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Studies on Domestic Resource Mobilization in Ghana

By

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(Student #: 1342989)

Doctoral thesis submitted in fulfilment of the requirements for the award of Doctor of Philosophy

in the field of

ECONOMICS AND FINANCE

at

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University of the Witwatersrand

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July 2021

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ABSTRACT

After many years of Aid to Africa, development practitioners have realised that they need to look beyond aid to finance poverty reduction and development. Domestic resource mobilisation and private resource financing strategies have been integral in discussing policy options available to finance development in Africa because of its resilience. Developing the two strategies has become critical, particularly in implementing the Sustainable Development Goals (SDGs) of the United Nations (UN) and the Agenda 2063 of the African Union. Moreover, even though some developing countries such as Ghana's revenue and spending has increased over the years, it has not met all its developmental needs. In most cases, there has been a wide gap between revenues and expenditure, resulting in budget deficits financed with external resources. The revenue challenges stem from the drying up of development aid, which hitherto bridged the gap between spending requirements and actual spending and the high cost of borrowing in international financial markets. Given this, it stands to reason that one of the viable and prudent sources of raising revenue for development that policymakers must explore is domestic resource mobilisation (DRM). This study seeks to contribute to public and development finance discourse in four empirical essays that touch on vital issues regarding DRM in Ghana.

The first objective of the study explored whether tax systems in Ghana are buoyant and or elastic. Relying on time series data from 1984 to 2018, and the Divisia index approach, and the GMM estimator. We established that taxes in Ghana are not buoyant but elastic. Thus, growth in tax revenue is primarily driven by automatism and not discretionary measures. We advocate for policy to strengthen the economy's tax base because of the strong connection between tax bases and their respective tax revenues. We also advise the minimal use of discretionary measures as their impact on revenue generation is low. Lessons for tax reforms are discussed in the chapter.

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In the second empirical chapter, we examined the symmetric and asymmetric response of poverty and inequality to tax systems in Ghana by employing the linear and the Non-linear ARDL models. Concerning the mediation effect of tax systems and poverty, in the long run, we found that, generally, the relationship is asymmetric when all measures of tax systems and poverty are employed. The relationship is only symmetric when indirect taxes and total taxes are employed as measures of tax systems in the poverty line model. We observed that while positive and negative shocks in direct taxes raise and reduce poverty, the negative and positive shocks in all the other tax systems produce negative results. We also establish that negative shocks generally produce more significant impacts on poverty than positive shocks. Therefore, a poverty reduction strategy that looks at tax reduction at all levels should produce the desired results in the long run. Similar findings were also discovered in the short-run dynamics. On the mediation effect of tax systems on inequality, the study revealed a symmetric relationship with a significant positive relationship between indirect taxes and inequality in the long run. Therefore, a policy that leverages tax systems to bridge income inequality with a stern focus on indirect tax systems should yield better results, especially if the focus is on reducing indirect taxes in Ghana.

We deepen the DRM conversation in the third empirical chapter by employing quarterly time series data spanning 2002-2018 to examine whether the domestic financial sector in Ghana can support domestic debt mobilisation uniformly across quantiles and or models. Further, we explore the level of domestic debt that the domestic market can mobilise for fiscal authorities. Relying on the quantile-on-quantile regression technique, we established heterogeneous impact across quantiles and between models. Although the role of financial sector development in domestic debt mobilisation is established from tau= 0.5 upwards, a positive relationship ensues only at the end (tau=1.00) of the overall financial sector model and the financial markets model's distributions. A negative relationship found at tau = 0.5 and tau = 0.75 quantiles in all models, and tau=1.00 of the financial institutions model. The finding

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suggests that the Ghanaian financial sector is not developed enough to support an expansive domestic public debt drive. On the second objective, relying on the Hansen Sample Splitting threshold technique, we observe that significant discontinuities in the domestic debt financial development nexus exist. Indeed, in all three measures of financial development adopted, there is a threshold of domestic debt that optimises financial development. In the overall index, the threshold is 2.5% of GDP, 6.25% in the financial institutions' development index, and lastly, 9.8% of GDP in the financial market model. In all the models, we find that, below the threshold, there is enough support for the safe asset theory.

Lastly, we reckon that countries are searching for revenues to improve development, and hence any policy that will support this objective ought to be projected. In the face of this, we examine whether improvements in governance holds the key to DRM (tax revenue) mobilisation. This exercise is theoretically grounded in the revenue negotiation argument by Levi (1989) called revenue bargaining. We do this by employing the standard Granger causality test, the Diks and Panchenko (2005, 2006) non-linear Granger Causality test, in both levels and scales (using the maximal Overlap Discrete wavelet transform MODWT), and the wavelet coherency and phase difference maps. We find the mixed result on the lead-lag relationship in levels, scales, and time.

In some cases, various revenue levels are for good governance to emerge; in many cases, good governance is a panacea for poor revenue mobilisation. Nevertheless, the revenue implications of good governance should not be downplayed; a policy attempt to increase revenues should begin from governing well. We discuss the detailed results in the chapter.

Keywords: *Domestic resource mobilisation; tax reforms; tax elasticity; tax buoyancy; sovereign debt; financial sector development; good governance.*

Jel Classification: E62, E63, H2, H5, H6, H20, H25,

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Outputs: Ongoing/Forthcoming Publications

Before submitting the thesis, parts of the chapters have been presented in the ensuing academic conference proceedings and published or under various stages of consideration in international peer-reviewed journals. Other related works published by the candidate is also presented.

I. Empirical research outputs: chapter three

1. **Adu, F.** Alagidede, I. P and Asamoah, M. E., "On the Elasticity, and Buoyancy of Domestic Resource Mobilization Systems in Ghana" (submitted for review, *Public Sector Economics*).

II. Empirical research outputs: Chapter Four

2. **Adu, F.** Alagidede, I. P and Asamoah, M. E., "Domestic Debt Resource Mobilization, and Financial Sector Development in Ghana: A Non-parametric Investigation" (submitted for review, *Review of Development Economics*).
3. **Adu, F**. Alagidede, I. P and Asamoah, M. E., "Finding the inflexion point; when does Domestic Debt become bad for the Financial Sector in Ghana?"(Under review*, African Development Review*).

III. Empirical research outputs: Chapter Five

4. **Adu, F.** Alagidede, I. P, Asamoah, M. E. and Ackah I., "Parametric and Non-parametric Interdependence Between Domestic Resource Mobilization, and Good Governance in Ghana: Evidence from time and frequency domain approaches". (under review, *Journal of Development Effectiveness).*

IV. Academic conferences

1. The Ghana Revenue Authority and VAT: silver bullets or wasted efforts? 2019 AREF conference, Wits Business School, Johannesburg.
2. On the Elasticity, and Buoyancy of Tax Systems in Ghana: Evidence from a Divisia Index Approach". 2019 AREF conference, Wits Business School, Johannesburg.

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Declaration

I, ***Frank Adu***, hereby declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in fulfilment of the requirements for the award of Doctor of Philosophy degree in the field of Economics and Finance at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

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Date: July 20, 2021



F. A

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Dedication

The strongest of dedications go to the almighty God and his son Jesus Christ under whose benevolence and might, I was able to able to embark on this journey with ease. Dedications also go to my parents, Mr and Mrs Antwi, and my sister and her husband, Mr and Mrs Kwarteng. They worked hard for this piece. The last dedication goes to the academic and policy community; it's your work. Enjoy it.

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LIST OF ACRONYMS

Augmented Dickey–Fuller	ADF
Autoregressive Distributed Lag	ARDL
Economic Recovery Programme	ERP
Domestic Resource Mobilization	DRM
Generalized Methods of Moments	GMM
Gross Domestic Product	GDP
Ghana Customs System (GCMS) and the Ghana Community Network	GC-Net
Instrumental Variables	IV
International Monetary Fund	IMF
Lagrange Multiplier	LM
Likelihood Ratio	LR
Highly Indebted Poor Countries	HIPC
Foreign Direct Investment	FDI
Non-linear Autoregressive Distributed Lag	NARDL
Ordinary Least Squares	OLS
Pay As You Earn	PAYE
Quantile-on-Quantile Regression	QQR
Sub–Saharan Africa	SSA
Sustainable Development Goals	SDGs
Two-Stage Least Squares	2SLS
United Nations	UN
World Development Indicators	WDI
The International Centre for Tax and Development	ICTD

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

After many years of Aid to Africa, development practitioners have realised that they need to look beyond aid to finance poverty reduction and development. Domestic resource mobilisation and private resource financing strategies have been integral in discussing policy options available to finance development in Africa. Developing the two strategies has become even more critical, particularly in implementing the Sustainable Development Goals (SDGs) of the United Nations (UN), and the Agenda 2063 of the African Union have started. Crude estimates by the UN suggest that globally, financing the SDGs could cost as high as between US$3.5 trillion and US$5 trillion a year.[1]. As staggering as the cost is, there is universal consensus among development and public finance experts that, unlike in the past, where the Millennium Development Goals were financed with Overseas Development Assistance (ODA), the Sustainable Development Goals, the Agenda 2063 and development, in general, will require financial resources from the domestic arena. For instance, it is a recommendation in Agenda 2063 that countries strengthen domestic resource mobilisation, financial institutions, the African capital markets and tackle illicit financial flows for the continent to finance its development efficiently. The preceding requires a bold approach to development financing and strengthening institutional and knowledge capacities for domestic resource mobilisation. This is imperative as the evidence demonstrates that all the countries that have experienced sustained economic growth have mobilised resources from their domestic frontiers to finance their growth.

[1] See <http://www.ipsnews.net/2015/08/u-n-targets-trillions-of-dollars-to-implement-sustainable-development-agenda/>

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When development is financed domestically, it strengthens the bond of accountability and transparency between governments and citizens compared to it being externally financed.

Moreover, development economists view foreign Aid (Official Development Assistant) as a necessary intervention to bridge developing countries' savings gap. This is based on a prevailing assumption that they lack the capital needed to generate savings for development. Aid (ODA) thus provides developing countries with a "big push" to bridge their savings gap. Rostow (1959) and Sachs (2005) have all advanced arguments for developed countries to provide aid to push developing countries into development or, in the words of Rostow, "self-sustained growth". Sachs (2005) proposed a massive aid package and some reforms aimed at helping developing countries get a "first foothold on the ladder of development".

Many years after the 'big push' argument was advanced, there is no conclusive evidence to support the theory. The current discourse on the subject matter on various development and policy platforms suggests that aid may not be the solution to propel developing countries such as Ghana from underdevelopment into development. Moyo (2010), in her book "Dead aid: Why aid makes things worse and how there is another way for Africa", asserts that, although more than US$2 trillion has been disbursed from developed countries to developing countries, with Africa receiving the lion's share, it has not lived up to the expectation of advancing sustainable growth and poverty reduction. The story is not different in Ghana. Because of the growing awareness of the weak aid-growth theory on the continent, Ghana's growing clamour to move beyond aid. This is based on the realisation that Ghana has not realised its developmental objectives after many years of aid. Granted, aid is even the answer to financing development in Africa; the statistics on the trend of aid flows as depicted in figures 1.1 and 1.2 suggest, SSA countries and Ghana must look at a new development financing model to support its growth. As shown in figure 1.1 and 1.2, aid is dwindling for SSA and Ghana.

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Over the 1990-2015 period, it has averaged about 4% of the SSA GDP. Taking individual countries in SSA into perspective, developed countries have reneged on their promises in providing specific quantum of aid as a form of assistance to SSA countries. This means that aid fatigue among donors and aid is also volatile, and countries do not control it. Because of this, SSA countries and Ghana cannot depend on aid as a financing instrument for development. An analysis of the development strategy of Asian countries which have received less Aid than SSA is indicative of the clandestine, elusive repression aid has had on the growth of SSA. China has thrived in the absence of

Figure 1.1: ODA% of GDP SSA

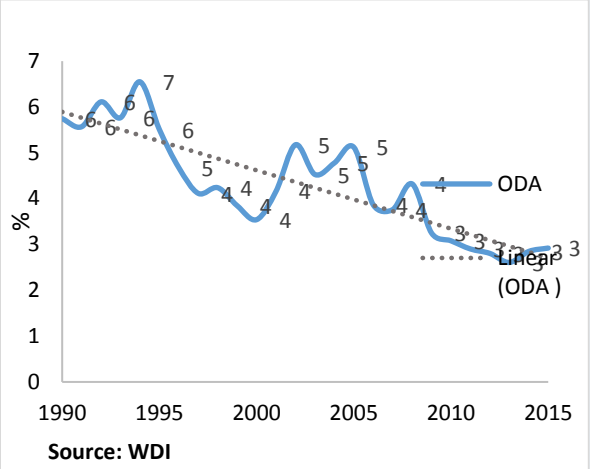
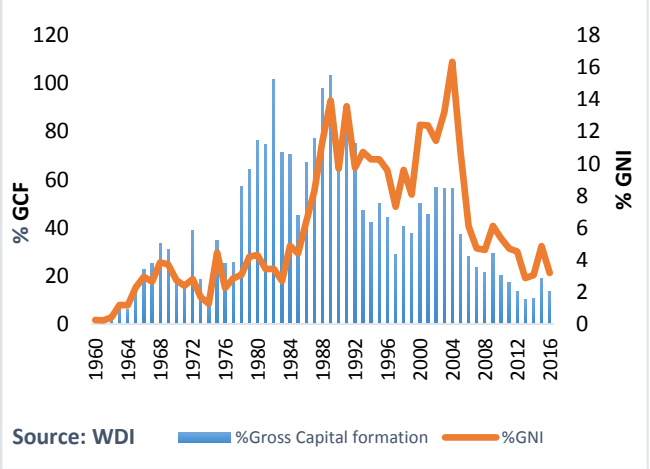


Figure 1:2: Net ODA of Ghana



aid. It was the first country to achieve the Millennium Development Goal of halving the number of people living in extreme poverty. The World Bank revealed that China alone lifted 439 million poor people from extreme poverty between 1990 and 2011[2]. Also, between 1981 and 2010, out of the 700 million people who were pulled out of poverty, 627 million were in China, with the rest of the World sharing the remaining 73 million. Thus, 89.6% were from China. Aid could not possibly be the main answer to development as China had no aid to do this. Instead of reversing the decried cycle of

[2] See <http://blogs.worldbank.org/eastasiapacific/ending-poverty-in-china-lessons-for-other-countries-and-challenges-still-ahead>

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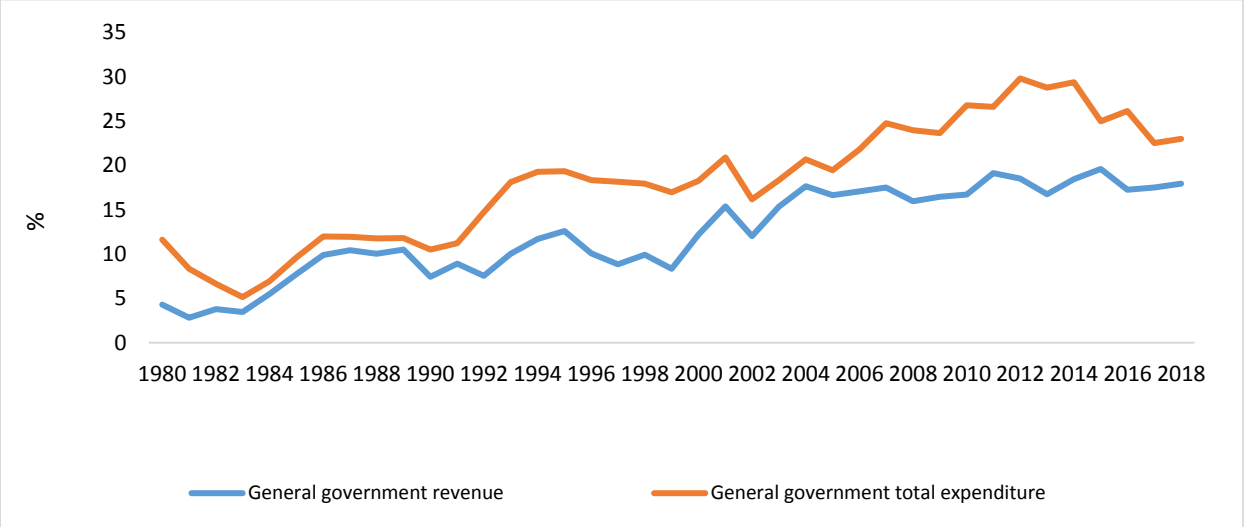
dependency between SSA countries and the West, Aid has disincentivised domestic private investment needed for economic growth and domestic resource mobility.

