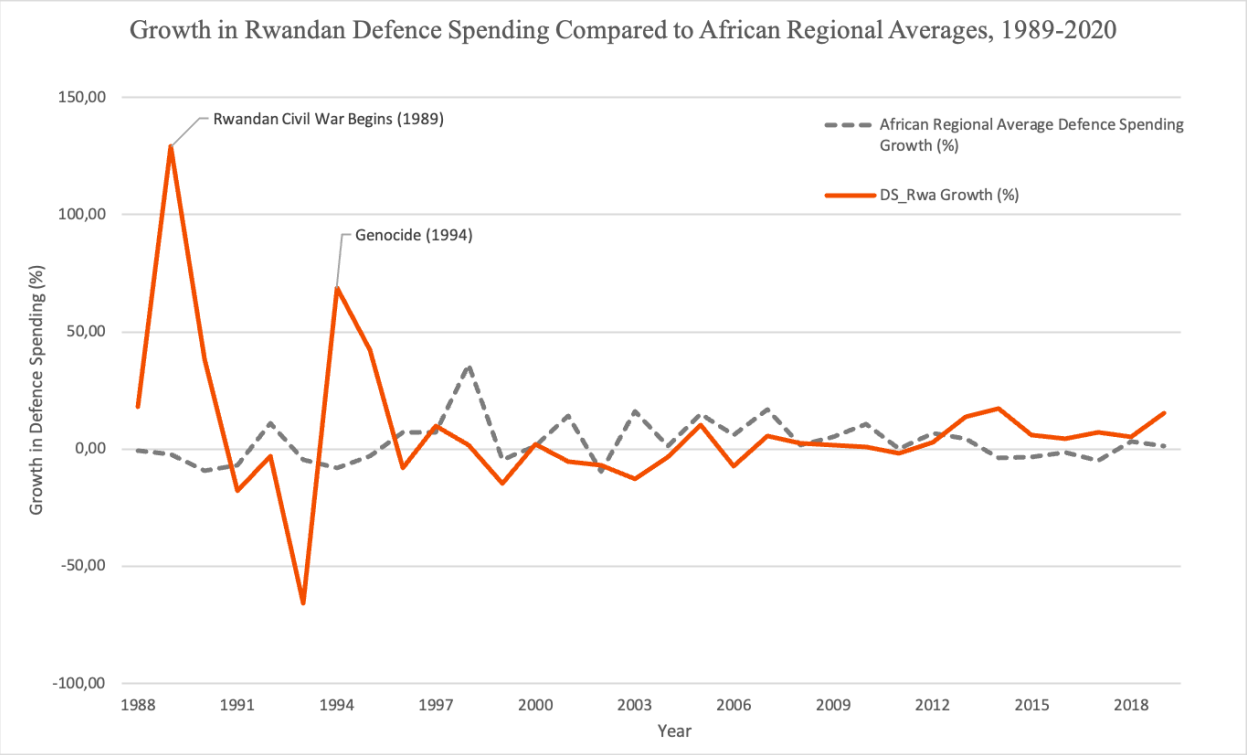
[34] Including supporting Tutsi-led rebel groups such as the *Rassemblement Congolais pour la Démocratie (RCD),* the *Rassemblement Congolais pour la Démocratie-Goma*, and the *Congrès national pour la défense du peuple*, *CNDP* between 2006 and 2009 before turning on its leader in exchange for Congolese support against the Hutu-led, Congolese based rebels in the form of the FLDR. Rwanda also provided aid, training, and financing for the original March 23 Movement (M23) and its resurging movements between 2012-2013 and again from 2017 to 2022 (Gouby, 2022).

[35] Laid out in Chapter II Article 10 of Law n°10/2011 of 13/05/2011 determining missions, organisation and powers of the Rwanda Defence Forces

engineering brigade, as well as regular forces to perform a variety of public works projects such as provision of medical service, agricultural works, construction of houses, helipads, roads, etc. (Karama Resettlement, 2020:15; Rwanda Defence Force, 2017; The Source Magazine, 2021).

Since 2009, the RDF has focussed on professionalising its forces. This process has included targeted reductions in the size of its forces from its 2002 peak of 80 000 to a target of between 30 000 – 35 000 (World Bank Development Indicators, 2022; Security Assistance Monitor, 2020). According to the CIA World Factbook (2022), the RDF has approximately 33 000 active members as of 2021, comprised of 32,000 army personnel and 1 000 air force members. It is considered *"one of Africa's best trained and most capable and professional military forces"* (CIA World Factbook, 2022). Since 2008, Rwanda has sought to update its military hardware through imports: In 2016, photographs taken during a military exercise purportedly showed that the Rwandan army was in possession of Israeli-made ATMOS 155 mm/52 calibre truck mounted howitzers – despite the lack of official acknowledgement of such a purchase made by the Rwandan government (armyrecognition.com, 2017). In 2017, photographs released by government media appear to include the deployment of RM-70 122 MLRSs (Multiple Launch Rocket System) manufactured in Czech Republic and the Chinese-made SH-3 self-propelled howitzers by the RDF (Binnie, 2017; Global Defense Security, 2017). To operate such technologies effectively, the RDF has embarked on a process of education and upskilling its fighting units.

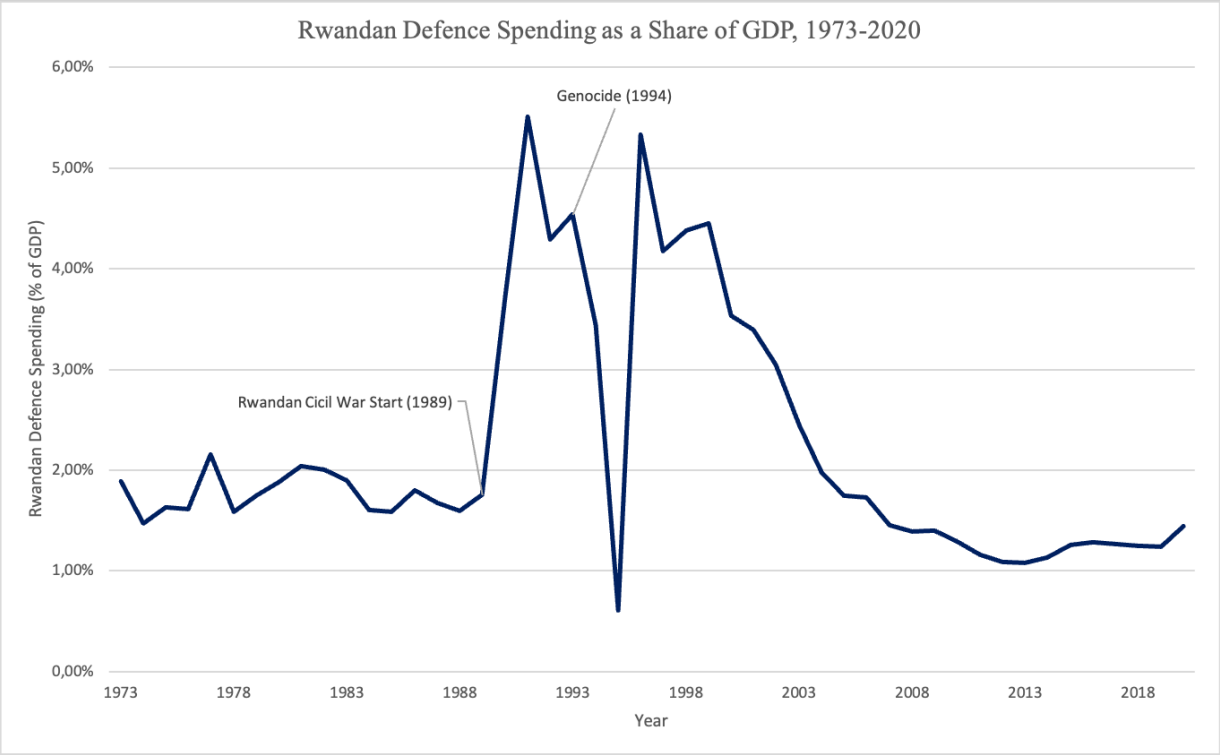
Figure 2:



Source: Data drawn from SIPRI 2022 Military Expenditures Database

Military spending patterns have changed markedly in Rwanda over the past 50 years. As demonstrated in Figure 2, from the end of the 1980s to the beginning of the arms embargoes in 1992, Rwandan defence growth increased significantly more quickly than its regional counterparts. This pattern was disrupted by the civil war and breakdown in government capacity during 1994, but recovered by the following year and remained high for the next two years. Between 1998 and 2013, growth in defence expenditures remained under the average for African countries. However, the start of a new security strategy in 2012 aligns with an increasing rate of growth in Rwandan defence spending which overtakes regional growth in 2013 and has remained notably higher ever since.

Figure 3:



Source: Data drawn from SIPRI 2022 Military Expenditures Database

In terms of its military burden, Figure 3 shows the relative consistency of defence spending over the past 50 years. In the absence of explainable external shocks, Rwanda seems disposed to spend between one and two percent of GDP on its defence budget. Marked exceptions include an increase in spending of over five percent of GDP during the civil war, in the lead up to the 1994 genocide, and during open conflict with the DRC between 1996 and 2002. Following a period of stable, comparatively low spending[36] it appears that defence spending has begun to climb once again. This is a worrying trajectory, particularly since 2019 coincides with increasing violence in the region attributed to the 'new' M23 insurgency.

[36] The Rwandan defence budget hangs around 1% of GDP between 2010 and 2015. This accords with the targeted cutbacks in the size of the armed forces beginning in 2009.

Chapter 4. Model Specification, Data, and Estimation Method

4.1. Determinants of Defence Spending

4.1.1. Model Specification

The RDF provides the country with more than security in a politically insecure region. Its mandate includes promotion of development. Its role includes construction projects, infrastructure projects and maintenance, and the provision of employment and education opportunities to a growing youth population. Therefore, funding the RDF through a public defence budget can be theoretically categorised, primarily, as a type of social welfare spending. Hence, to model the demand for Rwandan defence spending it follows to apply the approach taken by Nikolaidou (2008) and Dunne et al. (2000). The determinants of defence spending can, thus, be modelled as a spending decision whereby a social welfare mandate is maximised subject to economic, political, and strategic constraints. Based on neoclassical foundations, social welfare, *W,* can be described by a function made up of consumption (C), savings (S), government spending (G), and sociopolitical and strategic factors (Z)[37] (Dunne & Mohammed, 1995).

[37] In the form W = *f* (C, S, G, Z)

This baseline model can be transformed to better describe an optimisation problem for demand for defence spending (DS_Rwa) subject to economic (Y) and socio-political strategic factors (Z) as follows:

(1)

$$DS\_Rwa = M_D\,(Y, Z, Pm, Pc)$$

Where M_D stands for the military demand function in its functional form and P_m and P_c stand in as the relative price/income deflators for military and civilian spending respectively. There are only very few countries for which such deflators are available. As the direction of the deflators tend to move concurrently[38] , they are excluded from consideration in this study (Nikolaidou, 2008b: 279). This leads to a further specification:

(2)

$$DS\_Rwa = M_D\,(Y, Z)$$

Substituting Y and Z respectively for the economic and strategic explanatory variables allows for the generation of the simple, general demand model:

(3)

$$DS\_Rwa = M_D\,(GDP, Inv, Pop, NonDSGe)$$

where:

DS_Rwa: military expenditure level (constant 2020 US$);
GDP: GDP in constant 2015 US$;
Inv: Gross fixed capital formation as a share of GDP
Pop: population measured in 1000s;
Ge: non-military government expenditure in deflated constant 2015 US$;

Following this general specification, country specific factors ought to be included to account for significant events in Rwanda's history that are likely to affect the model's output: Adding these country-specific variables leads to the following specifications:

(4)

$$DS\_Rwa = M_D\,(GDP, Inv, Pop, NonDSGe, Genocide, Conflict)$$

[38] and considering the nebulous nature of quantifying and distinguishing the respective price deflators.

where:

GENOCIDE: A dummy that takes the value of 1 for the year 1994 and 0 otherwise to accommodate the exogenous shock of extreme internal ethnic violence experienced by Rwanda in that year;

CONFLICT: A dummy capturing the exogenous effects of internal and external conflict which takes on a value of 1 for those years where >25 battle related deaths were recorded, excluding 1994 and 0 otherwise

Finally, a series of other possible explanatory variables can be selectively tested in order to account for a full range of economic, political, and socio-strategic factors that might influence the Rwandan government's defence spending decision. These variables consist of: External debt in constant deflated 2015 US$ (DebtX); Official Development Assistance as the net official development assistance and official aid received in constant 2020 US$ (ODA); Trade openness proxied by share of trade balance (the sum of total exports and total imports) in deflated constant 2015 US$ (TB); Burundian defence spending in constant 2020 US$ (DS_Bur); Congolese (Democratic Republic) defence spending in constant 2020 US$ (DS_DRC); Tanzanian defence spending in constant 2020 US$ (DS_Tanz); Ugandan defence spending in constant 2020 US$ (DS_Ugan); the average military burden of bordering countries in constant 2020 US$ (SecWeb); and finally, a trend (T).

For the ARDL approach to cointegration to produce results, all included variables must be either I(0) or I(1). This can be confirmed through the application of an augmented-Dickey Fuller test to each variable of at the 5% level. To run this model, a constant term and a time trend are introduced. The large number of potential explanatory variables means that a general to specific method is most appropriate as an approach to developing the best form of empirical model. By incorporating a full set of explanatory variables in the general model and then selectively removing them according to their relative importance and statistical significance, the likelihood and weight of omitted variable bias [OBV] should be reduced (Hendry, 2000). Therefore, Rwandan defence spending (DS_RWA) will be first estimated using level GDP, investment, population, and non-military government expenditure. A further selective process will then seek to find the best performing model by including country-specific factors such as dummies for years of genocide and years of conflict as well as a number of possibly related socio-political and economic explanatory variables that theoretically determine a government's defence spending decision. The results of both the different model specifications are provided and discussed in Chapter 5.

4.1.2. Data

Rwandan data used in this study is primarily collected from opensource datasets made public by the Word Bank Development Indicators and the Stockholm International Peace and Research Institute (SIPRI). It should be noted that SIPRI indicates that figures for 1998 are likely incomplete as they only include expenditure recorded in the official defence budget and ignore additional sources of funding for military activities, both within the budget and outside of the budget. The conflict dummy variable is constructed based on data sourced from the 19.1 version of the Uppsala Conflict Data Programme (UCDP) Armed Conflict Dataset, taking on a value of 1 where internal or external conflict resulted in more than 25 battle related deaths in that year and 0 otherwise.