There is the need to focus on domestic resource mobilisation (DRM), which holds the key to development finance. Nevertheless, most SSA countries (Ghana inclusive) cannot mobilise the needed domestic revenue to embark upon their development. This is because most SSA countries' have their tax revenue around 17% of GDP, which is inadequate, and revenues are also driven by natural resources instead of domestic taxes and the domestic financial market. Regrettably, Ghana has also not found a remedy to the large informal sector, narrow tax bases, widespread evasion, and anti-tax behaviour of firms. Therefore, improving public financial management is non-negotiable as far as Ghana is concerned, and it must start with information from which solid DRM policies can be gleaned.

1.2 Problem of the study

A myriad of theories has explained the circumstances under which government spending may increase.

Figure 1.3: Revenue and expenditure trends in Ghana



Source 1: IMF World Economic Outlook

From the demand side theorists such as Wagner (1883) to supply-side explanations such as Baumol (1967), Buchanan (1977), and Oates (1972), there seems to be a consensus that government size grows

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over time although the reason for growth differs. The practicability of these theories in Ghana is perceptible. Even though government spending has increased over the years, it has not met all the developmental needs. The rapid rise in population, urbanisation and the desire for growth indicate the high quantum of public expenditure required in Ghana. It is estimated that Ghana alone needs to make a sustained investment in the infrastructure of about US$2 billion a year for the next ten years to bridge its infrastructure gap.[3] However, revenue performances have not matched the expenditures required to achieve these investments goals for many years. Figure 1.3 gives a pictorial representation of the revenue performance and the expenditure pattern of Ghana. In many instances, revenue deficiencies have resulted in yawning fiscal imbalances, putting pressure on macroeconomic indicators, and threatening the overall well-being of the economy. Moreover, due to the nature of the domestic financial market, deficits have been financed with external debt instruments, which has additional cost implications on the country's finances and strongly hamper its ability to develop speedily. Clearly, the domestic revenue trajectory of Ghana, in light of the revenue requirements for development, present a major development problem. Indeed, the problem is unmasked, and academic curiosity prevails when the central DRM handles' performance is evaluated in light of several interventions made.

First, taxation accounts for the largest share of DRM in Ghana and has the most prospect in development finance (Savoy, 2014). Brautigam (2008) asserted that tax systems are a fundamental component of any attempt to build nations. Observably, Ghana has not been able to drive Domestic Resource Mobilisation with taxes and lag behind its peers' tax revenue mobilisation for development.[4]. The tax GDP ratio has taken a downward trend in recent years below its capacity[5]. The downward trend bothers the framework for tax collection and the behaviour of economic agents. Narrow tax

[3] See < https://siteresources.worldbank.org/INTAFRICA/Resources/aicd_overview_english_no-embargo.pdf>
[4] Refer to<https://www.oecd.org/tax/tax-policy/revenue-statistics-africa-2017-infographic.pdf>
[5] See <http://citifmonline.com/2017/11/07/2018-budget-to-improve-domestic-revenue-collection/>

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bases characterise the tax system, widespread exemptions and the dominance of the "hard to tax" (informal) economic activities. These conditions give rise to rampant tax avoidance and evasion, which leads to lower tax revenues. Between January 2014 and May 2014, Ghana lost about GHc2.1 million of tax revenue due to tax evasion.[6]. In the Petroleum sector alone, Ghana loses on average a total of Gh200 million in tax revenues annually[7]. Tax exemptions, rebates and illicit flows have also severely hampered domestic resource mobilisation in Ghana. For instance, in the year 2015 alone, Ghana granted a total of GH¢4.5 billion or about $1 billion in tax exemptions[8].

In an attempt to change the tax revenue shortfall narrative, various government reforms have been advanced on a series of fiscal and financial adjustments intended to raise the revenue base of the economy. Most of these reforms were packaged during the IMF and World Bank-sponsored Economic Recovery Program (ERP). The reforms focused on removing existing distortions and strengthening economic incentives, particularly incentives for savings and investment, and enhancing efficiency in tax administration and equity in the overall tax system (Kusi, 1998). Despite the rigorous reforms the tax system in Ghana has gone through, the country is yet to breathe a sigh of relief. The expectation was that, as the tax bases grew, increased tax revenue will ensue. However, tax revenue is yet to experience growth in the dimension of growth in the bases. Although the Ghana Revenue Authority (GRA) has exceeded its revenue target, in some cases, there has been revenue underperformance, with the government resorting to discretionary measures to meet its target in such periods. In both cases, revenue mobilised can hardly meet the threshold needed for government activities. There is a seeming lack of understanding of the relationship between the reforms undertaken and tax revenue mobilisation. The deviation of tax revenue projections from actuals presents

[6] See< http://www.ghanaiantimes.com.gh/tax-evasion-stifles-ghanas-development>
[7] See< https://cbodghana.com/ghana-loses-200-million-over-tax-evasion-in-petroleum-downstream>
[8] See< https://www.ghanabusinessnews.com/2017/11/03/ghana-grants-tax-exemptions-worth-1b-by-2015/>

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significant planning problems for fiscal authorities and throws the government's business off course. There is, therefore, the need to investigate whether tax systems in Ghana are buoyant and or elastic. This estimation will aid us to understand the extent of the impact of the tax revenues reforms to smoothen, sharpen government revenue projection, and offer sharper recommendations for reforms to rake in maximum tax revenues.

Secondly, and as a follow up to the tax reforms undertaken in Ghana, it must be noted that, akin to many developing countries, Ghana seeks to improve welfare, lessen inequality and boost economic growth. Reforms to raise DRM and the expenditure of DRM on public investment must be done in a way that does not unduly counter these efforts, i.e. distort private sector innovation, investment patterns, or promote inequality. DRM strategies have moved from the era of Musgrave (1959), where it was only used to raise revenue to the government, to being used as a policy tool to redistribute income. Both Fellman (1976), Jakobsson (1976), and Kakwani (1977) are in support of the redistribution effect of DRM handles such as taxation, fines, and fees. Indeed, it is reasonable to assume that inequality will be unambiguously reduced if income is taxed progressively, and generous transfers are made to cushion low-income earners. Kaldor (1963) was particularly emphatic on the importance of progressive taxes in promoting a more inclusive economic development. Thus, tax reforms must intrinsically have inbuilt mechanisms to promote economic welfare. Though Ghana achieved the MDG target on poverty before the 2015 target, its incidence has deepened, and it has not done well in reducing inequality. Data from the World Development Indicators on the Gini Coefficient suggests that inequality had risen since 1992 when Ghana entered into multi-party democracy (Cooke et al., 2016). Thus, despite the many tax reforms and the effort made to accumulate tax revenues, structural welfare challenges remain in Ghana. A careful investigation into the role of the tax reforms and tax efforts in Ghana ought to be conducted to ascertain whether the welfare challenges could be attributed to them.

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Thirdly, **e**nhancing DRM involves improving the fiscal capacity of government and financial deepening to attract significant savings from the private sector for productive government investment. To Kefela (2009), both governments and the private sector are important actors in any effective Domestic Resource Mobilisation process. As indicated earlier, the private sector channel for mobilising DRM is savings. This involves the mobilisation of savings from private households through various financial intermediaries. Therefore, adequate mobilisation of savings depends on the level of efficiency and the development of the financial sector. According to Quartey (2008), although the financial sector in Ghana has undergone many changes since liberalisation in the late 1980s, the level of domestic savings is weak, averaging just about 9% of GDP from 1960 to 2016. This compares poorly with other peers of Ghana, such as; Botswana, 26.5%, Kenya 14.8%, and Nigeria, 17.5%. This has limited their capacity to raise domestic resources for Ghana and forced governments to look to the international financial market to finance public investment. Since 2007, the government of Ghana has raised over eight different Eurobonds to support its development drive, with the latest being US$3 billion issued in February 2020. Whiles the Eurobond provides a new source of finance externally and has a direct lower borrowing cost, it is not without challenges. The Eurobond risks destabilising the value of the local currency owing to the massive inflows and outflows associated with the bond issuance and its subsequent payment to external economies. This is especially true for a country that is already under significant pressure from the import sector. The challenges are reinforced when the payment of the bonds is due, and the currency has depreciated, as the country will have to raise more in local currency to pay off the debt. In most cases, the country is forced to issue new bonds to pay off maturing debts that is overwhelming it. Eurobond issuance also comes with rolling over risks, and the high volatility of capital in the international market can have dire consequences on the macroeconomic indicators. For instance, in 2015, Ghana was forced into an IMF bailout largely because of macroeconomic challenges and fiscal slippages emanating from the excessive issuance of

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sovereign bonds. Additionally, the international financial market Ghana has resorted to in recent times is not as cheap as the Eurobond apostles will make it sound.[9]. For instance, the 2013 Eurobond issued by the government of Ghana was at a rate of 7.875%, whiles the domestic bond market was at a rate of 19%-20%. Although the Eurobond could be said to be cheap at face value, it is not; with a currency depreciation of about 14.35% a year, Ghana will end up paying about 22.35% as the interest rate, which is expensive than what prevails in the domestic bond market. Better attention to the domestic financial market and its associated bond issuance could hold the key to development financing in Ghana. Whether the development of the domestic financial market could help Ghana rake in more resources for development remains a research question that ought to be investigated.

Lastly, Eubank (2012) suggests that modern states developed due to negotiations between tyrannical governments who needed domestic revenue to power interstate conflicts and citizens willing to finance these conflicts in exchange for government accountability. Thus, government demand for domestic revenues gives citizens with economic power leverage over the government to demand a more representative political institution and development vis-à-vis a process is known as 'revenue bargaining.

Joseph (2013) argues that institutional and governance failures are the most significant weaknesses to sustainable and transformative growth in Africa. The World Bank (1993) reports that most developing countries lack good governance capacities to undertake effective interventions for economic growth akin to the Asian miracle. These countries are characterised by static efficiency losses and rent-seeking costs, which have shaken their governance foundation. Indeed, most of the governance indicators are not kind to countries in SSA (Ghana inclusive). For instance, none of the SSA countries is ranked in the "good" category of the Natural Resource and Governance Institute's Resource Governance Index.

[9] See< https://www.cimaglobal.com/Documents/ImportedDocuments/14_SN_ma_financial_strategy.pdf>

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The highest-ranked are Ghana (67) in the oil and gas management sector and Botswana (51) in the mining sector. Both of whom are ranked "satisfactory". Africa, in 2016 scored a total of 50.8 out of 100 in the Ibrahim Index of African Governance, with Ghana scoring 65. In the World Governance Indicators by the World Bank, Sub Saharan Africa scored 26 on the government effectiveness section against 37 from South East Asia, 92 from North America, 33 in Lower Middle-Income countries and 46 from Ghana 2016. Because of the poor governance structures in most SSA countries, virtually all governments in Africa and development partners make essential genuflections to good governance. According to Sy and Sow (2016), there is a potential and interesting relationship between domestic resource mobilisation and good governance. Whiles good governance is needed to raise DRM, DRM also promotes participatory democracy, and raises the bond between the people and their government which are critical determinants of good governance. However, whether Ghana's current effort in domestic revenue mobilisation is making genuflections towards good governance remains unanswered. This study intends to satisfy this theoretical curiosity to study the spillover effect of domestic revenue mobilisation on governance systems.

Domestic resource mobilisation is one path out of aid dependence. This is because, for a country to own its development and project itself into the space of self-sufficiency, it must be able to mobilise its resources domestically for development. An enquiry into the conditions that give rise to increased DRM must therefore be embarked on to ensure adequate levels of productive human and social development.

1.3 Research Questions

Because of the preceding, the fundamental problems underpinning this study is identified in answering these four questions;

1. *How has tax policy reforms impacted domestic resource mobilisation in Ghana?*

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2. *What is the effect of tax effort on economic welfare in Ghana?*

3. *What is the role of Ghana's financial sector development in domestic resource mobilisation?*

4. *What is the relationship between domestic resource mobilisation and good governance in Ghana?*

1.4 Objective of the study

The study's main objective is to improve the quantum and understanding of domestic resource mobilisation in Ghana. We study holistically domestic resource mobilisation by looking at tax reforms and tax revenue mobilisation, tax revenue mobilisation and its effects on welfare, financial sector development and domestic revenue mobilisation, and conclude on the effect of DRM on governance in Ghana.

1.5 Structure of the thesis

The gaps identified from the research questions are addressed as follows;

Chapter two is dedicated to reviewing the extant literature on domestic resource mobilisation, with a stern biased focus on tax systems. We also extensively give a descriptive analysis of the Ghanaian economy with a vivid description of how the economy's structure has evolved over the years and the trend of some key macroeconomic variables.

Chapter three of the study explores both the theoretical and empirical literature on the impact of tax reforms undertaken in Ghana on domestic resource mobilisation. We do this by exploring the nature of tax buoyancy and or elasticity in Ghana. We extend the Divisia index in growth literature to estimate the impact of the reforms on tax buoyancy and elasticity in Ghana.

Chapter four will study the effect of tax systems on poverty and inequality in Ghana. In this chapter, we recognise that although the development of the state is to some extent based on its ability to collect tax revenue to solve its everyday economic and social challenges. From this, it could be hypothesised

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that a direct relationship ensues that "ceteris paribus", the higher the tax revenue, the higher the citizens' welfare. However, the relationship may not be as simple as that. Tax systems and policies can also have negative implications on poverty and inequality that can thwart the development ensuing from tax revenues. Therefore, there is the need to have a balanced focus on tax policies and their implications on citizens' welfare.

Chapter five delves into the role of Ghana's financial sector development on domestic resource mobilisation. The chapter redefines domestic resource mobilisation to mean domestic debt resources. Thus, the role of the domestic financial sector in mobilising debt resources is the focus of this chapter. Theoretically and empirically, the chapter will argue that the development of the domestic financial market can lead to improved mobilisation of domestic debts for development. However, there is an optimum level or threshold of domestic debt that should not be exceeded to destabilise the domestic financial market.

Chapter six explores the theoretical and empirical relationship between domestic resource mobilisation and good governance in Ghana. The chapter examines whether it is good governance that generates more revenues or revenues that drive good governance. The chapter is significant for the government's DRM drive. If governing well leads to improved DRM, then an avenue exists for government to leverage governance to attract more revenues.

Chapter seven looks at the summary, conclusions and policy recommendations of the whole thesis. Finally, we offer the way forward as far as each of the issues analysed is concerned.

1.5 Justification of the study

"Even if there were no aid fatigue, and with the best will in the world, and the most charitable governments in place in the so-called donor countries, there will never be enough aid to develop

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Ghana to the level we want."[10]. This statement by the president of Ghana emphasises the need for studies on DRM in Ghana. The Africa Capacity Builders Foundation reports that out of the 28 OECD donor countries, only five were able to meet the Pearson's commission's recommendation of giving out 0.7% of GNI as aid to developing countries. Development Aid is drying up, and alternative mechanisms for financing development must be explored, and this study intends to lead the conversation. It is expected that policymakers will rely on the policy fallouts to chart a path to development financing in Ghana.

Moreover, the development finance challenges enumerated above do not apply only to Ghana. Most Sub-Saharan African countries face similar challenges, and as a result, the policy outcomes of these essays are pretty and easily applicable to other developing countries to support their revenue mobilisation drive. However, the applicability of the study's outcome to other African countries is immutable because the terms of international finance are expected to worsen in the medium term as commodity prices are expected to deteriorate.[11]

This study is also justified because of the need to resolve the revenue negotiation-governance debate in public choice, specifically, on the relationship between raising revenues domestically and its associated impact on the governance credentials of Ghana. Domestic Resource Mobilisation suggests the uncompromising contribution of citizen's resources towards the running of the state to improve governance. However, existing literature on governance and DRM is by no means conclusive on the relationship. Therefore, we employ recent data and new approaches to contribute to the extent but inconclusive literature by examining this phenomenon.

[10] https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Akufo-Addo-outlines-policies-for-Ghana-beyond-aid-632060

[11] Refer to < https://www.devex.com/news/brookings-calls-for-africa-to-improve-domestic-resource-mobilization-91901>

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Undoubtedly, Ghana, as a member of the United Nations, has committed itself to implement the current global development objectives of the UN (The sustainable Development Goals). These global goals that build on the MDGs' achievement have as its objective "to end poverty, protect the planet and ensure that all people enjoy peace and prosperity". Expressly, goal number 17.1 enjoins countries to "strengthen domestic resource mobilisation, including through international support to developing countries to improve domestic capacity for tax and other revenue collection". This research adds to the localisation strategy of Ghana to implement the SDGs. It has the edge to move goal 17.1 forward by crafting strategies for implementing it as far as Ghana is concerned. A more critical fallout will be donors, CSOs and the government to achieve the goal.

In a period where cross country studies are thriving on the academic landscape, one would have expected a panel study on the subject matter to capture country nuances in DRM effort. Nevertheless, undoubtedly, optimal policy recommendation requires country-level analysis and knowledge on DRM developments as leverage. There is, therefore, the need to do a by country compass analysis to determine the leverage. This study kick-starts the analysis with a keen focus on Ghana.

Studies on DRM are rare in SSA and Ghana, basically because it has been a development concept with the academic world just about looking at it with a keen eye after the failure of mainstream development financing strategies such as aid in Africa. Nnadozie et al. (2017) indicated that very little had been done in the area of DRM. This study has become even more critical as there have been no extensive direct studies on DRM in Ghana after the rhetoric. The originality of the study is strengthened by the cutting-edge methodologies that are employed. We use econometric techniques that have seen little application on the subject matter.

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CHAPTER TWO

LITERATURE REVIEWS

2.1 Introduction

This section briefly reviews part of the extant literature on domestic resource mobilisation. It touches particularly on theories of optimal taxation, determinants and the Ghanaian economy. This chapter is organised as follows; Section 2.2 gives a brief overview of the conceptual definitions and domestic resource mobilisation types. Since taxation is an essential part of domestic resource mobilisation, we review some of the theories on optima taxation in section 2.3. We also review part of the extant literature on tax reforms. Potential drivers or determinants of taxation are explored in Section 2.4. We then delve into the economy of Ghana in section by discussing the major trends in macroeconomic issues in Ghana in section 2.5. The trend of taxation and the various components are then dealt with in section 2.6.

2.2 Conceptual definitions of domestic resource mobilisation and taxation

The United States Agency for International Development (USAID) defines domestic resource mobilisation DRM as "the process through which countries raise and spend their funds to provide for their people."[12]. The European Commission defines it as "the generation of government revenue from domestic resources, from tax or non-tax sources (royalties, licenses, levies or other income)."[13]**.** The World Bank merely sees it as the process involved in "increasing the flow of taxes and other income into government treasuries."[14]. We adopt the OECD definition in this study, which is "the generation of savings from domestic resources and their allocation to economically and socially productive investments[15]".

[12] refer to < https://www.usaid.gov/what-we-do/economic-growth-and-trade/domestic-resource-mobilization>
[13] see< https://ec.europa.eu/europeaid/policies/financing-development/domestic-resource-mobilisation_en>
[14] See< http://www.worldbank.org/en/topic/governance/brief/domestic-resource-mobilization
[15] Refer to< https://www.oecd.org/site/devaeo10/44272298.pdf

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Domestic resource mobilisation can be mobilised from two primary sources; tax and non-tax revenue. Non-tax revenues are mainly raised from grants, dividends and profits from state corporations, and fines and fees charged for the use of government services. Taxation, however, has more significance in the determination of domestic revenue mobilisation. It is almost always higher than non-tax revenues, and it is the most complex element of domestic resource mobilisation globally. Issues of taxation are multi-disciplinary, which can find its way in various fields. However, tax has been defined by Taylor (1953) as "a compulsory contribution from a person to the government to defray the expenses incurred in the common interest of all, with little reference to the special benefit conferred". Resmi (2009) defines taxation as "the dues of the people to the state treasury under the law (which can be enforced) by not getting: reciprocal services (contra) directly demonstrated, and which is used by the state treasury to pay for general expenses." The OECD defines tax "as compulsory unrequited payments to general government"[16]. The term unrequited means that the benefits of tax are not distributed in accordance with ones' contribution. Granger (2013) has also recently defined tax as "a financial charge or other levy imposed upon a taxpayer (an individual or legal entity) by a state, or the functional equivalent of a state". In the Ghanaian context, Amponsah, et al. (2012) defined taxation as "any system that compulsorily ensures the surrender of control of an entity's private goods and or services to enable a government in the provision of public goods and services".

2.3 Tax reforms and the optimum DRM

The objective of taxation is to raise revenue for the state, which depends on the tax rate applicable.

Although raising revenues are an integral component of tax reforms, it is not without challenges. Tax rate determination is now more scientific than crudely fixing a figure and making a law to enforce it. It must consider issues such as equality, economic growth, and poverty reduction. Thus, there is an

[16] See< https://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=REV&Lang=en&Coords=[TAX]&backtodotstat=false>

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extent or an optimal level within which tax rate can be pegged to derive the optimum revenue without compromising these economic concerns. Arthur Betz Laffer theoretically espoused the relationship between tax rates and the optimum amount of revenues it is able to raise domestically.

Laffer (2004), distinguished between two effects that tax rates has on tax revenues. The arithmetic effect and the economic effect. According to Laffer (2004), if the tax rate is reduced during a tax rate reform, the cedi per tax base will reduce. The reverse is equally true for a tax hike. This is the arithmetic effect. On the other hand, the economic effect of reducing the tax rate factors in the positive impact that a tax cut will have on the tax base vis-à-vis variables such as employment and output. Thus, a tax cut will incentivise the tax base to put in more effort to increase productivity and employment. It is important to note that the Laffer curve does not conclude that a tax cut will increase domestic tax revenues. The impact of a tax cut or hike depends on the arithmetic and the economic effect, which works in opposite directions. On a general economic policy level, the resulting impact of tax cuts or hikes on revenues will depend on the tax system, the time of the tax rate reform, how swift one can move into the underground economy, the tax rates already in play, the pervasiveness of legal and accounting-driven tax loopholes, and the tendencies of the factors of production.

Alfred Laffer was not the first to consider an optimal tax theory. Indeed, the optimal tax theory provides the theoretical anchor on which tax reforms are based. It does have a significant influence on academic research in tax reform and public finance. Ramsey (1927) was the first to deepen understanding of the optimal taxation theory. Ramsey (1927) set off to design a tax system that raises maximum revenue from citizens to lower or reduce the system's distortions on the economy. Alternatively, he set off to maximise the welfare or utility of citizens by raising the taxes needed to finance such welfare. Ramsey's theory hinges on three assumptions;

1. The lump-Sum tax was prohibited in his theory.

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2. He also acknowledged that not all goods could be taxed. An example is leisure and
3. He also assumed that product prices are fixed. Thus, they face a perfectly inelastic supply curve. The maths of the theory thus normalises all prices to 1.

Where; price of good 'i', $p_i = 1$; Post-tax price of good 'i' $q_i = 1 + \mu$, Where μ is the specific tax on good "*i*"

The individual maximisation problem is established by setting the optimal tax equation, we first assume that there is only one individual who does not factor in the impact of the specific tax "μ" on government. This is because one person accounts for a small fraction of the total population.

The agent maximises his utility over '*n*' number of goods and '*n*' and labour "*L*" as,

$$U(x_1, x_2, x_3, \dots \dots x_n, L) \qquad eqn\ [2.1]$$

Subject to the budget constraint of the cost of the goods and his income given as,

$$q_1 x_i + \ q_2 \dots . . q_n x_n \leq wL + Y \qquad eqn\ [2.2]$$

Where "w" is wage and "Y" is non-wage income, with no taxes on his labour income.

The lagrangian function of the individual's maximisation problem is set as'

$$L = U(x_1, x_2, x_3, \dots \dots x_n, L) + \infty(wL + Y - (q_1 x_i + \ q_2 \dots . . q_n x_n) \qquad eqn\ [2.3]$$

Where "∞" $is\ the\ Lagrangian\ Multiplier$

The first Order Condition is given as;

$$U_{X_i} = \infty q_1 \qquad eqn\ [2.4]$$

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Where $\infty = \partial V/\partial Y$ This is the marginal utility of an extra dollar or the marginal value of money to the individual

The differentials result in a Marshallian kind of demand function $X_1(\ q, Y)$, and an indirect utility function $V(\ q, Y)$, where "*q*" is the entire price factor. That is the price for $(w,\ q_1, q_2, q_3 \ldots\ldots q_n)$

The Social Planners' problem is first set up by amalgamating all the utility of the individuals in society to satisfy them.

$$Max\ V(\ q, Y) \qquad eqn\ [2.5]$$

This becomes the objective function of the government. The maximisation of the welfare of individuals is therefore subject to raising enough revenue to satisfy the welfare. Which is given by,

$$\mu\ .X_i = \sum_{i=1}^{n} \mu\ X_i\ (\ q, Y) \geq R \qquad eqn\ [2.6]$$

The Lagrangian is therefore set as;

$$L = V(\ q, Y) + \beta \sum_{i=1}^{n} \mu_i\ X_i\ (\ q, Y) - R \qquad eqn\ [2.7]$$

Where, β is the lagrangian multiplier.

Differentiating the Lagrangian concerning "q" is the same as differentiating with respect to μ_i the tax on the goods.

Hence, $$\frac{\partial L}{\partial q_i} = \frac{\partial V}{\partial q_i} + \beta \left[X_i + \frac{\sum_j^n \mu_i . \partial x_j}{\partial q_i} \right] = 0 \qquad eqn\ [2.8]$$

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Where $\frac{\partial V}{\partial q_i}$ is the private welfare loss of raising the price of good "i", and X_i is the mechanical effect on the revenue. And $\sum_j^n \mu_i . \partial x_j \,/\, \partial q_i$ captures the behavioural response of a change in the tax. I.e. the loss in revenue emanating from a hike in tax resulting from a reduction in consumption.

The application of Roy's identity yields, $\frac{\partial V}{\partial q_i} = -\beta X_i$ eqn [2.9]

This means that, by applying the envelope theorem, the utility lost to a unit tax burden is the unit amount in tax multiplied by the number or amount of money spent on the good (in this case, "i")

Substituting $\frac{\partial V}{\partial q_i}$ into the lagrangian yields equation 2.10

$$(\beta - \infty)x_1 + \frac{\beta \sum_j^n \mu_i . \partial x_i}{\partial q_i} = 0 \qquad eqn\ [2.10]$$

The difference between β and ∞ indicates the marginal value of a dollar to the government relative to the individual. It is possible that the government may value money more than the individual. This is especially true where the public good provided is beneficial to society.

The optimal tax rate will therefore satisfy a system of "n" equations and "n" unknowns

$$\sum_j^n \mu_i . \partial x_i \,/\, \partial q_i = \frac{x_1}{\beta}\ (\beta - \infty) \qquad eqn\ [2.11]$$

Equation 2.11, therefore, is the optimal tax specification according to Ramsey. From the Ramsey model, it is generally concluded that;

1. Inelastic goods should be taxed more to lessen the efficiency cost.
2. Ramsey did not factor in the redistribution objective of the social planner (government). A problem that Diamond (1975) addressed later.

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3. Because necessities are less elastic than luxuries, the optimal tax system a' la Ramsey (1927) is more regressive.

Although Ramsey's model has been very instrumental in tax theory and practice, especially in the provision of public goods, the question that surfaces are why Ramsey (1927) imposed a tax system on the social Planner? Why does he not expose all the possible tax schemes to the Social Planner, together with the non-linear and symbiotic taxes on goods, income from different avenues, and the different non-economic peculiar characteristics? This question stems from the fact that optimal tax theory aims to get the best tax system. Mankiw (2009) indicates that if we expose the social Planner to all the available systems, the social Planner's problem becomes easy. Lump-sum taxes will be the order of the day. This is because in an economy made up of a representative consumer, that consumer will pay the tax revenue requirement of the Social Planner one way or the other. It is important to note, however, that not many countries rely on lump-sum taxes. This is mainly due to the equity challenges associated with it; any lump-sum tax must be based on the ability to pay. Such information on the heterogeneity in the consumer's ability to pay will help the Social Planner design a lump-sum system that addresses the inequality challenges. Moreover, since these taxes do not depend on individuals' choices, they rarely distort consumption and production.

Mirrlees (1971) was the first to tackle the defect of the Ramsey model. He incorporated the idea of a lump-sum tax. His theory focuses on the trade-off between redistribution and efficiency. His primary focus is to tax higher those who can pay and give transfers to those with low income who cannot pay in his model. However, the Social Planner also want to make sure that he does not raise tax so high on those with ability, to feign inability to pay. The Social Planner also has to make sure that those in the higher income group are not dis-incentivised to produce at a lower level, although higher taxes are directed to them. The theory is based on the following deductions;

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i. $T(\mathrm{I})$ is the tax liability of an economic agent. Thus in this model, the tax is not a linear function, but it is a function of the agent's earnings.

ii. Let the size of the transfer to an economic agent with zero earnings be given by $-T(0)$

iii. The marginal tax rate is given by $T'(I)$ where agents keep $1 - T'(I)$ for any \$1 made by the agent. This means that the size of the non-earnings transfer reduces with every dollar made by the agent.

iv. The participation tax rate $\tau_p = [T(I) - T(0)]/2$, means the agent gets to keep a portion of his earnings $1 - \tau_p$ when his earnings increases from 0 to I.

v. $I - T(I) = -T(0) + I - [T(I) - T(0)] = -T(0) + I.(1 - \tau_p)$ Thus, the net earnings of the agent is the transfer he/she receives when income is nil in addition to the margin of his income he/she gets to keep after tax. This presupposes a point where there is neither transfer nor tax payment from the individual. We symbolise that point as I^*.

vi. The breakeven point $I^*$is thus the point at which $T(Z^*) = 0$

We first examine the situation, assuming there are no behavioural responses.

1. Assuming that the utility function of the individual is given by $U(y)$, which is increasing and concave, it is also homogenous where(y) is the after-tax income.

2. Income is denoted by "*I*", it is fixed for all agents $y = I - T(I)$, $T(I)$ *is the tax on I*

3. The summation of all individual utilities presents the government with a maximisation problem given by;

$$\int_0^{\infty} \big(I - T(I)\big)\, h(I) dI \qquad eqn\ [2.12]$$

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This objective is subject to the constraint of

$$\int T(I)h(I)dI \geq R \qquad eqn\ [2.13]$$

Where R is the total revenue needed to be raised to finance the objective function.

The lagrangian is set for maximization as;

$$\text{L}= \int_0^{\infty}[u\,(I - T(I)) + \Omega.T(I)].h(I) \qquad eqn\ [2.14]$$

The FOC for $T(I)$ the problem is therefore given as

$$0 = \frac{\partial L}{\partial T(I)} = \left[-U'\left(I - T(I)\right) + \Omega\right].h(I) \qquad eqn\ [2.15]$$

$$U'\left(1 - T(I)\right) = \Omega \qquad eqn\ [2.16]$$

$$I - T(I) = Y \qquad eqn\ [2.17]$$

This is constant for all agents

$$Y = \bar{I} - R \qquad eqn\ [2.18]$$

Where $\bar{I}$ is the average income of the economy? Observably, in this model, taxes could be levied even if there is no need to raise revenue to finance public goods' provision because of the redistribution function of taxes.