4.1.3 Estimation Technique – The Autoregressive Distributed Lag (ARDL) Approach to Cointegration

Estimation of models for military expenditure have increasingly made use of modern econometric methods, and cointegrating frameworks (Nikolaidou, 2008b: 279). Variables are considered cointegrated in the case that a stationary linear combination or long-term relationship among those variables exists (Kreinovich et al., 2019:367). The ARDL method to cointegration developed by Pesaran & Shin (1999) offers particularly useful methodological characteristics. Unlike the Johansen cointegration method whereby variables must be either I(1) or I(0) otherwise resulting in biased estimators, the ARDL cointegration technique produces unbiased estimators whether the included variables are I(0), I(1), or a combination of both I(0) and I(1) (Nkoro & Uko, 2016:64). Perhaps most importantly, ARDL estimation generates a robust description of both long run and short run dynamics (Nkoro & Uko, 2016: 86-87).

Use of ARDL cointegration is confined to cases whereby both the explanatory and independent variables converge to a steady state in the long run (Nkoro & Uko, 2016:75). By performing an Augmented Dickey-Fuller (ADF) test on each of the variables it is possible to ensure that they are either I(0) or I(1) as well as to ensure the absence of secondary unit roots.

4.2. The Effects of Defence Spending on Growth

4.2.1 Model Specification

In a 2012 meta-analysis, Alptekin & Levine (2012:647) find that methodological variation between commonly accepted means of econometric analysis tends to significantly predict whether the relationship between defence spending and growth is positive or negative. In this case, a Solow-Swann growth model with technological progress and augmented for defence spending as a share of GDP is employed. As such, the model can be expressed as:

$$GDP_C = f(INV, PopG, MILEX, TREND)$$

Where:

GDP_C represents GDP per capita in constant 2015 US$

INV represents growth fixed capital formation as a share of GDP

PopG proxies labour force growth

MILEX represents military expenditure as a share of GDP.

Before these variables can be included in the model, first they must be shown to be either I(0) or I(1) using an Augmented-Dickey Fuller test applied to each of the explanatory variables as well as to the dependent variable with the exception of dummies. Such tests ensure that the included independent variables are stationary. To run this model, a constant term and a time trend are introduced. Because the model is relatively simple, a specific to general approach is used. As a result the first iteration of the model seeks to estimate the log of GDP_c subject to a full set of variables as well as accounting for hypothesised country specific factors (including the use of dummy variables to capture instances of genocide and conflict). The results of the estimation appear under Chapter 5.2.

4.2.2 Data & Method

Like the determinants model, data for the supply model comes from the World Bank Development Indicators. Figures for military spending are drawn from the latest SIPRI records. These data have the same conditions as in the previous model. Similarly, the conflict dummy variable is constructed based on data sourced from the 19.1 version of the Uppsala Conflict Data Programme (UCDP) Armed Conflict Dataset, taking on a value of 1 where internal or

external conflict resulted in more than 25 battle related deaths in that year and 0 otherwise. Furthermore, the ARDL approach to cointegration is applied to the supply model for the same reasons as in the determinants model. The same advantages to this technique apply in this case.

Chapter 5. Results of the Empirical Models

This chapter presents the most robust results obtained by applying the methodology outlined in Chapter 4. First, a series of determinants models are presented including both the long run and short run outputs. These results are interpreted and discussed before moving on to the supply model output.

5.1. Demand Model

For the ARDL approach to cointegration to work, the variables must not contain second unit roots. Using an augmented-Dickey Fuller test, all the variables meet this criterion at the 5% level with the exception of the log of population. Such problems with stationarity are sometimes the product of a small sample size[39]. This does not necessarily mean that it is not appropriate to continue. Further testing shows that LPOP cannot be considered as I(2). Rather, by applying the unit root tests with structural break – this variable passes the test at the 10% level of significance. FDI is I(0) as is Congolese defence spending (DS_DRC); all other variables tested are I(1). Therefore, it is appropriate to continue with the ARDL estimation technique for the basic model.

For the general model, using a maximum lag order of 4, the Schwartz Bayesian Criterion suggests a selection of (1,2,0,4,2). The preliminary bounds tests imply strong cointegration; both the F-statistic and W-statistic are considerably above the critical bounds at the 5% level of significance[40]. All these values should be interpreted as it being appropriate to continue with the estimation process.

[39] In this case, 48 observations.
[40] The results of the Bound Tests for the Demand Models can be found in the Appendix in Table A2.1.

5.1.1. Long Run Estimates

Table 1 shows the long run output from the ARDL with cointegration for the best five models run out of twelve successful iterations of a total of fifty-nine regressions run[41]. In general, the results from the long run estimations suggest relatively large and generally significant results.

In all the models presented, GDP is shown to be a highly significant determinant of defence spending. The size of the effect of GDP on military spending is relatively large in all cases. At higher levels of GDP, defence spending tends to fall on average[42] by a relatively large amount. This may be due to increases in perceived stability associated with GDP growth, which might decrease the perceived opportunity cost associated with shifting limited government spending away from military security. However, the direction of the effect is not constant across all models. Model 3 represents a case where the investment variable is substituted for FDI. In Model 3, GDP appears to have a large, significantly positive effect on defence spending.
While investment is positive for all models in which this variable is included, at no time does it appear statistically significant in the long run. Investment is maintained in the model, with the exception of Model 3 when it is substituted for FDI, due to the investment variable's strong theoretical relation. The lack of statistical significance of this explanatory variable in *this* case remains theoretically interesting. It seems that Rwandan defence spending occurs independently of gross fixed capital formation in that country. Conversely, FDI seems to be significantly, negatively related to demand for military spending. It may be that foreign investors seek public partnership which draw spending away from military projects. This may result in a kind of crowding out effect. Alternatively, foreign investors may use soft power, in the form of linked provision of economic partnership opportunities, as a means to influence public policy within the Rwandan state. In most of the models presented, the population variable has a statistically significant effect of sizeable magnitude on defence spending. The direction of this effect is less straightforward. In the baseline model, and in Model 5, increases in population tend to retard military spending in the long run.

[41] The less significant regressions appear in the Appendix of this study (the long run results are presented in Table 3.2 while the short run results appear in Table A4.1.1 and A4.1.2), those models that failed the diagnostic tests have been excluded from this study.
[42] As in the supply model, all discussion of effects of explanatory variables are assumed to be interpreted *ceteris paribus*.