Where $\bar{I} = \int Ih(I)dI$ $eqn\ [2.19]$

I.e. is the average income. We now assume an optimal tax with behavioural responses

1. we begin by assuming a standard supply of labour model where the individual maximises

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$U(K, L)$, Which is subject to $K = wL - T(wL)$ where K is consumption, and L is labour supply, w is wage rate and $T(.)$ is the income tax.

2. We also assume that there is individual variation in abilities as such, there is a density function wages (w) given by $f(w)$

3. The government's social welfare maximisation problem is set as;

Social Welfare $= \int G\big(u\ (K, l)\big) f(w) dw)$ eqn [2.20]

We put a welfare weight of "G" in the function (noting that, this is based on the distribution preferences of the social planner, the planner could put more emphasis on low-income earners). This objective function is subject to two constraints; first, the revenue needed to be mobilised to finance the welfare which is given by;

$\int T(\ wL) f(w) dw) \geq R$ eqn [2.21]

And the second constraint is that the individual FOC is given in the equation below. Again, this motivated by the social planner's drive to satisfy all the individual utilities. Thus, the system will have to be incentive compatible.

$w\big(I - T(I)\big)u_k + u_l = 0$ eqn [2.22]

The Mirllesian approach thus maximises the weighted sum of ex-post consumption. His optimal tax trades off revenue and redistribution. According to him, the optimal tax should be negative to individuals with low income. Thus transfers should be given to such people. He also concludes that positive transfers should apply only to those making more income.

$T(.) < 0$ for the bottom transfers and

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$T(.) > 0$ For those at the upper level

The Mirleesian model has only two general results; the marginal tax rate is somewhere between zero (0) and 100%, and also, the marginal tax rate should be zero at the top of the skill distribution. A fallout of this theory is the complexities with which policymakers must work with. Incentive-compatibility constraints required so that individuals do not produce as if they had lower levels of ability makes the optimal tax problem much harder.

Diamond, and Mirrlees (1971), focused on the consequences of taxes on production theoretically. They observed that irrespective of the tax system in place, production efficiency is desired, and as such, there is the need not to tax intermediate inputs. Thus, to be on the production possibility frontier, intermediate products should not be taxed. Atkinson and Stiglitz (1976) also theoretically combined the Mirlleesian model of optimum commodity tax with optimal progressive income tax to reveal how commodity taxes should be implemented in the face of optimal income tax. Their results differed from Ramsey (1927) exposition on commodity taxes. They conclude that if a country has access to progressive income tax, they do not need consumption taxes. However, this model falls short on its assumption that there should be no taxation of capital, but Chamley (1986) and Judd (1985), in separate works, found out that it is possible to levy taxes on it in the short run. However, such taxes may not be desirable in the long run.

Dixit and Sandmo (1977) worked on interpreting the optimal income taxation by changing the model of some result in a structure that permits using analytical tools of optimal commodity taxation. Linearising the income tax and using elasticities, the equity-efficiency trade-off was seen more readily than the previous formulas. The optimal tax on capital, in the long run, is thus zero (0). Saez (2001) also derived the optimal income tax by employing compensated and uncompensated elasticities of earnings of tax rates. Employing elasticities Saez (2001) revealed the different economic implications

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of the significant parameters of Mirrlees optimal tax formula. He also expressed the optimal non-linear tax rate formulas in elasticity terms and the shape of the income distribution. The formulas were numerically implemented by employing empirical earning distributions and some realistic elasticity considerations.

Can behavioural agents be added to the Ramsey and Mirrleesian model? Gabaix and Farhi (2017) respond by developing an optimal tax rate using a behavioural framework that incorporates behavioural biases such as internalities and misperceptions. Revisiting the three main optimal tax pillars, linear commodity taxation by Pigou, linear commodity taxation for revenues and redistribution by Ramsey, and Mirrlees' non-linear income taxation, they altered the optimal tax formulas three pillars and incorporated nudges in the optimal taxation frameworks. Their exploration of the Diamond-Mirrlees productive efficiency result and the Atkinson-Stiglitz uniform commodity taxation proposition revealed that it is likely that these theories are likely to crush if behavioural agents are inculcated in the model. The theory of optimal taxation has also witnessed significant contributions from Tuomala (1990), Salanie (2003), and Kaplow (2008), all juggling with the Mirrleesian approach without significantly different alterations to the outcome of the theory.

The theories have been informative, revealing and insightful, but are the empirical accounts supporting the theories? If they are, are the findings any different in terms of inter-country comparison? It is worthy of note that optimal tax theories have been criticised for their impracticality in developing countries. The criticism is thunderous when it comes to the data needed to practicalise it. The data is either scarce or non-existent in developing countries. The theory does not also zoom in on tax administration. It assumes that tax administration is perfect, which may not be the case in many developing countries.

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2.4 What determines tax revenue mobilisation?

Since Kaldor (1962) exposed the sluggish nature of revenue performance in developing countries, inquisitions on potential sources of tax revenues have driven the philosophy of taxable capacity (Addison and Levin, 2012). An economic evaluation of taxable capacity is more revealing compared to GDP by employing cutting edge regression techniques that meet the requirements of the central limit theorem. Traditionally, Chilliah (1971), Bird et al. (2008), Motsati (2008), and Alabede (2018) all recognise that per capita income, population growth, trade openness, and the share of agriculture in GDP are the main macro-economic factors that drive tax revenue. According to them, the per capita income of a state is a measure of its level of economic development. Therefore, a hike in per capita income is expected to raise the demand for public goods and services, which has a significant bearing on the level of tax revenues needed. Countries with high development will have a high tax capacity, thereby improving domestic resource mobilisation. They, therefore, find a positive relationship between per capita income and tax revenue mobilisation.

Alabede (2018) asserts that the essential regressors in conventional tax effort models are the tax handles; these factors explain the country's economic structure. Among these handles include trade openness and demographic characteristics. Openness denotes the extent to which the economy is opened to foreign economies for business. Tanzi (1989) and Frankel and Romer (1999) have indicated an indirect relationship between trade openness, imports, and revenue performance. This is primarily due to the behavioural of consumption and production to price changes informed by trade reforms. The elasticity of import demand, together with the price elasticity of supply for import substitutes, is likely to be affected by a reduction in import tariffs. In scenarios where the import demand is inelastic, import volumes and revenue performance will be unchanged, notwithstanding the price changes induced by the high import tariff reform. However, import volumes and revenue performance will experience variations should import tariff induced price changes; if the import demand function is

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elastic, this sums up the theoretical position on openness. Gaalya et al. (2017) assert that trade openness promotes the export and import of efficiently produced goods, lowers the prices and goods and services, raising real income and producer and consumer welfare and higher total fa tor productivity. Given the above, Teera (2003), Gupta (2007), and Hisali (2012) found a positive relationship between trade openness and tax revenue mobilisation.

Concerning demographic factors, Gaalya et al. (2017), Alabede (2018), Schmelzle (1948), Goudswaard and Van de Kar (1994) were the primary studies that settled on demographic factors as a potential variable that affect tax revenue performance. Higgins (1998) reveals three mechanisms through which demographic factors affect fiscal policy. First, according to the study, the ageing population dampens the active labour force, raising the dependency ratio. Secondly, the hike in dependency ratio depresses private savings. The last straw is the seeming pressure on public fiancé vis-à-vis increased pension and healthcare expenditure. The spending that ensues widens budget deficits and shrinks public investments. In this regard, countries with a high population could be characterised by low revenue performance due to reduced economic activities. Bahl (2003), and Bird (2008), who identified population as a supply-side variable posit that, countries with a high rate of population growth might not be able to absorb new taxpayers as compared to their counterpart with slower population growth as such, there was a negative relationship between population growth and tax revenue mobilisation.

Observably, agriculture is an important sector in many developing countries; it supports the livelihood of many people because of its inclusive nature and the subsistent level within which it is organised. However, owing to the informal nature of agriculture is organised, tax revenue mobilisation in the sector is difficult (Addison and Levin, 2012). This development is because most farmers are peasant farmers who barely go through a tax assessment. The inability of the revenue authorities to assess these farmers is because of the high cost involved in undertaking such an exercise. Given these

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developments, Ghura (1998), Gupta (2007), and Addison and Levin (2012) posit a negative relation between agriculture and tax revenue mobilisation.

Ghura (1998) expanded the conventional regressors to include other macroeconomic variables. Such as inflation to the list of regressors. This is because, in regimes of high inflation, business fundamentals are eroded, and the cost of doing business rises. This is especially true for companies that cannot pass the additional cost to consumers. In such circumstances, tax evasion and avoidance behaviour may be encouraged, and which may lower the overall tax revenue. Alternatively, if inflation is mild with slow growth, income will rise in line with growth in inflation, especially when the government does not raise the income tax threshold.

Runde et al. (2014) assert that foreign direct investment inflows improve and raise the competitiveness of countries because of the inflows and the technological transfers, which also improves GDP and economic growth. On the other hand, Bayer and Ozturk (2018) argue that there is no theoretical conclusion on the relationship between FDI and domestic revenue performance because such a relationship could be established indirectly. Thus, through the economic activities that FDI promotes, the economy's tax base expands, and revenue grows. Thus, FDI inflows raise productivity through improvement in the capital stock, technological transfer, know-how, and human capital improvement (Hlavacek and Domanska, 2016). However, this relationship could be offset by the high tax holidays, rebates and concessions given to investors to incentivise them to invest in the home country. The conclusions as far as FDI is concerned have been divergent; While Razin et al. (2005); Beck and Chaves (2011); and Varol et al. (2015) all revealed a negative relationship, while Groppve Kostial (2000); Sarisoy and Koc (2010); Mahmood and Chaudhary (2013); Okey (2013); Bunescu and Comanicu (2014); Odabas (2016); and Bayer and Ozturk (2018) found a positive relationship between FDI and some measure of domestic revenue performance.

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Aid has also been added to the basket of regressors in some studies. Gang and Khan (1991); Iqbal (1997); Rubino (1997); McGillivary and Amed (1999); and Osei et al. (2003) in Ghana have all contemplated on the aid revenue relationship but arrived at different conclusions. The reason why the literature is divergent is that the argument that supports this variable is not straightforward. Whiles public finance experts in Africa acknowledge that taxation cannot support all the development needs of developing countries, and as such, agree that aid could make up the funding gap, the question that arises remains whether aid is used to cushion the budget of developing countries or there is a substitution effect. Thus, theoretically, the social Planner has two choices when aid is given him; the Social Planner can choose to invest the total amount of the aid on public goods or lower the tax effort of the country or in the words of Gambaro et al. (2007), borrow to keep the budget spending constant. The substitution effect of aid has been examined primarily on public expenditure under the term 'aid fungibility' by Devarajan et al. (1999), Gupta et al. (2003), and Njeru (2003). This study partially examines the revenue side implications to form some conclusive evidence by including aid in the regressors; we fall on the WDI for data on aid. We specifically use net ODA as a percentage of GNI. We expect a positive relationship because of the seemingly dwindling aid fortunes of Ghana over the last decade. We envisage that the strength of institutions is critical to the revenue mobilisation story, and as such, we measure this with data on institutions from the international country risk guide data set. We expect a positive relationship on an apriori level.

As part of an effort to move beyond the conventional variables to explain tax revenue mobilisation, institutional factors have also been identified as potential regressors. Most of these variables revolve around corruption and compliance measures. Tax revenue compliance is critical in every tax revenue assessment strategy. It is important to note that, where minimum corruption and the strength of tax collection institution is high, tax revenues are high. Nawaz (2010) opine that more than half of the tax revenues collected by government treasuries in developing countries could not be traced to the

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treasury due to corruption. So severe is the impact of corruption on tax revenue that they practically erode the economy's tax base. Tanzi and Davoodi (2000) found strong evidence on the correlation between corruption and different taxes and established a robust negative relationship between corruption and these tax revenues. Ashraf and Sarwar (2016) also looked at the impact of institutions on tax revenue buoyancy in 50 developing countries. They found out that factors such as bureaucratic efficiency, the rule of law and corruption have negative impacts while democracy confers positive impacts on tax revenue.

Alabede (2018) opines that, although the conventional variables focused on the impact of the economy's structure on the tax revenue mobilisation, the literature has not been able to unravel the factors leading to lower tax revenues. Therefore, it is expedient to expand the regressors to factor in government interventions in the economy and their impact on the tax effort. Given the preceding, tax reforms which are critical interventions made by governments, could provide a breakthrough in explaining the revenue phenomenon. Thus, in addition to the macro variables, administrative tax reforms could provide a path for understanding DRM mobilisation. Furthermore, a myriad of policies suffices as tax reforms. These include changes in the tax laws, administrative setup changes, and new policies regarding tax revenues.

Most studies and reports on administrative tax reforms have focused on descriptive statistics with no rigorous econometric analysis accompanying the conclusion. For instance, Baer (2013) reviewed how 40 countries deal with large taxpayers and how effective their strategies have been without any rigorous estimation. The study identified government commitment, the need to incorporate large taxpayer units into broader tax reforms, and continuous tax reforms as critical to large taxpayer units' success. Kloeden (2011) also looked at the impact of revenue administration reforms in 16 out of the 19

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Anglophone Africa countries, and his conclusion indicates that challenges persist, particularly in an administrative capacity.

Most studies on administrative tax reforms have focused on three areas: creating a semi-autonomous revenue authority (SARA), the implementation of VAT, and the setting up of large taxpayers' unit (LTU). It is worthy of note that some studies were specific on the kind of administrative reforms they wanted to look. Kidd and Crandall (2006) looked at one type of administrative reforms (the effectiveness of SARAs) specifically on tax administration and concluded that there is nothing to suggest that countries with revenue authorities perform better than countries without revenue authorities. On the other hand, Keen and Lockwood (2007) focused on the introduction of the VAT system and its impact on revenue generation. Using a panel of 143 countries and observing over 25 years, the study concluded that the introduction of VAT has indeed impacted positively on domestic resource generation. With an eye on a single country study on the effect of VAT reforms on DRM, Teefera (2004) and Alemayehu (2004) confirmed that there had been some positive impact of VAT on domestic revenue for Ethiopia. The above studies were on the macro level, but Talierco (2004), basing his conclusion on microdata, takes the administrative reform conversation to Latin America, specifically Bolivia, Mexico, Peru, and Venezuela. He employed primary data from professionals. With a firm econometric technique, the study outcome revealed performance indicators that support the premise that performance, perceptions of credibility, and the autonomy of the revenue authority are linked. Fjeldstad and Moore (2009) also studied revenue authorities in sub-Saharan Africa. Their conclusion supports Kidd and Crandall (2006) that, although the revenue authorities were created to enhance revenues, they have done little on that, but their presence also aids the government in raising revenues. Dom (2018) also focused on making revenue institution semi-autonomous and impacting domestic revenue mobilisation in 46 countries from 1980 to 2015. The study revealed that there was no impact on revenue generation attributable to making revenue institutions autonomous. This finding

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was also affirmed by Mavungu and Krsic (2018), who moved from assessing only one type of reforms to three, and further controlled for time fixed effects and relevant covariates using data from 1980 to 2013 from 46 countries in SSA. They demystified the revenue-generating capacity of tax reforms as laid out in existing literature. Their study did not find any evidence that making revenue institutions autonomous, introducing VAT, and creating a large taxpayer's unit increased tax collection performance in Sub-Saharan Africa. It is pretty revealing how most of the studies on tax revenue productivity or domestic resource mobilisation is carried out on the multi-country level.