TABLE 1 – DEMAND MODELS – ESTIMATED LONG RUN COEFFICIENTS 1973-2020

	C	LGDP	LINV	LFDI	LNonDSGe	LPop	LDbtX	LDS Tanz	LTB	Trend	Gen Dummy	Conflict Dummy
Model 1	**89,191***** **(4,821)**	**-2,164***** **(3,115)**	0,538 (1,291)	–	**1,749***** **(3,997)**	**-5,235***** **(3,811)**	–	–	–	–	–	–
Model 2	-13,42 (0,584)	**-2,933***** **(3,378)**	0,499 (0,882)	–	-0,338 (1,266)	**5,194**** **(2,248)**	–	**1,106***** **(3,480)**	–	0,0014 (0,0314)	**-3,967***** **(4,196)**	–
Model 3	-17,828 (0,818)	**1,828**** **(2,481)**	–	**-0,365***** **(3,130)**	-0,089 (0,345)	-0,991 (0,772)	–	–	–	-0,0228 (0,506)	–	**0,293***** **(2,917)**
Model 4	-16,314 (0,800)	**-2,483***** **(3,336)**	0,305 (0,615)	–	-0,335 (1,436)	**4,813**** **(2,428)**	–	**1,033***** **(3,806)**	–	-0,007 (0,187)	**-3,426***** **(4,345)**	**0,175**** **(2,224)**
Model 5	**38,653***** **(6,027)**	**-0,558*** **(1,888)**	0,375 (1,691)	–	**-0,242**** **(2,491)**	**-2,464***** **(4,820)**	**0,297***** **(9,026)**	–	**0,663***** **(3,33)**	**0,038**** **(2,159)**	**-1,267***** **(5,285)**	**0,104***** **(3,085)**

Notes: T-ratios are in parentheses; stars indicate significance at the * 1%, ** 5%, *** 10% level

This may be, theoretically, explained by increasing demand for spending elsewhere as civilians perceive economic, environmental, or health security to take priority (in terms of their self-interest) over welfare garnered through military security (Dunne et al., 2008). However, the results of Models 2 and 4 suggest a positive relationship between population growth and defence spending. This may have to do with increases in population leading to a relative decrease in tax burden held by the average citizen for the provision of security as a public good (Nikolaidou, 2008).

Non-defence government spending has heterogenous effects and significance across the five included models. For the baseline model, non-defence government spending has an average positive and relatively sizeable effect on defence spending in the long run. It seems that there is little evidence of a 'crowding out effect' in Rwanda. Rather, increases in government spending seem to be spread across all sectors. However, by accounting for trade and debt effects, Model 5 returns a statistically significant negative relationship between non-defence government spending and demand for public defence budgets. In this case, it appears that there *is* a trade-off between defence and non-defence public spending. If this is the case, then it seems prudent to consider the positive effects that external debt and trade openness have on defence spending (captured previously by the non-defence government expenditure variable). Increasing trade openness may facilitate increases in military procurement, while higher levels of external debt may take the form of public debt to foreign military technology manufacturers[43]. Nevertheless, when disaggregated and fully accounted for it becomes clear that there *is* a crowding out effect taking place where a trade-off exists between non-defence expenditure and defence budgets.

An interesting result drawn from the empirical models is the large, statistically significant positive effect that Tanzanian defence spending has on Rwanda's military expenditure decision for models 2 and 4. Though Rwanda and Tanzania are by no means political allies, their foreign relation history contains fewer instances of conflict compared to Rwanda's relations with the DRC, Burundi, or Uganda. It seems clear, however, that the two countries compete for hard power superiority in the region. In terms of international relations, both countries compete for investor confidence and international recognition as stability-makers in the Great Lakes region. There is, therefore, sufficient theoretical reason to explain the possibility of an arms race between Rwanda and Tanzania in the long run.

[43] Or to friendly states who provide weaponry, ammunition, or other military technologies to the Rwandan regime.

There seems little evidence to support the idea that there is a substantial, significant, long run trend in defence spending for Rwanda. However, the country-specific dummy variables have a clear role to play in modelling the determinants of defence spending in Rwanda. In all models in which the genocide is accounted for, it has a highly significant substantially negative effect on demand for defence spending. The theoretical explanation for this effect may be that, firstly, during the worst of the genocide in 1994, a number of sanctions were imposed by the UN and European nations on trade of arms to Rwanda. Secondly, there was no functional government in Rwanda which had the capacity to make official spending decisions for a number of months. Finally, the expected positive sign can be seen resulting from the effects that conflict has on Rwandan defence spending. When Rwanda is involved in conflict, increases in defence spending can be expected to pay for increasing personnel, operations, and materials used during military operations.

5.1.2. Short Run Estimates

Table 2 shows the coefficient and t-ratio outputs from the Error Correction Model. These results provide information on the short run relationships that exist between Rwandan defence spending and the given set of explanatory variables used in each model alongside their respective lags. In each of the models presented, the lagged error correction term has a negative sign and is statistically significant, which can be interpreted as confirmation of cointegration as well as demonstrating the speed of adjustment toward equilibrium. In this case, the coefficients fall between 0,61 and 0,86.

The first variable of note is lagged Rwandan defence spending. In Models 2,4, and 5 the effect of public defence expenditure from the previous period has a moderate, but highly significant, positive effect on defence spending decisions in the current period. It seems that, like many public budgetary items, defence spending has a certain level of inertia.

For the baseline model, in the short run, the empirical results show that current GDP growth has no significant bearing on the demand for defence spending. However, lagged GDP has a large, highly significant, positive effect on the Rwandan defence budget. From this, it may be inferred that when the government sees increased revenues, it revises upwards its intended budgetary spending for the following period. In Models 2,3,4, and 5 the SBC does not suggest the use of lags for GDP; but in these country-specific cases current GDP shows a large, and highly significantly, positive effect for GDP growth on demand for military expenditures. The interpretations drawn from these results remain similar to the case of lagged GDP in the general model. When the country increases its productivity or wealth, the government draws more revenue.

TABLE 2 – DEMAND MODELS – ERROR CORRECTION MODEL COEFFICIENTS 1973-2020

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
dL_DS_Rwa (lag 1)	–	**0,373*** (3,129)**	–	**0,309** (2,705)**	**0,623*** (6,120)**
dL_GDP	0,207 (0,499)	**1,994*** (4,037)**	**1,263** (2,573)**	**-1,796*** (3,841)**	**-0,766* (1,821)**
dL_GDP (lag 1)	**1,107*** (2,986)**				
dL_Inv	0,359 (1,371)	-0,228 (0,897)	–	-0,285 (1,199)	-0,031 (0,153)
dL_FDI	–	–	-0,055 (-1,200)	–	–
dL_FDI (lag 1)	–	–	**0,086*** (3,375)**	–	–
dL_NonDS_Ge	0,283 (1,587)	-0,230 (1,377)	-0,061 (0,3490)	-0,242 (1,560)	**-0,332** (2,553)**
dL_NonDS_Ge (lag 1)	**-1,016*** (4,947)**	–	–	–	–
dL_NonDS_Ge (lag 2)	**-0,575*** (3,742)**	–	–	–	–
dL_NonDS_Ge (lag 3)	**-0,368*** (2,757)**	–	–	–	–
dL_Pop	**-16,826*** (3,345)**	9,359 (0,764)	**-26,316*** (3,215)**	6,361 (0,555)	**-35,252*** (6,208)**
dL_Pop (lag 1)	**21,327*** (3,800)**	-47,001 (1,575)	**40,773*** (3,224)**	-36,294 (1,289)	**42,230*** (4,730)**
dL_Pop (lag 2)	–	**59,639** (2,084)**	**-19,559*** (3,009)**	**46,890* (1,723)**	**-15,095*** (2,788)**
dL_Pop (lag 3)	–	**-31,523** (2,691)**	–	**-26,080** (2,337)**	–
dL_DebtX	–	–	–	–	0,084 (1,071)
dL_DebtX (lag 1)	–	–	–	–	**-0,174** (2,140)**
dL_DebtX (lag 2)	–	–	–	–	**-0,193** (2,635)**
dL_DS_Tanz	–	-0,200 (1,380)	–	-0,162 (1,192)	–
dL_DS_Tanz (lag 1)	–	**-0,560*** (3,647)**	–	**-0,580*** (4,055)**	–
dL_DS_Tanz (lag 2)	–	**-0,471*** (3,142)**	–	**-0,467*** (3,353)**	–
dL_TB	–	–	–	–	0,0155 (0,067)
Trend	**0,173*** (4,431)**	0,9150E-3 (0,0313)	-0,016 (0,529)	-0,005 (0,190)	**0,052* (2,035)**
Genocide	–	**-2,697*** (7,137)**	–	**-2,479*** (6,800)**	**-1,739*** (5,811)**
Conflict	–	–	**0,202*** (3,023)**	**0,126** (2,248)**	**0,142*** (3,032)**
ECM(-1)	**-0,66859*** (4,2630)**	**-0,67973*** (5,2729)**	**-0,69124*** (4,5410)**	**-0,72349*** (5,9560)**	**-1,3725*** (9,5082)**
Adjusted R^2	0,65085	0,74838	0,61558	0,78232	0,86607
DW	2,1418	2,1669	1,8338	2,1451	2,2693

Notes: *T-ratios are in parentheses. *, **, *** indicate significance at the 1%, 5%, 10% level.*

This revenue is then channelled toward public welfare goods. In this case it seems that defence spending is an included channel for increasing government expenditure. Growth in gross fixed capital formation, embodied by the investment variable, does not appear to have any significant effect on Rwandan defence spending. This implies that the Rwandan government has no incentive to change the amount spent on defence, in order to pursue increasing investment at home and abroad. This result is supported when investment is substituted in the model for FDI. While the FDI variable included in Model 3 shows a negative effect of FDI on defence spending, the output is insignificant at the 10% level. Nevertheless, *lagged* FDI has a highly significant, albeit relatively small, positive effect in determining Rwandan defence spending. It may be that foreign countries or private industrial firms (that make up the military industrial complex abroad) support Rwandan defence projects through the provision of FDI.

With the exception of Model 5, there seems generally uniform consensus that current non-defence government expenditures have no statistically significant effect on Rwanda's defence spending decision. The Model 5 *does* show the expected crowding out effect on demand for defence spending. This interpretation is supported by the high significance of non-defence government spending for the lagged observations 1 to 3 in the general model. In Model 5, the direction of effect is considerable and negative. While non-defence spending does not seem to crowd out defence spending in the long run, it seems to have a marked crowding out effect in the short run.

Unlike the consistent effects shown through the investment and FDI, population growth has highly significant effects whose directions alternate in the current and lagged periods. Population in the current period is highly significant at the 1% level in Models 1,3, and 5. In each of these cases, the coefficients are large and negative. However, lagged population growth shows a substantially positive effect on demand for defence spending. This result may suggest that a growing tax base associated with higher numbers of tax payers may provide the government with more money to spend on public welfare goods in the form of defence. However, the desires of a larger population seem to lie in public goods not linked to defence. This may explain the negative effects observed in the current period. David Easton's negative feedback loop may be useful in describing how civilians prioritise their current needs over their long-term interests – particularly with respect to costs associated with security (Easton, 1957:384).

Intriguingly, while external debt holds the expected positive value in the current period, this result appears to be statistically insignificant at the 10% level. In fact, lagged external debt

i.e., external debt in the previous two periods, turns out to have a small but highly significant negative effect on demand for defence spending. This may be explained by a crowding out effect as public spending gets drawn away from direct expenditures on public welfare toward debt servicing.

Perhaps the most interesting short run result appears with the inclusion of Tanzanian defence spending in Models 2 and 4. Again, the current level of the Tanzanian defence burden appears insignificant at the 10% level. However, in both the first and second lags, this explanatory variable becomes highly significant and of moderate size. Furthermore, unlike the positive long run output – which suggested competition over defence spending between Rwanda and Tanzania over time – in the short run there is a negative relationship between Rwandan demand for defence spending and real growth in Tanzanian defence spending. Politically, there seems little evidence of an ally effect. A possible explanation may be found by considering the unique security considerations prevalent in the area: Rwanda and its neighbouring countries have a seemingly endemic problem with armed insurgent groups and rebel factions. Unregulated movement of these violent organisations creates a border security problem for all of these countries. However, solving the problem can be costly. The areas that need to be patrolled tend to be large compared to the military capacities of government forces in the Great Lakes region. This creates a sort of multi-player cooperation game for countries deciding how much they need to spend on defence to maximise their security output. If all countries spend on defence, then the relative cost of security to each country decreases. There is, however, an incentive to 'freeload' off of the positive externalities received from other countries' spending. Perhaps increases in security provision through Tanzanian defence spending creates an external security benefit for Rwanda, allowing the country to optimise its security strategy at a lower level of defence spending.

Where it appears statistically significant, in the general model and in Model 5, the trend of defence spending is increasing. Rwanda remains a country prone to conflict involvement, particularly with its neighbours. Such efforts, or even the threat of such efforts, require spending.

Finally, it is necessary to consider the effects of the control variables used in the form of country-specific dummies. Wherever included, both Genocide and Conflict are highly statistically significant determinants of defence spending in both the long and short run. The expected negative sign associated with the year of genocide, 1994, is confirmed by the error correction model. In the same way, demand for defence spending tends to rise in times of conflict.

Each of the models presented passes all diagnostic tests for functional form, normality, heteroskedasticity, as well as for serial correlation[44]. Lastly, the model estimates a Durbin-Watts statistic of 2.14.

5.1.3. Overall Summary of Results for the Determinants Models of Rwandan Defence Spending

The empirical results drawn from both the long and short run output for Rwanda demonstrate its use as a case study to better understand post-conflict, African defence budgets. In particular, the empirical output provides a robust, data driven account of Rwandan demand for public defence spending. Incorporating country-specific dummies, as well as considering the effects of trade openness, external debt, and Tanzanian defence, spending leads to a better performing specification than the general model for demand for defence spending in Rwanda, based on the comparatively high adjusted R^2 values[45] as well as the high number of statistically significant variables

5.2. Supply model

Using an augmented-Dickey Fuller test all the included variables are confirmed to be I(1), including GDP_c, *INV, Popg*, and *MILEXRwa*. Therefore, it is appropriate to continue with the ARDL estimation technique for the basic model. A maximum lag order of 4 is chosen for the ARDL, which returns, using the SBC, a recommended selection of (1,0,1,0). Consequently, it is appropriate to continue to the bounds test. For the supply model, the F-statistic appears at 7.185 – well above the upper and lower critical bounds at the 5% level. This result strongly suggests that the null hypothesis of *no level effect* can be rejected. Thus, the bounds test implies that there is cointegration in the model in the long run. This interpretation can also be taken from the W-statistic, which – at 28.739 – also lies above its upper and lower critical bounds at the 5% level[46]. These preliminary tests strongly imply a long run relationship at the 5% level of significance for the explanatory variables in the model

[44] These results can be found in the Appendix in Table A2.1.
[45] 0,78232 for Model 4 and 0,86607 for Model 5
[46] The results of the Bound Tests for the Supply Model can be found in the Appendix in Table A1.2.