Ghana has made many administrative reforms that have not been researched. It is essential to see the effect of all the significant reforms and their impact on domestic revenue mobilisation so that the policies that gave rise to these reforms could be evaluated. Thus, the analysis must move from the aggregate impact to the effect of some specific reforms on DRM. Also, while we agree with Kaldor (1962) that tax is an under-development problem, we believe that the nuances that come with country experiences are obscured in panel studies and that is a bi-compass country study will be more relevant for tax policy reform assessment. Unfortunately, the empirical literature, particularly on the single country study, is scanty or non-existent. In the spirit of this, this study finds relevance and a gap as far as the Ghanaian economy is concerned.

In conclusion, the data frame of all the previous analysis has changed; indeed, it has been expanded, the old studies no longer have significant relevance in policy circles, a new study that takes cognisance of current Ghanaian development problems in light of current development priorities must be interrogated using current estimation techniques. This chapter attempts to contribute to the tax buoyancy and elasticity literature to fill this void.

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2.5 The Ghanaian Economy in Perspective

Described as a shining star and a model economy before independence, Ghana's economy lost its shine owing to political instability and bad economic management throughout the 1960s to the mid-1990s. Assisted by the World Bank and the IMF, Ghana began a series of programs to recover the economy from the slump it was experiencing in the early 1980s. Although many quarters describe those programs as largely successful[17], it was the restoration of democracy in 1992 and the subsequent change in government in 2000 that saw the economy regaining investor confidence and recording good macroeconomic indicators.

2.5.1 Macro-Economic Trajectory

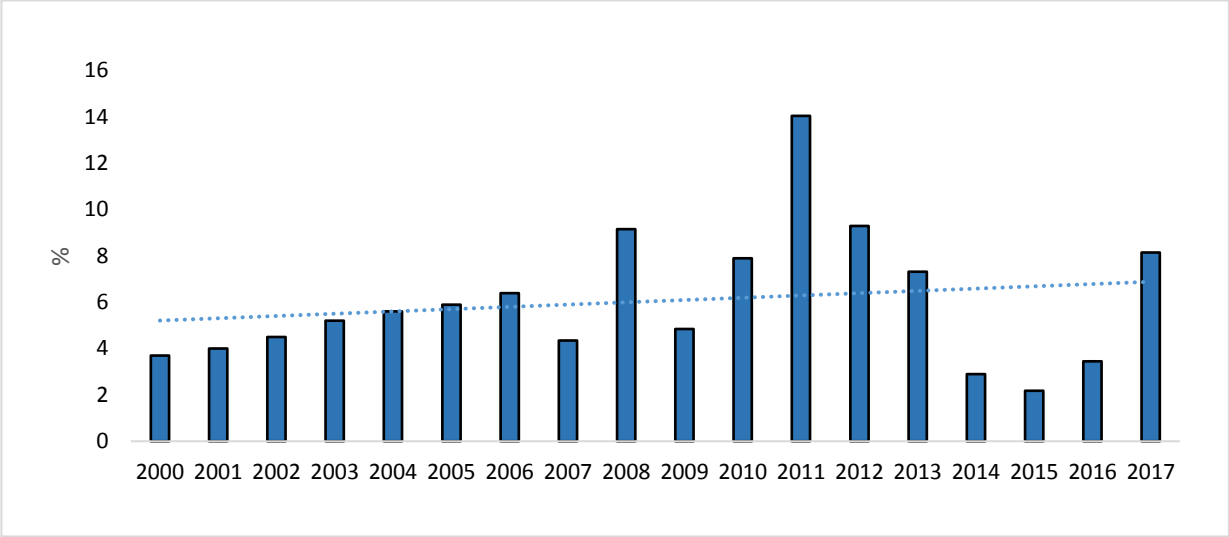
The macroeconomic story of Ghana is a mirror image of its political history. In 2007 Ghana observed half-century as an independent country. Macroeconomic aspirations were brimming with confidence in the early years of independence, but a series of instability staggered early gains until 2000, when the base of the economy became resilient, building a solid foundation for macroeconomic gains consolidation. The economy of Ghana is built on natural resources and raw materials export, such as cocoa beans. Until 2010 when crude oil export began, gold, diamonds, manganese and bauxite were the leading natural resource on which the economy was based. The enactment of a new mining and investment code ensured maximum macroeconomic gains from the mid-1990s to the early 2000s.

[17] See < https://apps.dtic.mil/dtic/tr/fulltext/u2/a620425.pdf>

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The gains achieved in the 2000s strengthened the economy's macro credentials, and the completion

Figure 2.1: GDP Growth

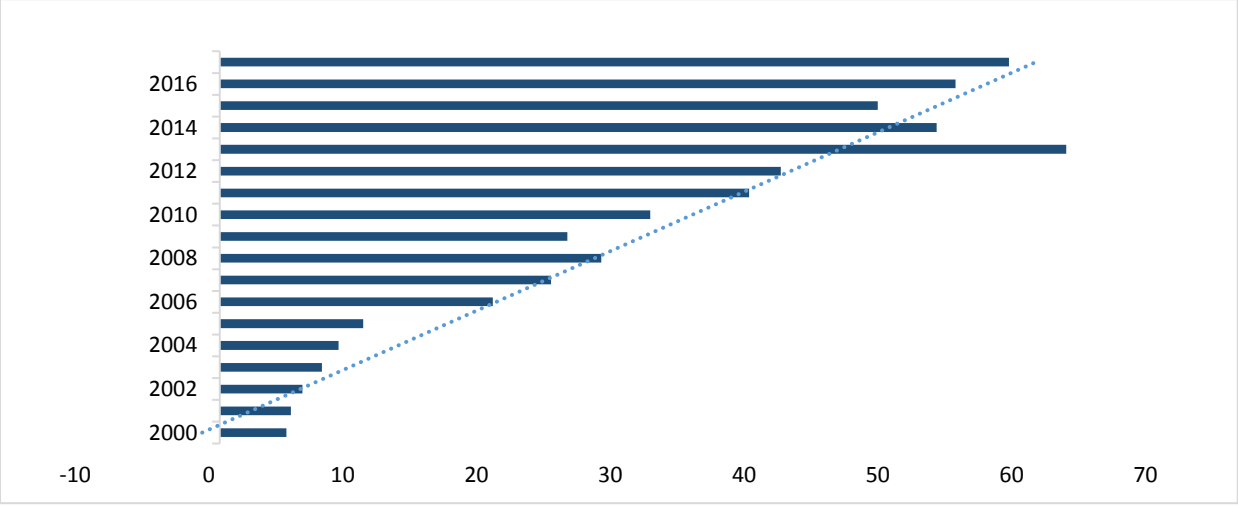


Source 2: WDI

of the Highly Indebted Poor Country program (HIPC) raised the country's growth prospects.

The successes recorded led the country further into a lower middle-income country status in 2006. The economy consolidated its gains with improvements in the management of its extractive resources and human capital. Buoyed by the natural resource sector, the nominal size of the economy

Figure 2.2: Nominal GDP (GHc Bill.)



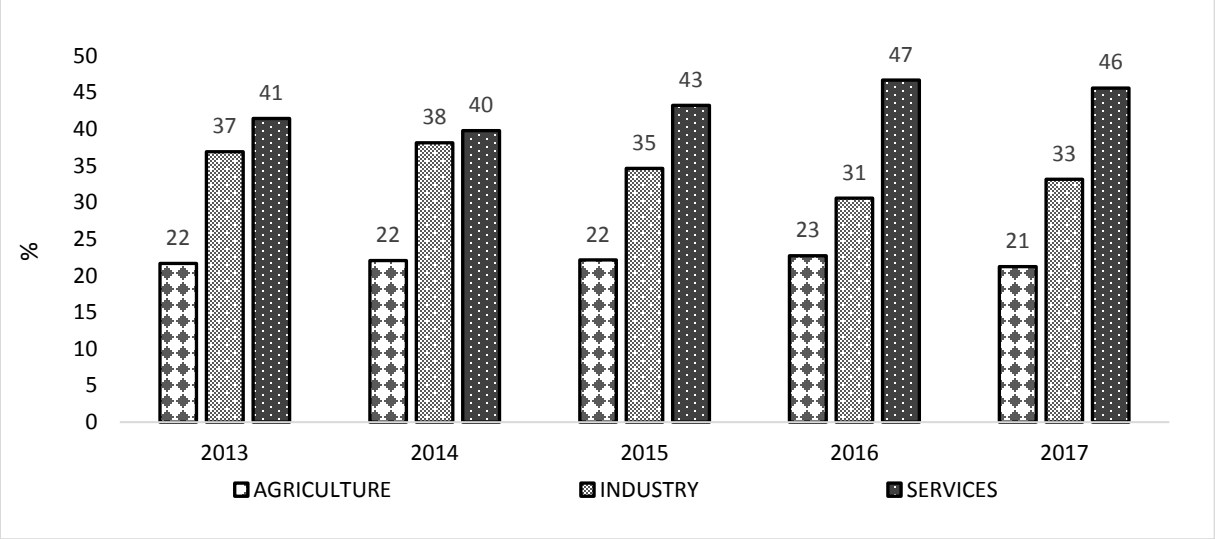
Source 3: WDI

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quadrupled between 2003 and 2008. In addition, the discovery of crude oil products doubled the size of the economy between the years 2008 to 2011.

The subsequent coming on stream of other oil production fields raised the size of the economy by about 50% between 2011 and 2013. Between 2013 and 2017, the nominal size of the economy has

Figure 2.3: Distribution of GDP



Source 4: GSS

seen an expansion of about 90%, mainly because of developments in the natural resource sector. Although most of the economic history of Ghana describes it as an agrarian economy, the current narrative per emerging data indicates otherwise. The services sector as of 2009 contributes the highest to growth; it contributes highly to economic growth in Ghana. Spurred by investment in banking, telecommunication and transportation, the sector between 2013 and 2017 contributed on average about 43.4% of GDP. Indeed, the growth trends and composition of the country's GDP defy development theory which suggests that transitioning economies must first move from being agrarian to one supported by industry and then to the services sector. The industrial sector in Ghana has always played second fiddle. The sector is the second-largest and is heavily supported by the extractive sector. The manufacturing sector and the timber industries played significant roles, but good management in

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the mining, oil, and gas sector and the demise of the timber industry has put the extractive sector ahead in the industrial sector. The mining and quarrying sector was busy in 2011, 2012, 2013 and 2014 when gold prices were at their peak in the international market. There are also significant activities in agro-processing, with Ghana processing about 30% of its cocoa locally and the pharmaceutical sub-sector. Currently, the government of Ghana has an ambitious plan[18] to make the manufacturing sector viable again. Critical in the plan include supporting the private sector to put up factories in every district (Owing to the failure of government enterprises in the 1960s, the policy has reduced government's role to only assistance and not the principal shareholders of these businesses), improving macroeconomic environment, and empowering the private sector capacity. The Agricultural sector, spurred by cocoa, contributes the lowest to GDP. Price levels have assumed interesting figures in recent years. Although interest rates (borrowing rate) are disturbingly high, the central bank has reiterated its commitment to bringing it down. Their policy stance has strongly reflected in the downward nature of the bank's policy rate. As of the end of January 2019, data from the Bank of Ghana put the policy rate was 16%. All the other rates have also recently assumed a downward trend to strengthen the government's efforts at bringing the cost of borrowing down. The table below gives the Treasury bill rate between 2013 and 2017.

Table 2.1: Interest Rates in Ghana

YEAR	TBR-1 YR.	TBR-182 DAY	TBR-91 DAY
2013	17.0	18.8	18.8
2014	22.5	26.4	25.8
2015	24.5	24.4	23.1
2016	21.5	18.5	16.8
2017	15.0	13. 8	13.3

Source5: Bank of Ghana

[18] The one-district-one factory initiative

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However, there seems to be an inelastic response between the policy rate and the bank lending rate. This has poorly affected the country's performance on the World Bank's ease of doing business indicator (70, 120, and 114) in 2013, 2018, and 2019 respectively.

After assuming unprecedented levels in the early 1980s, inflation has averaged about 13% between 2007 and 2017 and resulted in a single-digit figure of 9.4% as of December 2018. As shown in figure 2.4, the trend indicates that there has been significant progress in bringing inflation down within the

Figure 2.4: inflation trend in Ghana

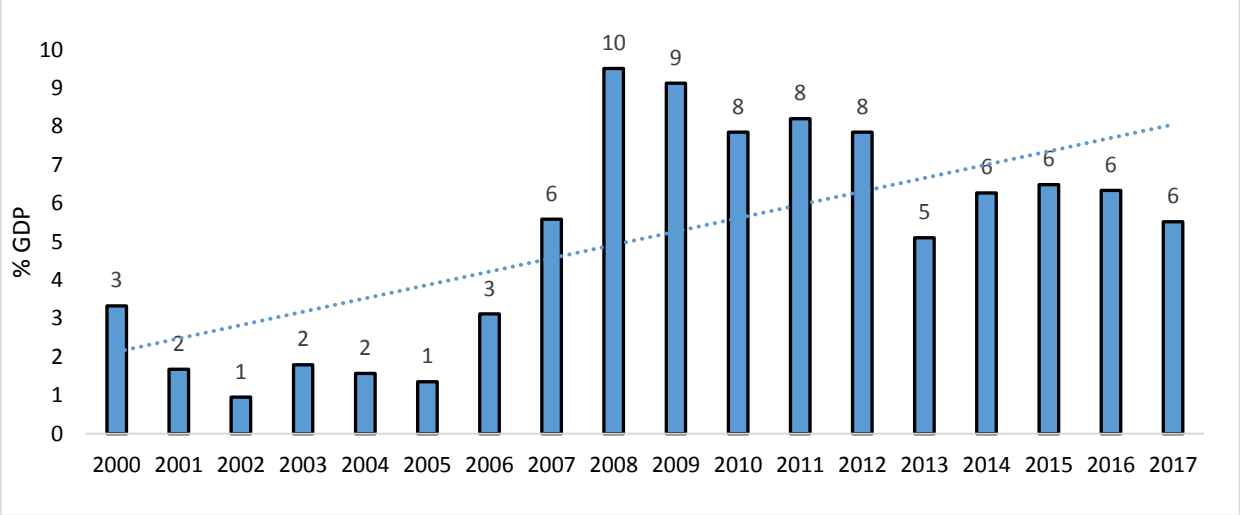


Source 6: World Bank (WDI)

last decade and a half. Mainly due to the adoption of inflation targeting strategies by the Bank of Ghana. Although assuming a downward trend, Ghana's inflation trajectory indicates that elections years are the worse. Inflation in Ghana is also everywhere, a food and oil price phenomenon. It responds sharply to changes in elements of these items in the inflation basket. The reduction in inflationary pressures and the booming extractive sector has opened up the economy for investment. Indeed, foreign direct investment inflow has averagely grown at about 6% of GDP from 2014 to 2017. The extractive sector dictates FDI in Ghana. Figure 2.5 below pictorially demonstrate the pace of FDI in Ghana. Together with Oil and Gas sectors, the mining sector has attracted the most resources in

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Figure 2.5: FDI trend in Ghana



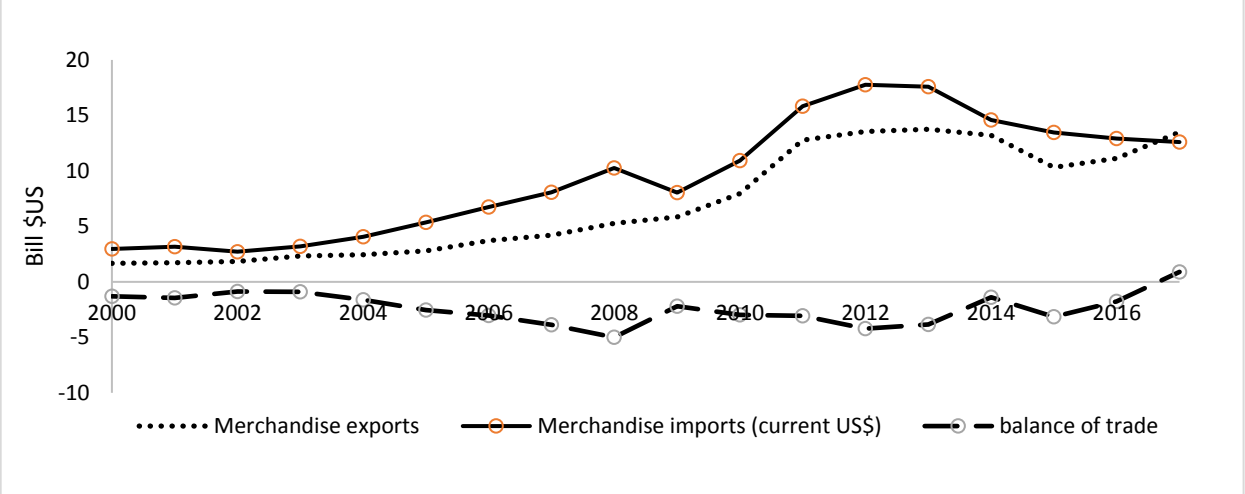
Source 7: World Bank (WDI)

recent years. It is investments in these sectors that have moved Ghana from 8th to the 7th position in the league of countries that attracts the most investment in Africa[19]. The pace of FDI inflow is expected to improve, especially as new oil fields are being discovered, and the government is making a huge investment in electricity and natural resource infrastructure to entice investors. Robustness is seen in the external accounts of Ghana as detailed in figure 2.6 below, with surpluses recorded in the balance of payment account in the years 2009 and 2010. However, the current account and the trade accounts have always been in deficit save for 2017, where a surplus was recorded. The year 2008 recorded the highest trade account deficit. This is the impact of the usual disarray that occurs in economic indices during elections. Figure 2.6 below presents an overview of the trading account of Ghana between 2000 and 2006. Ghana's export has been dominated by mineral product.

[19] See < https://www.ey.com/Publication/vwLUAssets/ey-attractiveness-program-africa-2017-connectivity-redefined-france/$FILE/ey-attractiveness-program-Africa-2017-connectivity-redefined.pdf>

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Figure 2.6: Merchandise Account



Source 9: WDI

The mining sector contributes more than 30% of the country's products, with Cocoa beans, other agricultural products, and crude oil export making up the rest of the export. Imports are primarily dominated by consumables and petroleum products from other countries. Since 2000, imports have averaged about US$9 billion, whiles exports averages about US$7 billion. The performance in the external sector has left the exchange rate falling freely against the major trading currencies.

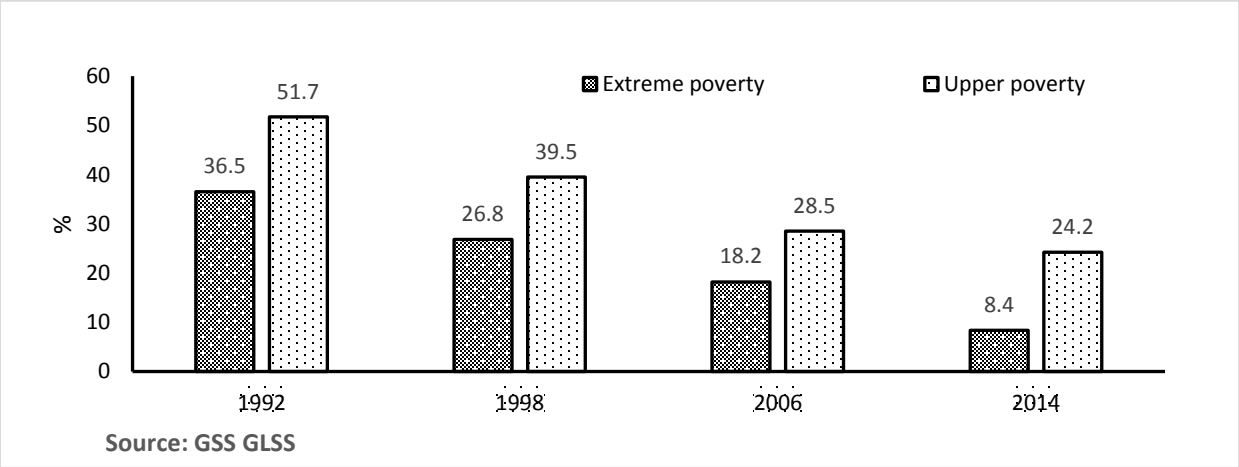
2.5.2. Social Sector Developments

Currently, the second largest population in West Africa, Ghana's population has experienced growth in high population growth economies. The high population growth is attributed mainly to the improvement in the standard of living, reduction in the death rate, and high birth rate. The death rate had reduced from 10 in 2000 to 8 in 2017, whiles the birth rate has also reduced from 35 to 31 in the same period. From the world development indicators, the population of Ghana grew on average at 2.5% per annum from 2000 to 2017. As of the year 2018, the population stood at 30 million. A disturbing observation in the population dynamics is that urban population growth has since 2000 been higher than rural population growth. A puzzle that policymakers may have to unravel, especially as the urban population is more educated. It has averaged about 3.8% between 2000 and 2017

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compared to 1.2% in the same period for rural population growth. Though employment data are hard to come by, it is worth stating that employment lags behind population growth. According to the 2014 African Transformation report, employment on average rose by 3.5% between 2000 and 2010, but most of the jobs were in the informal sector. With a high labour force participation rate of 77% in 2018, firms in the manufacturing sector have an impressive workforce at a cheaper rate. Figure 2.7 gives a visual summary of poverty levels in Ghana.

Figure 2.7: Poverty levels in Ghana



Education has seen an average steady public investment of about 6.2% GDP between 2000 and 2017. The investment has culminated in improvement in enrolment from 61% to 87% in 2013. Whiles the literacy rate had improved from 57 in 2000 to 71 in 2010 and 87 in 2013. Given this, Ghana met the Millennium Development Goal on universal primary education and gender parity in primary school. Though progress could be seen in the sector, other targets were missed (primary school completion). Because of this, the government has put in place measures to improve the quality of education in Ghana. Key among them include the school feeding program, the free senior high school program, and the provision of educational infrastructure nationwide. Although there are new global development goals, Ghana also achieved the MDG target of reducing poverty by 50% before the 2015 deadline. The poverty incidence fell by 44.9%, from 51.7% in 1992 to 28.5% in 2006. However, the

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spate of inequality seems to be widening in Ghana. The Gini index had risen from the 1990 figure of 36 in 1990 to 43 in 2005.

However, the economic gains made in Ghana have not generally transformed the economy; transformation has been marginal compared to some of Ghana's African peers. Relying on the African Transformation index developed by the African Centre for Economic Transformation (ACET), we notice the 2014 transformation report.[20] The high transformers on the African continent are Mauritius, South Africa, Côte d'Ivoire, and Senegal. Ghana was the sixteenth best-transformed economy out of the 21 countries the report focused on. Although the oil discovery has provided much-needed fiscal space, the other sectors are not buoyant enough to support the extractive industry. As such, the economy weakly performed in the diversification, productivity, and technology sections. The economy was, however, firm in export competitiveness and human wellbeing categories. More needs to be done to transform the economy massively. Nevertheless, there are prospects in light manufacturing, tourism development, horticultural exports and cocoa processing.

2.2 Fiscal Developments in Ghana

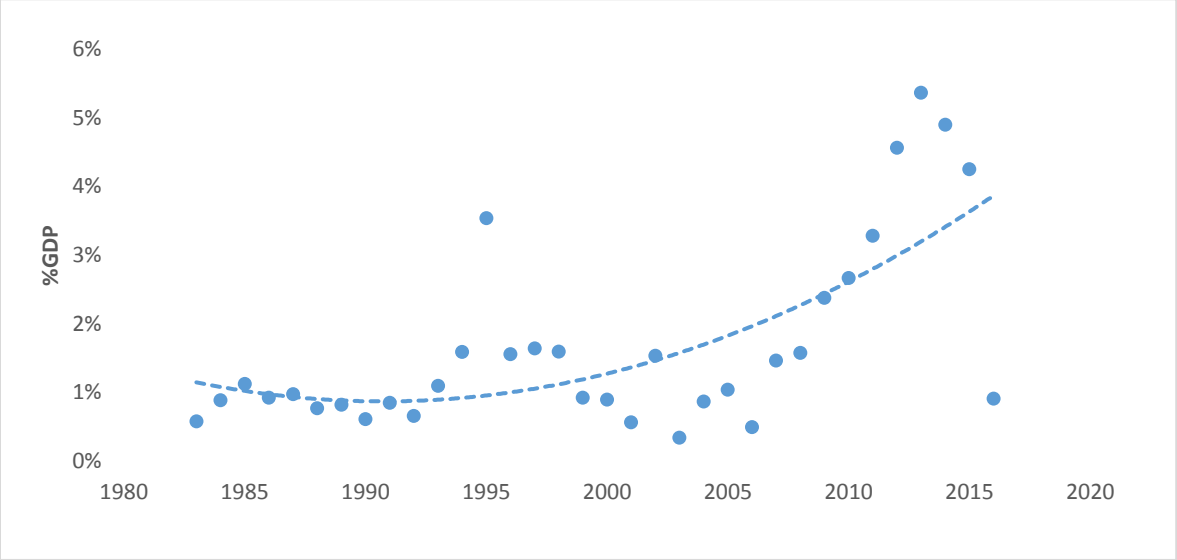
Tax revenue, debt mobilization continues to finance development in Ghana. Although non-tax revenue has some role to play, it is not in the aforementioned areas' dimensions.

[20] See<http://acetforafrica.org/acet/wp-content/uploads/publications/2016/03/2014_acet-african-transformation-report-overview.pdf>

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According to ICTD data, between 1983 and 2016, it averaged just about 2%. Fiscal sustainability remains a topical issue in Ghana because a sustained rise in public expenditure in light of poor revenue performance continues to undermine public finances. Figure 2.8 gives a pictorial view of the trend of fiscal deficit and non-tax revenue in Ghana. Owing to aggressive public investment and high recurrent spending, the country has recorded a sustained fiscal deficit which has seen the sovereign debt

Figure 2.8: Non-tax revenue trend



Source 10: ICTD government revenue dataset

assuming unprecedented high levels. Between the year 2003 and 2013 alone, the fiscal deficit averaged about 7.3% of GDP. The deficits have peaked in election periods, with the year 2008 recording the highest of about 14.5% of GDP. However, commitment to fiscal discipline prompted by an IMF program has kept the budget deficit under reasonable control, although revenue mobilization is yet to catch up with expenditure. The deficits have mostly been financed with debt instruments which have also driven up the public debt in Ghana. In 2014, the debt/GDP ratio was as high as 73.2%. The debt sustainability challenges informed a decision to go for an extended credit facility from the International Monetary Fund. A major challenge in the fiscal development of Ghana is the debt service burden. From a meagre 8.5% in 2008, interest payments have risen to 11.8%, 21.1% and 25.8% in 2012, 2016

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and 2017 respectively[21]. Debt re-profiling became the order of the day in 2017 to create fiscal space for government programs. Given this, the government issued several Eurobonds to give significant relief to the economy's fiscal managers.

2.6 Stylized facts about taxation in Ghana

Taxation mainly manifested in the form of tributes in the pre-colonial years. The traditional rulers in various parts of the then Gold Coast had their system for financing their kingdom and their wars. The tributes were paid by conquered towns and villages that owed allegiance to the demanding overlords and some subjects. This greatly facilitated the building of empires (Atuguba, 2006). The Denkyiras, Ashantis, and the Akyems benefited from this strategy to build their empires. The British colonial rule ushered formal taxation in Ghana. Discretionary taxes were abolished by the British even though they relied on the traditional rulers to collect the taxes on their behalf. The two primary legislation that defined taxation in the colonial period were the legislation to collect poll taxes in Ghana in 1852 and the income tax ordinance in 1943. The second was a side-shoot of the Second World War and the general downturn in the cocoa sector. Over the years, the tax base expanded to include mineral duty 1952, betting tax 1952, and casino revenue tax 1955 (Twerefou et al., 2010).

Post-independence Ghana harbours most of the history of taxation in Ghana. The tax bases were developed in that era. Property tax (1961), entertainment duty tax (1962), Airport tax, hotel customers' tax, standard assessment and excess profit tax were introduced between 1961 and 1963. The reforms were, however, deepened during the Economic Recovery Program. Since 2009, the Ghana Revenue Authority collects and administer taxes in Ghana. It was formed in 2009 by the merger of three state institutions prior to 2009. The Authority is under the direct supervision of finance and economic planning and has three divisions: the Domestic Tax Revenue Division (DTRD), the Customs Division

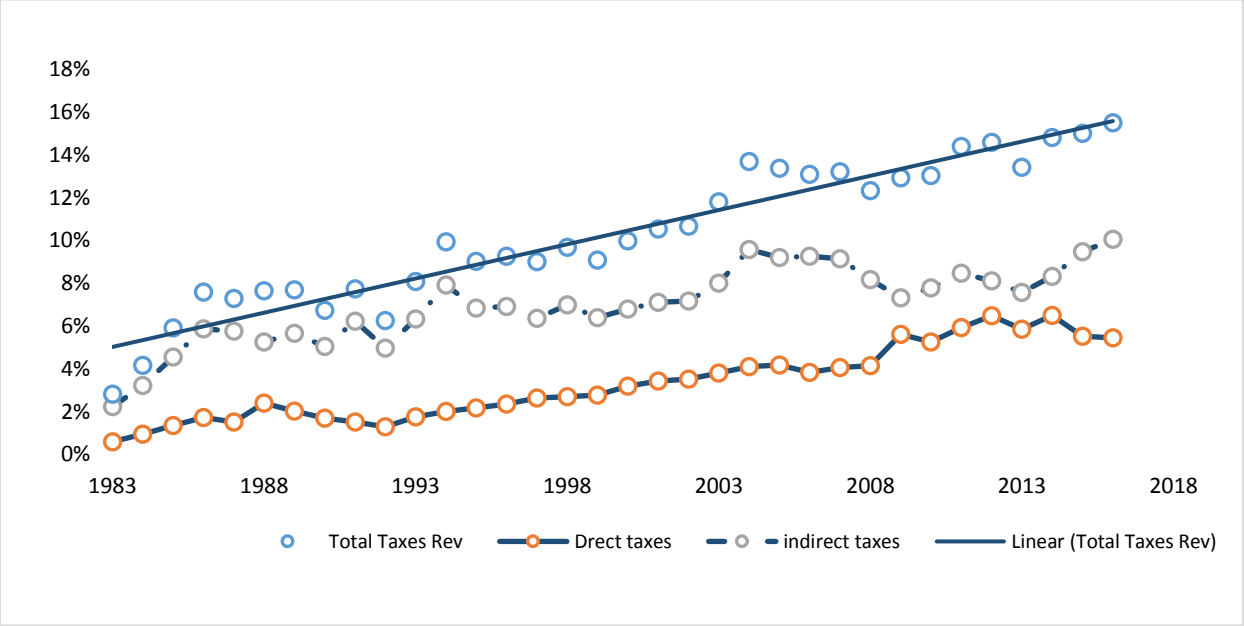
[21] See< http://ifsghana.org/wp-content/uploads/2018/10/Fiscal-Alert-11.pdf>

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and General Administration. Domestic Tax Division is responsible for the identification, assessment and collection, and payment of the following taxes into the government chest; Income Tax (Corporate Tax, Personal Income Tax, and Pay As You Earn (PAYE), Value Added Tax, Gift Tax, Capital Gains Tax, Domestic Excise Duty, Stamp Duty, Royalties, National Health Insurance Levy (NHIL), Ghana Education Trust Fund Levy, Communications Service Tax (CST), National Stabilization Levy[22]. The Customs division handles international trade taxes, Petroleum Tax, Import Excise, and other taxes.