5.2.1. Long Run Estimates

Based on the long-run output drawn from the ARDL, the specific model appears with the following coefficients:

$GDP_c = 5{,}133^{***} - 0{,}248\ LInv - 5{,}709\ LPopG^{*} - 0{,}476\ LMilRwa^{**} - 4{,}753\ Gen^{**} + 0{,}110\ Conflict + 0{,}0159\ Trend^{***}$

*Asterisks indicate significance at the * 1%, ** 5%, and *** 10% level.*

The results for the long run growth model confirm the expected negative direction of the relationship between Rwanda's defence burden and economic growth at the 5% level of significance[47, 48]. Population growth also has a highly negative impact on per capita growth, but (at the 10% level) the effect is less significant than the defence burden. This also accords with expectations and public policy insights. Rwanda's Vision 2020 suggests that increasing population density and growth is increasing faster than increases in wealth. The overall costs of increasing population growth are, therefore, higher than the productivity returns. The 1994 genocide had a highly negative, significant effect on growth as was expected. Contrary to the theory, the empirical results suggest an insignificant relationship between investment and growth.

5.2.2. Short Run Estimates

TABLE 3 – SUPPLY MODEL – ERROR CORRECTION MODEL 1973-2020

Variable	Coefficient	T-Ratio
L_Inv	-0,0387	-0,546
L_PopG	0,335	0,700
L_MilRwa	**-0,074*****	**3,871**
Genocide	**-0,742*****	**12,343**
Conflict	0,017	0,979
Trend	**0,003*****	**3,197**
ECM (-1)	**-0,15618*****	**2,7895**
Adjusted R^2	0,90082	
DW	1,7505	

Notes: **, **, *** indicate significance at the 1%, 5%, 10% level.*

[47] All discussion of effects of explanatory variables are assumed to be interpreted *ceteris paribus*.
[48] *, **, *** indicate significance at the 1%, 5%, 10% level.

The empirical output of the error correction model (shown in Table 3) is negative and significant at the 1% of analysis, implying the robustness of the model and confirming the existence of cointegration between the variables. From these data, a number of noteworthy results are obtained. Firstly, in the short run, neither population growth nor investment growth seem to significantly affect $GDP_{/capita}$. This outcome seems surprising, but might be explained by the complex component effects that these variables have on the state's economy. Future disaggregation of the types and effects of gross fixed capital formation and population growth may increase the understanding of general Rwandan growth patterns and prospects. Although there seems little short run empirical indication of the effects of population growth and investment, the relationship between defence spending and growth seems much clearer. Overall, it may also be that the true growth modelling robustness of the Solow-Swann model is obscured by confounding factors. Firstly, the aid-dependence of the Rwandan state may allow for the country to maintain its growth levels separately from the real domestic situation. Secondly, a large informal sector might explain why official investment and population levels are not true reflections of Rwanda's growth potential. The defence burden has a highly significant negative effect on growth. Development in Rwanda is likely to be retarded by increases in government defence spending. While Rwandan involvement in general conflict seems not to have a significant impact on its economic potential, the 1994 genocide had a highly significant, large negative impact on growth. Finally, even in the short run, Rwandan growth has the expected upward trend consistent with high levels of sustained growth observed from the early 2000s.

To ensure that the model presented is structurally sound, it is necessary to ensure that the model passes the requisite diagnostic tests. In this case, the model shows no statistically significant sign of serial correlation or heteroskedasticity. In addition, preliminary diagnostic tests indicate that the model passes the requisite tests for normality and functional form[49]. Therefore, the model seems to contain a robust structural evidence for the effect of defence spending on Rwandan growth.

[49] These results can be found in the Appendix in Table A2.2.

5.2.3. Overall Summary of Results for the Supply Model of Rwandan Defence Spending and its Effects on Growth

The empirical results of this model seem relatively robust, and accord with the literature that finds a negative relationship between defence spending and growth. The high level of significance and considerable magnitude of the effect of Rwandan defence spending on Rwandan growth may be noted by policy makers in that country. There is no reason to think that current defence spending supports government efforts to achieve targets laid out in the Vision 2020. Moreover, there is good reason to think that current defence spending is actually hindering Rwandan progress in achieving its long run economic goals.

Chapter 6. Conclusion

This study attempts to identify the determinants of Rwandan defence spending, as well as the effect that such spending has on Rwandan economic growth prospects. Rwanda is an important case study, considering its economic and political prominence. Furthermore, it is a country which has experienced both internal and external conflict. Despite these country-specific characteristics, there are no studies that consider Rwanda independently. Employing the Autoregressive Distributed Lag (ARDL) approach to cointegration over the period 1973-2020, the study finds compelling evidence for the growth retarding effects of defence spending while it confirms that conflict and economic factors have been key determinants of the country's level of military expenditure. In particular, it seems that trade openness, external debt, and Tanzanian defence spending are major determinants of the Rwandan defence spending decision. In the long run, the Rwandan defence burden is stimulated by its capacity to import arms and military technical expertise. This procurement seems likely to be financed by external debt, leading to a short run trade-off between debt and demand for military spending. However, in the long run Rwanda's increasing debt capacity bolsters its sustained military spending. One interesting political consequence of the demand model appears in the relationship between Rwandan and Tanzanian demand for defence spending. In the short run, the Rwandan defence burden is inversely related to Tanzanian defence spending. This might best be explained through the application of game-theory – suggesting that Rwanda receives a positive 'free-riding' externality in the form of increased domestic security from Tanzania's defence burden. In the long run, however, Rwanda and Tanzania compete for regional power and investment.

Therefore, there is a positive long run relationship between Rwandan and Tanzanian defence spending. In all models, the country's involvement in domestic and foreign conflicts played a significant role in its defence spending and growth prospects. Clearly, the use of force requires targeted spending. Independently of other conflicts, the 1994 genocide had a large and negative effect on all aspects of Rwandan government function, with a significant effect on future defence and growth patterns. The civil war and resulting genocide caused a marked reduction in the capital and human capital resources available to the country. This constrained defence spending as well as any other government spending until the establishment of the new RPF government. Additionally, during the genocide, the government's capacity to act in any way was severely limited. These findings may prove important for policy makers who aim to facilitate the country's development processes – especially in the post-conflict era.

With respect to the growth-defence spending nexus, the available literature is wide but nebulous. Some empirical studies find that there is no consistent relationship between defence spending and growth – tacitly giving a government empirical reason to make defence burden decisions without factoring in economic or human costs associated with such spending. Other empirical work finds that growth is negatively impacted by a country's defence spending decision. The theory surrounding such work explains that component effects operate in different directions, the magnitude of which creates an unpredictable net effect. For the case of Rwanda, the net effect is directly measurable – defence spending retards Rwandan growth. *If* it is the case that growth is a necessary component of overall development then, by the law of transitivity, it seems reasonable to think that there is likely a negative relationship between Rwanda's defence burden and its development prospects in the long run. It should be noted that this negative relation holds even if some of Rwanda's significant sustained growth comes from the reported profiteering by its forces in the DRC. Ultimately, there seems little evidence to suggest that the sustained high levels of Rwandan defence spending are motivated by, or create, any long run security for the country – economically or as a deterrent. Rather, defence spending seems to have geopolitical strategic ramifications for Rwandan actions on the global stage and as a leading political actor on the African continent.

The most important limitations associated with this research have to do with the availability and quality of data. There is limited public access to government documents such as a Hansard outlining full accounts of budgetary discussions. If these data were collected, future work could investigate the disaggregated effects that procurement has on growth compared to money spent on operational costs of military interventions. Furthermore, the understanding and optimisation of public welfare with respect to security strategies could be enhanced by some measurement

of efficiency of existing military operations undertaken by the RDF. A full cost-benefit analysis which took into account the environmental externalities associated with security operations may also assist policy makers in Rwanda to optimise spending strategies as they relate to Rwandan growth and security. Increasingly economists have argued that development requires a more holistic measure than simple growth in order to more fully account for human welfare benefits (and costs) accrued through policy action. As more data becomes available it would be informative to investigate a more complete conception of the relationship between defence spending and development in Rwanda.

Chapter 7. References

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Chapter 8. Appendix

8.1. ADF Tests

Table A1: Augmented Dickey Fuller Tests for Unit Roots			
Variable	**Test Statistic (Max SBC)**	**95% Critical Value**	**Unit Roots**
DS-RWA			
L-DS-Rwa	1,9684	3,5189	
dL-DS-Rwa	3,7509	3,5217	I(1)
MILEX			
L-Milex	3,5113	3,5189	I(0) *or*
dL-Milex	3,5567	3,5217	I(1)
GDP			
L-GDP	1,4453	3,5189	
dL-GDP	6,7811	3,5217	I(1)
GDP/capita			
L-GDP/ capita	1,7567	3,5189	
dL-GDP/ capita	6,3358	3,5217	I(1)
INV			
L-INV	1,9091	3,5189	
dL-INV	11,3168	3,5217	I(1)
FDI			
L-FDI	4,0159	3,5189	I(0)
NonDSGe			
L-NonDSGe	1,5936	3,5189	
dL-NonDSGe	6,0680	3,5217	I(1)
Pop			
L-Pop	2,3680	3,5189	*At the 10% level the test statistic is 3,092355 with a critical value of 2,603944 indicating that LPOP is I(1).*
dL-Pop		2,931404	
PopG			
L-PopG	3,0033	3,5217	
dL-PopG	4,7667	3,9272	I(1)
DebtX			
L-DebtX	1,6601	3,5189	
dL-DebtX	3,9693	3,5217	I(1)
ODA			
L-ODA	3,2019	3,5189	
dL-ODA	3,7583	3,5217	I(1)
DS-Bur			
L-DS-Bur	1,7767	3,5671	
dL-DS-Bur	8,1801	3,5731	I(1)
DS-DRC			
L-DS-DRC	3,4976	3,7612	
dL-DS-DRC	5,6780	3,7921	I(1)
DS-Tanz			
L-DS-Tanz	1,8663	3,5189	
dL-DS-Tanz	9,9679	3,5217	I(1)
DS-Ugan			
L-DS-Ugan	2,5032	3,5189	
dL-DS-Ugan	5,4020	3,5217	I(1)
SecWeb			
L-SecWeb	3,1475	3,5189	
dL-SecWeb	6,5961	3,5217	I(1)
TB			
L-TB	1,2103	3,5189	
dL-TB	6,0618	3,5217	I(1)

8.2. Bounds Tests

Table A2.1: Bounds Tests – Demand Models

	F-Statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound	W-Statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
Model 1	**6,5311**	3,8504	5,1328	3,2561	4,4136	**32,6556**	19,2518	25,6642	16,2804	22,0680
Model 2	**5,5482**	3,5410	4,7578	2,9895	4,1256	**33,2895**	21,2458	28,5469	17,9372	24,7535
Model 3	**4,2531**	3,9831	5,2466	3,3531	4,5013	**21,2655**	19,9153	26,2330	16,7654	22,5063
Model 4	**6,7319**	3,6993	4,9039	3,0910	4,2164	**40,3917**	22,1958	29,4232	18,5458	25,2982
Model 5	**9,5673**	3,4089	4,6779	2,8906	4,0338	**66,9709**	23,8621	32,7453	20,2339	28,2365

Table A2.2: Bounds Tests – Supply Model

	F-Statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound	W-Statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
Model 1	**7,1846**	4,6044	5,8101	3,8763	4,9280	**28,7385**	18,4178	23,2404	15,5052	19,7121

8.3. Diagnostic Tests

Table A3.1 Diagnostic Tests for ARDL – Determinants Models

	A: Serial Correlation	B: Functional Form	C: Heteroskedasticity	DW-Statistic
Model 1	$X^2(1)$ = 1,2846[0,257] F(1,28) = 0,84209[0,367]	$X^2(1)$ = 0,13910[0,709] F(1,28) = 0,088802[0,768]	$X^2(1)$ = 0,030643[0,861] F(1,42) = 0,029271[0,865]	2,1418
Model 2	$X^2(1)$ = 1,8437[0,175] F(1,25) = 1,0934[0,306]	$X^2(1)$ = 0,77098[0,380] F(1,25) = 0,44587[0,510]	$X^2(1)$ = 0,15505[0,672] F(1,42) = 0,14852[0,702]	2,1669
Model 3	$X^2(1)$ = 0,17251[0,678] F(1,30) = 0,11808[0,734]	$X^2(1)$ = 0,58342 [0,445] F(1,30) = [0,530]	$X^2(1)$ = 0,6123E-3[0,980] F(1,42) = 0,5845E-3[0,981]	1,8338
Model 4	$X^2(1)$ = 1,7240[0,189] F(1,24) = 0,97870[0,332]	$X^2(1)$ = 2,2931[0,130] F(1,24) = 1,3196[0,262]	$X^2(1)$ = 1,540[0,215] F(1,42) = 1,5233[0,224]	2,1451
Model 5	$X^2(1)$ = 1,6027[0,206] F(1,23) = 0,86945[0,361]	$X^2(1)$ = 0,21777[0,641] F(1,23) = 0,11440[0,738]	$X^2(1)$ = 0,0037344[0,951] F(1,42) = 0,0035649[953]	2,2693

Table A3.2 Diagnostic Tests for ARDL – Supply Model

	A: Serial Correlation	B: Functional Form	C: Heteroskedasticity	DW-Statistic	Durbin's h-Statistic
Model 1	$X^2(1)$ = 0,44391[0,505] F(1,33) = 0,34423[0,561]	$X^2(1)$ = 1,7766[0,183] F(1,33) = 1,4222[00,242]	$X^2(1)$ = 0,62377[0,803] F(1,41) = 0,059563[0,808]	1,7505	3,1974(0,379)