Tax revenues to the central government in Ghana as revealed by the ICTD dataset, picked up after the structural adjustment program started in 1983. Although it has assumed an ascendency in recent years due to oil discovery, its level is not appreciable. Between 1983, and 2016 the tax GDP ratio averaged just about 10% of GDP. As shown in Figure 2.9, direct taxes have lagged behind indirect

Figure 2.9: Trend of Taxes in Ghana



Source 11: ICTD government revenue dataset

taxes with average direct tax between 1983 and 2016 just about 3% of GDP compared to the 7% for indirect taxes. Ghana continues to rely on indirect taxes because of the vast informal sector, which

[22] See<http://www.gra.gov.gh/index.php/divisions/domestic-tax-revenue>

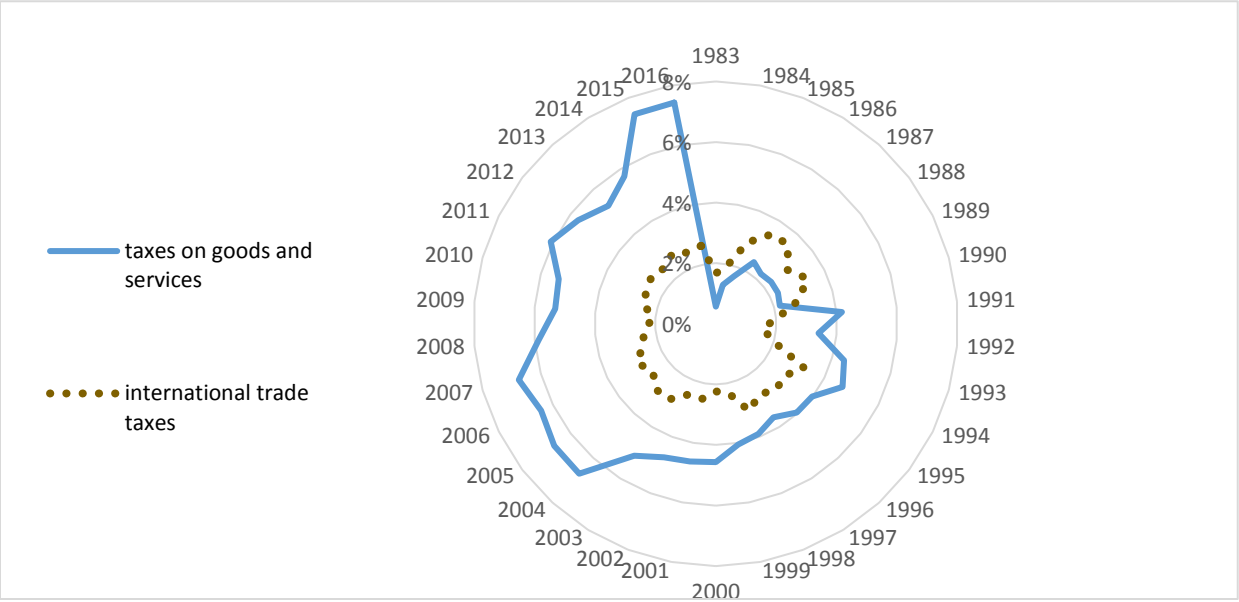
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hides many economic activities. Trading, agriculture, and service provision are mostly made in the informal sector and these activities dominate the economy with many evading income taxes. Because of this, a lazy approach that overly relies on indirect taxes (VAT and sales taxes, communication service tax) has been relied on to reform taxes. Activities to rope in more people into the income tax net has virtually been abandoned. The figure below gives a pictorial overview of the trend of the significant handles of taxation in Ghana. The Tax Justice Network[23] also revealed that corporate income tax incentives given by West African countries such as Ghana to attract investments have badly hampered revenue generation. The report revealed that between 2011 and 2014 alone Ghana lost about US$693 million to corporate tax incentives given investors. Indeed, a look at the minerals and mining Act 703 of Ghana indicates that royalties on mining activities shall be between 3% and 6%, but most companies in the past have only paid the 3%. Most mining companies are also given stability clauses that cap the royalty rate for not less than 15 years; all these strategies, in the name of attracting investment, poorly impact on revenue generation strategies. A look into the indirect tax handles also brings to bear the dominance of excise taxes in Ghana. Although Ghana is highly dependent on import from external economies, the revenues generated from international trade was only higher from 1983 to 1991. The period only coincided with the ushering of Ghana into constitutional and democratic rule in 1992. International trade taxes are mostly import duties with the cocoa sector recording the only export tax. Figure 2.10 below details the graphic trend analysis of indirect tax handles in Ghana.

[23] See<https://www.taxjustice.net/2015/08/25/the-west-african-tax-giveaway-new-report/>

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Figure 2.10: Indirect tax % GDP



Source 12: ICTD, GRD

The period within which international trade taxes dominated indirect taxes also coincides with how the import programme was launched during the economic recovery program. The ERP period also witnessed the removal of foreign exchange restrictions which gave firms and individuals the capacity to import raw materials and finished products for their activities. The two policies led to improvement in the tax base of international trade taxes. However, the cedi started depreciating very fast, which made it relatively expensive in later years to import, according to the local currency depreciated on average about 36.3% between 1990 and 2000, which gave importers some problems. Although the current improvement in technology and the introduction of paperless procedure at the port in 2018 has led to improved revenues at the port, the size of international trade taxes lags behind excise taxes. Other challenges with tax mobilization include high exemptions, narrow tax bases and high evasion, especially in the natural resource sector.

2.7 Conclusion

This chapter primarily reviewed brief definitions of the literature on domestic resource mobilization.

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We sampled some of the acceptable definitions, types, and theories of domestic resource mobilization and also presented some studies that have tested determinants of domestic resource mobilization. We also provided an extensive review of the structure, scope, and evolution of the Ghanaian economy with an insightful exposition on macroeconomic trends and current developments in domestic resource mobilization systems in Ghana. Concerning the definitions, while we acknowledge the myriad of definitions for domestic resource mobilization, we adopt the definition given by the OECD.

We reviewed optimal tax theories al 'a Laffer (2004), but the originator of the conversation is Ramsey's work (1927). It was later expanded by the works of Mirrlees (1971); Diamond (1975), and Gabaix and Farhi (2017), which are critical to the tax conversation. Important theoretical narratives emanate for knowledge uptake. Upon our review of the economy of Ghana, we also establish that taxes make a significant part of all domestic resources and that taxes in Ghana are mainly indirect taxes.

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CHAPTER THREE

ARE DOMESTIC RESOURCE MOBILIZATION SYSTEMS IN GHANA BUOYANT AND OR ELASTIC?

3.1 Introduction

The seeming reduction in aid flows hit developing countries hard, and there is a sudden understanding that taxation strategies need to be prioritized. The need to prioritize domestic resource mobilization is keenly featured in current regional and global development policy documents. For instance, the Agenda 2063 of the African Union enjoins countries to improve their domestic resource mobilization to promote self-sufficiency. The United Nation's sustainable development goals' target 17.1 encourages countries to "strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection". The frontier development issue is clear, domestic resource mobilization is at the heart of development policy, and the research community is exploring various topical issues to help governments.

Taxation has been touted as the most important and sustainable source of domestic resources mobilization. Taxation, an essential tool for economic policy, provides the most consistent source of government revenue and introduces some element of certainty in public finance.[24] Moreover, it increases the bond of accountability between the state and citizens, thereby strengthening the social or fiscal contract between state and citizens (OECD, 2014). According to Mansfield (1972), one acute problem that hampers the realization of sound public finances is the inability of developing countries to mobilize sufficient resources sustainable for development. According to Jalles (2018), many countries have attempted to boost their economic growth and revenue generation prospects with increased expenditure. The reason is that the rise in income will come with improved tax collection

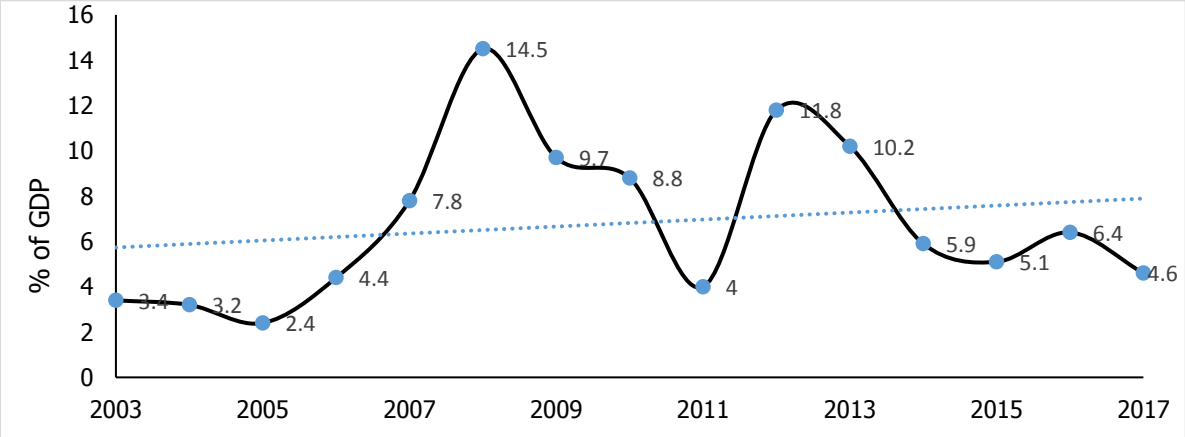
[24] This is because public policy and law in most states support governments' tax levying decisions and enforces them.

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and restore a fiscal balance. However, growth in expenditure has not been matched with a commensurate rise in tax revenues. Conventionally, narrow tax bases and reliance on few commodity revenues have been cited as the cause of the revenue slump (Morrissey et al., 2016). However, Mansfield (1972) asserts that, in considering a criterion to evaluate tax systems, the focus must be on estimating the buoyancy and the elasticity of the tax system. The former measures the responsiveness of a tax system to changes in income, and the later measures the automatic response of tax revenue to income or its base. High tax elasticities are desired in all scenarios as it leads to improved revenues without fiscal authorities resorting to politically strenuous discretionary hikes in tax rates, and the sudden introduction of taxes.

Ghana's revenue performance, akin to many African countries, has been less than desired. As depicted in figure 3.1, revenue growth lags behind expenditure growth resulting in deficits for most of the economic history of Ghana. The gap in most instances has been financed with a combination of borrowing and discretionary tax policy.

Figure 3.8: Fiscal deficit as a percentage of GDP in Ghana



Source 13: Bank of Ghana

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Economic theory postulates that economic growth improves economies' taxable capacity and generates commensurate tax revenues (Gurdal et al., 2020). This assertion is, however, not supported in Ghana. Growth in tax revenues has not matched growth in the dimensions of tax bases (GDP). Tax revenue targets are frequently missed, with the fiscal authorities resorting to discretionary measures to raise revenue. For instance, the Ghana Revenue Authority (GRA) missed its 2018 revenue target of GH₵39,802.27 billion by 5.5%[25]. These ad hoc discretionary measures are the basis of compliance and resistance from taxpayers. Therefore, fiscal sustainability and sound public financial management are threatened when discretionary measures are relied on too often to meet revenue targets. Previous studies (e.g., Kusi, 1998; Twerefou et al., 2010; Appiah, 2013; Bekoe et al., 2016; Andoh et al., 2019) have attempted to estimate the tax buoyancy and elasticity for Ghana. However, as indicated in the methodology section, their estimation strategy has econometric challenges. We offer a different approach and cover many taxes such; direct taxes, indirect taxes, and total taxes for a holistic tax policy recommendation. We also employ current time-series data (1983-2018) in light of the changing structure of the Ghanaian economy.

The significance of this piece cannot be overemphasized. First, the role revenue systems play in fiscal sustainability and stabilization is revealed by tax buoyancy and elasticity estimates in the long run and the short run, respectively. These responses over the business cycle are also crucial for the government's intertemporal budget constraint and smoothening budget objective (Dudine and Jalles, 2017). Moreover, tax buoyancy and elasticity is essential for tax policy evaluation as it assesses the rate at which tax revenue is keeping pace with tax policy. Through the estimate, the social planner is made aware of where to double his efforts, as systems that have slipped pace with the sustained increase in income are exposed.

[25]see <https://www.peacefmonline.com/pages/local/news/201902/374596.php>

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This paper aims to inquire into the extent and magnitude of the buoyancy and elasticity of tax systems in Ghana and assess whether these estimates are the same, equal, or differ in short and long-run periods.

The rest of the paper is structured along these lines. First, we study the dynamics of tax policy in Ghana. This section will catalogue all the tax reforms that have taken place within the period under review. Next, we will move on to sample the literature on tax elasticity and buoyancy. This section will try to explain the concept as employed as understood in this study. We next delve into the empirics as conducted in Ghana and discuss methodologies employed and their weakness. We will then provide a solid estimation strategy for this work. We then discuss the result and offer some recommendations for future reforms.

3.2 Taxation dynamics in Ghana; tax reforms (1983-2018)

Although tax reforms were carried out before 1983, this epoch captures most of the critical reforms from 1983 to 2018. This period witnessed a series of economic reforms which defines the current structure of the Ghanaian economy.

3.2.1. Tax Reforms under the Economic Recovery Program (1983-1993)

Major tax reforms in Ghana started in 1983. According to Kusi (1998), the reforms were part of the government's economic recovery program (ERP) to recover the economy from its slump. Prior to the reforms, the major economic indices were misaligned, with high budget deficits. Given that, measures to reduce the budget deficit, including expenditure rationalization and tax reforms aimed at boosting revenues, were introduced. The reforms dealt with the prevailing distortions in the tax system to boost savings and investment and improve tax administration. According to Osei and Quartey (2005), these reforms could be divided into three phases: restoring the tax base, strengthening production incentives and enhancing tax efficiency and equity.

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3.2.2 Restoring the tax base

Exchange rate adjustment, price deregulation, and changes in administrative procedure in the form of assessment were the main tools used to achieve this target. First, the currency was overvalued, and the margin between official prices and market prices was misaligned. As such, the tax base was virtually eroded. Therefore, the exchange rate was adjusted to rake in more revenues from the export of cocoa and import duties. The was also a change in the system of assessment for import duties and certain indirect taxes (sales and purchases taxes) to make dutiable goods reflect their face value in addition to surcharges. The basis for corporate tax assessment was changed from previous years' income to current income or profit or profit. In 1984, cigarette taxes were increased, whiles the income tax was reduced (Tekper, 1995).

3.2.3 Strengthening production through incentives.

Investment promotion strategies anchored this phase of the reforms. Agriculture, manufacturing, construction, and tourism were the main priorities. A host of incentives were provided to the targeted areas to boost investment. In addition, new investment laws were promulgated to support the investment growth agenda. Key among the laws was the new mining code in 1986. This new mining code sought to bring clarity to promote investment in the sector. Incentives like corporate tax allowance and capital allowance allowed significant capital investment write-off against taxes. In addition, to foreign service loans, the law also allowed mining companies to have offshore accounts.

As part of the reform in 1987, direct taxes were reduced from 55% to 45%. General sales taxes were also reduced from 20% to 10% to make up for the shortfall in tax revenue experienced because of abolishing the duties on products (save beverages, petroleum products and tobacco). In 1988, the special tax applied on locally manufactured textiles, alcoholic beverages, and tobacco was also slapped on similar products imported. In 1989, there was also a reduction in the general sales tax from 25%

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to 22.5%. The special tax implemented in 1989 were also compressed to a uniform rate of 10%; the aim was to reduce the inefficiencies in production and give a competitive edge to local firms. The licensing needs for imports were subtly removed, and the duty was slashed to 5%. In the same year, corporate tax in specific industries (real estate, construction, and manufacturing) was reduced to 35% (corporate tax, in general, was reduced from 50% to 40% in 1992). The progressive nature of capital gains tax was dumped for a flat rate of 5%, although income from mergers and acquisition and shares traded publicly were exempted. Corporate taxes were further reduced from 35% to 30% for publicly listed companies on the Ghana stock exchange, with unlisted companies paying 32.5% (Addison and Osei, 2001).