8.4. Further Regressions: Error Correction Results for Models 6-12

TABLE A4.1.1 – DEMAND MODELS – ERROR CORRECTION MODEL COEFFICIENTS 1973-2020

	MODEL 6	MODEL 7	MODEL 8	MODEL 9
DS_Rwa (lag 1)	**0,493*** **(3,834)**	**-**	–	–
dL_GDP	**-2,226*** **(2,843)**	0,257 (0,59945)	0,251 (0,583)	**1,320** ** **(2,621)**
dL_GDP (lag 1)	–	**1,157*** **(2,776)**	**1,039** ** **(2,584)**	–
dL_Inv	-0,091 (0,421)	0,354 (1,229)	0,310 (1,086)	–
dL_FDI	–	–	–	-0,062 (1,310)
dL_FDI (lag 1)	–	–	–	**0,086*** **(3,351)**
dL_NonDS_Ge	**0,305*** **(1,977)**	0,263 (1,442)	0,269 (1,475)	-0,055 (0,306)
dL_NonDS_Ge (lag 1)	**-0,786*** **(5,749)**	**-1,050*** **(4,258)**	**-0,965*** **(4,137)**	–
dL_NonDS_Ge (lag 2)	**-0,370*** **(3,286)**	**-0,574*** **(3,426)**	**-0,547*** **(3,300)**	–
dL_NonDS_Ge (lag 3)	**-**	**-0,370** ** **(2,601)**	**-0,349** ** **(2,473)**	–
dL_Pop	**-7,169** ** **(2,310)**	**-16,394*** **(2,957)**	**-15,802*** **(2,860)**	**-26,119*** **(3,158)**
dL_Pop (lag 1)	**8,713** ** **(2,610)**	**20,778*** **(3,236)**	**19,936*** **(3,124)**	**40,394*** **(3,160)**
dL_Pop (lag 2)	–	–	–	**-19,104*** **(2,894)**
dL_Pop (lag 3)	–	–	–	–
dL_DebtX	–	–	–	–
dL_DebtX (lag 1)	–	–	–	–
dL_DebtX (lag 2)	–	–	–	–
dL_DS_Tanz	–	–	–	–
dL_DS_Tanz (lag 1)	–	–	–	–
dL_DS_Tanz (lag 2)	–	–	–	–
dL_DS_Ugan	–	0,108 (1,049)	–	-0,065 (0,639)
dL_TB	–0,05 (0,018)	–	–	–
Trend	**0,192*** **(5,693)**	**0,170*** **(3,916)**	**-0,164*** **(3,804)**	-0,012 (0,393)
Genocide	**-2,429*** **(4,411)**	–	–	–
Conflict	–	0,002 (0,024)	0,037 (0,481)	**0,216*** **(3,045)**
ECM (-1)	**-0,81623*** **(5,7177)**	**-0,62920*** **(3,7910)**	**-0,67694*** **(4,2335)**	**-0,72922*** **(4,4249)**
Adjusted R^2	0,78170	0,64263	0,64134	0,60809
DW	2,1689	2,1970	2,0894	1,8923

Notes: *T-ratios are in parentheses. *, **, *** indicate significance at the 1%, 5%, 10% level.*

TABLE A4.1.2. – DEMAND MODELS, Continued – ERROR CORRECTION MODEL COEFFICIENTS 1973-2020

	MODEL 10	MODEL 11	MODEL 12
DS_Rwa (lag 1)	**0,492*** **(3,939)**	**0,309** **(2,649)**	**0,47267*** **(3,683)**
dL_GDP	**-2,343*** **(3,072)**	**-1,806*** **(3,765)**	**-2,304*** **(2,9884)**
dL_GDP (lag 1)	–	–	–
dL_Inv	-0,160 (0,749)	-0,288 (1,186)	-0,146 (0,676)
dL_FDI	–	–	–
dL_FDI (lag 1)	–	–	–
dL_NonDS_Ge	**0,286** **(1,902)**	-0,247 (1,539)	**0,287** **(1,897)**
dL_NonDS_Ge (lag 1)	**-0,743*** **(5,500)**	–	**-0,775*** **(5,430)**
dL_NonDS_Ge (lag 2)	**-0,326*** **(2,897)**	–	**-0,344*** **(2,968)**
dL_NonDS_Ge (lag 3)	–	–	–
dL_Pop	**-5,742** **(1,831)**	6,519 (0,556)	**-5,729** **(1,811)**
dL_Pop (lag 1)	**6,532** **(1,863)**	-36,876 (1,276)	**6,650** **(1,879)**
dL_Pop (lag 2)	–	47,526 (1,700)	–
dL_Pop (lag 3)	–	**-26,365** **(2,295)**	–
dL_DebtX	–	–	–
dL_DebtX (lag 1)	–	–	–
dL_DebtX (lag 2)	–	–	–
dL_DS_Tanz	–	-0,172 (1,158)	–
dL_DS_Tanz (lag 1)	–	**-0,579*** **(3,969)**	–
dL_DS_Tanz (lag 2)	–	**-0,471*** **(3,276)**	–
dL_DS_Ugan	–	0,0165 (0,186)	0,064 (0,756)
dL_TB	0,115 (0,425)	–	0,113 (0,415)
dL_TB (lag 1)	**0,714*** **(3,516)**	–	**0,757*** **(3,561)**
Trend	**0,175*** **(5,110)**	0,006 (0,219)	**0,180*** **(5,116)**
Genocide	**-2,505*** **(4,672)**	**-2,502*** **(6,394)**	**-2,492*** **(4,606)**
Conflict	0,094 (1,624)	**0,122** **(1,925)**	0,074 (1,145)
ECM (-1)	**-0,88200*** **(6,1135)**	**-0,71632*** **(5,5219)**	**-0,84658*** **(5,5380)**
Adjusted R^2	0,79462	0,77358	0,79105
DW	2,1707	2,1382	2,1925

Notes: *T-ratios are in parentheses. *, **, *** indicate significance at the 1%, 5%, 10% level.*

8.5. Further Regressions: Long-Run Results for Models 6-12

TABLE A4.2. – DEMAND MODELS – ESTIMATED LONG RUN COEFFICIENTS 1973-2020

	C	LGDP	LINV	LFDI	LNonDSGe	LPop	LDbtX	L_DS Tanz	L_DS Ugan	LTB	Trend	Gen Dummy	Conflict Dummy
Model 6	**82,689*** (6,896)**	**-1,609*** (2,981)**	-0,111 (0,420)	–	**1,369*** (5,572)**	**-4,726*** (5,012)**	–	–	–	-0,146 (0,420)	**0,235*** (6,836)**	**-2,976*** (4,469)**	–
Model 7	**93,448*** (3,506)**	**-2,415** (2,496)**	0,562 (0,267)	–	**1,913*** (3,181)**	**-5,458*** (3,126)**	–	**1,106*** (3,480)**	0,171 (0,947)	–	**0,270*** (3,789)**	–	0,003 (0,024)
Model 8	**83,051*** (3,741)**	**-1,999** (2,653)**	0,457 (1,034)	–	**-1,656*** (03,554)**	**-4,911*** (3,223)**	–	–	–	–	**-0,243*** (4,181)**	–	0,055 (0,484)
Model 9	-15,759 (0,755)	**-1,811** (2,570)**	–	**-0,357*** (3,199)**	-0,075 (0,303)	-1,098 (0,892)	–	–		–	-0,017 (0,379)	–	0,297 (3,073)
Model 10	**70,994*** (5,691)**	**-1,601*** (3,305)**	-0,181 (0,750)	–	**1,208*** (5,249)**	**-3,985*** (4,287)**	–	–	–	0,064 (0,198)	**0,199*** (5,567)**	**-2,840*** (4,772)**	**0,107*** (1,691)**
Model 11	-16,700 (0,7900)	**-2,521*** (3,164)**	0,329 (0,623)	–	-0,345 (1,395)	**4,893** (2,334)**	–	**1,040*** (3,680)**	0,023 (0,184)	–	-0,009 (0,215)	**-3,492*** (3,899)**	**0,170** (1,988)**
Model 12	**74,920*** (5,237)**	**-1,651*** (3,215)**	0,172 (0,678)	–	**1,314*** (4,553)**	**-4,227*** (4,060)**	–	–	0,075 (0,720)	-0,035 (0,094)	**0,213*** (4,921)**	**-2,944*** (4,542)**	0,087 (1,214)

Notes: T-ratios are in parentheses; *, **, *** indicate significance at the 1%, 5%, 10% level