3.2.4 Enhancing tax efficiency and equity.

Kusi (1998) asserts that the reforms in the ERP era were broadened to encapsulate efficiency in the tax administration and improve the equity dimensions of the tax system. Tax administration was loose in the years before 1986. The revenue collection institutions (customs excise and preventive service CEPS and the internal revenue service IRS) were not independent and could not carry out any significant reforms. The morale of the staff was generally weak, and corruption was rife in revenue-generating institutions (Addison and Osei, 2001). Administrative reforms were the primary fiscal intervention in 1986, the Customs Excise and Preventive Service (CEPS) and the Internal Revenue Service (IRS) were made autonomous institutions synonymous to state-owned enterprises operating with ministerial powers, with new incentives. In 1992, these institutions were put under the supervision of the ministry of finance. To improve tax administration, unique tax identification numbers were issued to computerize tax administration management.

Also, to eliminate the double taxation that characterizes dividend payment, withholding tax on dividend payment was made to attract a final tax of 15%. In 1992, it was reduced further to 10%.

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There were also significant reforms in the personal income tax system in this phase of the program. The goal was to reduce the challenges to improved productivity and entrepreneurship. A new five bracket income tax system was introduced in place of the 17 brackets in 1986. Significant reliefs were also given to low-income earners. In an attempt to mitigate the pressure on disposable income due to the broadening of the tax base, the top marginal rate of the personal income was reduced from 55% to 25% in 1991. To align corporate tax with the personal income tax to curb tax avoidance but was further increased in 1993 to 35%.

3.2.5 Post ERP tax reforms (1994-2000)

Tekper (1998) chronicles the major tax reforms that occurred from 1984 to 1998. Some of the post ERP reforms that occurred is chronicled as; beginning with the year 1994, the passage of the Value Added Tax bill into law was seen as a move that will change the face of indirect taxes in Ghana and boost domestic revenues. It is important to note that it was not until 1995 that the law came into force at a flat rate of 17.5% in place of the then sales tax of 15%. The law was withdrawn amid substantial public outcry and nationwide protest, and the sales tax was reintroduced in 1995. The Value Added Tax (VAT) was implemented in 1999.

3.2.5 Tax Reforms in a New Government, with Soaring Public Confidence (2000-2008)

The restoration of democracy in 1992 opened the door for the people to change the government, and in 2001 a new political party assumed office. Owing to the massive endorsement, the elected government did not have problems initiating tax policy reforms (Pritchard, 2009). Several reforms were, therefore, made without civil unrest to support the fiscal policy of the government.

The government passed the income tax law in 2000 (Act 592 of 2000). The law will, however, become operational in 2001. According to Osei and Quartey (2005), critical reforms made to the income tax regime in the law include; the upward adjustment of the minimum taxable income to 1.2 million cedis,

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from 0.9 million cedis; also the top marginal tax rate of 35% was made applicable to incomes above 48 million cedis, additional reductions were made in the top marginal rate of the higher-income group from 35% to 30% and for middle-income group 25% to 20%. In addition, the law came with significant reliefs such as tax allowance to disabled owned businesses, reliefs for aged people (60 years and above), tax reliefs for a person who sponsors his/her child's education.

The 2001 Budget and Economic Policy Statement of the then government gave birth to a national reconstruction levy to source funds from some insurance companies, banks, and pension funds for the government to meet its fiscal obligation. It was proposed in the budget statement that 15% of the gross profit of affected companies was to be charged on their account after taking out bad debt. However, when the law came into effect, it was charged at a rate of 10% for high earning institutions and 7.5% for other affected companies. In the proposal stage, the levy was to last for three years, but in 2004 this was extended to 2007.

The reforms that took place in 2002 were mainly administrative. Clearing procedures were automated by installing the Ghana Customs System (GCMS) and the Ghana Community Network (GC-Net) at the Kotoka International Airport, Tema Port and the CEPS main office. The move was to aid the revenue authorities to minimize revenue leakages and physical interference between taxpayers and revenue collection officers. A large taxpayer's unit (LTU) was also set up to deal with about 350 taxpayers. A taxpayer's identification number was implemented, which saw an amendment to section 123 of the IRS Act 2000. In 2003, activities geared towards improving efficiency in tax assessment and mobilization were reviewed. Export duties on lumber were depressed, tax levies on insecticide-treated materials and VAT were also eliminated. A 0.5% stamp duty was imposed on share capital, a downward revision from 2%. Administrative wise, the CEPS bonded warehouse scheme was also reviewed.

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The year 2004 heralded the coming into force of the National Health Insurance Levy NHIL to cater to the National Health Insurance Scheme –a replacement of the cash and carry system in the health sector. The aim was to provide a more humane system for health care delivery in Ghana. The levy added 2.5%to the VAT levy of 12.5%, making the VAT rate chargeable 15%. Corporate tax was reduced in 2005 from 28% to 25%, although it was effective in January 2006. The burden of the national reconstruction levy was also reduced in 2005 on category A and B firms, whiles it was abolished entirely on category C firms. A Communication Service Tax of 6% was imposed on mobile phone users in Ghana in 2008. The tax replaced the VAT and NHIL levies pf 12.5% and 2.5% on mobile phone sales. The intent behind the new tax was to promote efficiency in tax collection. Importers largely evaded the original tax at the various points of entry and sale.

This period could essentially be described as a revenue boom period. This is because there was minor public uproar and political opposition to tax reforms as the government could impose taxes in election years.[26]. Also, the entry of Ghana into the HIPC program saw the country receiving significant debt reliefs, which gave fiscal space to the new government.

3.2.6 Tax Reforms, in an Oil Economy (2009-2017)

Having reached a fully-fledged democracy, Ghana experienced a governance transition from the capitalist minded party back to the socialist party in 2009. The first significant reform was purely administrative. The government merged all the revenue collection institutions and put them under one authority, the Ghana Revenue Authority (GRA). To pass cutting edge tax laws and repeal outmoded ones, the tax laws project was launched in 2010. Through this project, many laws were passed, and some old ones were amended. In 2014, the Value Added Tax amendment law (Act 870) was implemented. The law sought to extend the VAT to some activities that were not part of the tax

[26] The National Reconstruction levy and the Communications Service Tax were extended and imposed in 2004 and 2008.

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net. The VAT rate was also adjusted upward from 12.5% to 15%. Inclusive of the NHIL charge of 2.5%, the total VAT rate was 17.5%. Regulations were later made to administer the VAT in 2016[27]. In 2015, the income tax act (Act 896) was given legal impetus as an amendment to the old law. In order to smoothen the administrative procedure that will be relied on in its implementation, the income tax regulations law (LI 2244) was also given legal force. In the parent law, capital gains tax and gift tax were all abolished. The thin capitalization ratio was also raised from 2.1 to 3.1, the corporate tax rate on hotels was raised to 22% from 20%. The customs act was also amended in 2015[28]. The amendments were primarily administrative. Key among them is the privileges given the Commissioner-General to inspect letters of credit, bank guarantees, and insurance where applicable. The final major administrative reform that occurred was enacting the revenue administration act 2016 (Act 915). In 2017, some taxes were scraped in the budget statement. Key among the scraped nuisance taxes were 1% special import levy, 17.5% VAT/NHIL on financial services, 17.5% VAT/NHIL domestic airlines, excise duties on petroleum, 5% VAT on real estate etc. The 2017 budget statement also indicated the government's resolve to tackle systemic challenges in revenue generation, such as tax exemptions.

Andoh et al. (2018) identify four types of taxes in Ghana. They include taxes on income and property, taxes on domestic goods and services, international trade taxes and value-added tax. However, because there are certain taxes in the 'taxes on domestic goods and services, and the 'international trade tax' category that have VAT charges, we identify three main types of taxes, taxes on income and property, taxes on domestic goods and services, and international trade taxes. These types of taxes also fall under two main groupings; direct taxes and indirect taxes. Indirect taxes by far make the most tax revenues; it is dominated by taxes on goods and services followed by international trade taxes. Thus,

[27] See the VAT regulations, 2016, LI 2243
[28] See Customs act 2015 (Act 891).

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Ghana's performance is not markedly divergent from the performance of some African countries. Table 3.1 gives details of the tax mobilization effort of some of Ghana's peers.

Table 3.1: Tax revenue mobilization in Africa (%GDP)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Benin	0.12	0.11	0.11	0.12	0.12	0.12	0.11	0.13	0.13
Burkina Faso	0.14	0.14	0.16	0.17	0.15	0.15	0.17	0.17	0.20
Botswana	0.33	0.36	0.37	0.39	0.38	0.32	0.34	0.31	0.28
Cameroon	0.15	0.17	0.17	0.17	0.17	0.18	0.16	0.16	0.16
Nigeria	0.05	0.06	0.05	0.05	0.04	0.03	0.02	0.02	0.03
Liberia	0.14	0.14	0.16	0.17	0.15	0.14	0.14	0.14	0.13
Kenya	0.16	0.17	0.18	0.17	0.18	0.18	0.18	0.17	0.17
Eq. Guinea	0.27	0.28	0.28	0.25	0.24	0.26	0.17	0.17	0.19
Gambia	0.12	0.10	0.11	0.11	0.13	0.13	0.12	0.12	0.13
Guinea	0.11	0.13	0.15	0.14	0.14	0.14	0.15	0.14	0.13
Ghana	**0.12**	**0.13**	**0.14**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**
Gabon	0.26	0.29	0.30	0.30	0.30	0.21	0.17	0.16	0.17
Ethiopia	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09
Egypt	0.21	0.18	0.18	0.19	0.16	0.18	0.18	0.18	0.18

Source 14: ICTD dataset

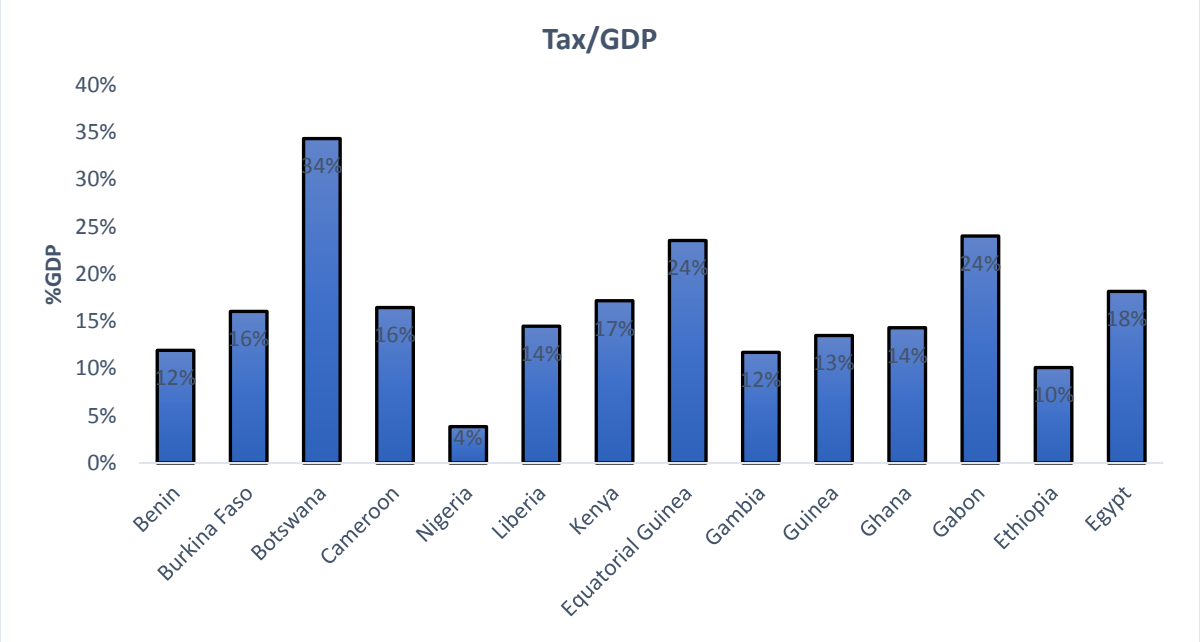
This compares poorly with Botswana, which is about 34% of GDP, Gabon 24%, Kenya 17%, and Equatorial Guinea 24%. On the other hand, although Ghana's performance is not encouraging, it performs better than African giants like Nigeria, which accumulates average tax revenue of 4%, Benin 12%, and Gambia 12%, Ethiopia 10%, and Liberia 14%.

Whiles, we acknowledge that SSA countries also rely on resource revenues to support their development. Indeed resource-rich countries in Africa are among the lowest-performing countries in tax revenue generation. For instance, while non-resource rich countries in Africa saw their tax revenues grow from 15.3% of GDP in 2010 to 16% in 2018, the resource-rich countries grew from 9.2% to 15.2% in 2015 and shrank to only 10.2% in 2018 due to fluctuating oil prices. Moreover, tax revenue generation in resource-rich countries is volatile because of mineral resource prices' volatile nature. For example, although an oil-producing country, Ghana finds itself somewhat in-between the two classes of countries. Consequently, the price of natural resources has a significant impact on taxes

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in Ghana. This is because most of the economic activities crowd around either the mining or oil and gas sector. Figure 3.2 illustrates the average tax revenue generation of selected African countries.

Figure 3.9: Average tax revenue mobilization (%GDP, 2010-2018)



Source 15: ICTD

From figure 3.2, we notice that irrespective of the effort by the government of Ghana to rake in maximum tax revenues from taxes, it has hovered an average figure of 14% of GDP since 2010.

3.3 The concept of tax buoyancy and elasticity

Two concepts, tax elasticity and tax buoyancy, traditionally measure the growth performance of tax revenue. Thus, buoyancy measures the overall responsiveness of tax revenue to changes in the national tax base and other discretionary measures such as tax rates adjustments, tax rules amendments, and tax administration reforms. On the other hand, tax elasticity relates to the automatic changes in tax revenue brought about by changes in the tax base, holding the revenue effect of the discretionary tax adjustment constant (Bilquees, 2004; Osoro, 1993). According to Belinga et al.

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(2014), knowledge of tax buoyancy is essential for smooth public financial management. The nature of tax buoyancy is significant for the long-run fiscal sustainability management. It also guides policy in proffering solutions to stabilize the economy over the business cycle in the short run. To the extent that tax revenues that move with output, in the long run, is good for the sustainability of fiscal policy. In the short run, a very responsive relationship between revenues and outputs means that the tax system is an exemplary output stabilizer. Knowledge of tax buoyancy is thus suitable for the government's intertemporal budget constraint and tax smoothing goals. It also helps the government to assess its revenue performance against the level of economic activity. Fiscal authorities are thus able to determine if more effort should be put into revenues mobilization.

A sound tax system has the appeal of both buoyancy and elasticity[29]. More so, it is desirable when the tax elasticity is higher than the buoyancy estimate, in that the tax regime has the potential of generating revenue automatically when the base grows. A highly elastic tax system circumvents the political difficulty and citizens agitations aroused by ad hoc changes and the introduction of new taxes, which usually dominates the political atmosphere in Ghana. According to Andoh et al. (2019), decoupling the long-term and short-term effects is significant. This is because the long-term responses estimate the impact of the base on long-term fiscal sustainability, whiles the short-term estimate measures the behaviour of tax revenues. In each of the horizons, it is desired that the elasticity coefficient is more significant than unity. According to Belinga et al. (2014), short-term estimates more significant than 1 means that the system is variable and, therefore, an excellent automatic stabilizer and vice versa.

Four traditional methods have been developed to analyse tax elasticity and buoyancy. They are; the Proportional Adjustment Methods (PAM) as used by Baas and Duxin (1974), Mansfield (1972), Osoro (1993), and in Ghana, Bekoe, et al., (2016); The Constant Rate Structure (CRS) method as relied on

[29] It is elastic when the coefficient is greater than 1. In that way, the revenue effect of an increase in the base is higher than the improvement in the base.

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by Choudhry, (1975), Tanzi, (1976); the Dummy Variable Technique (DVT) as used by Wilford, (1978), Appiah (2013), and Twerefou, et al., (2010); the last is the Divisia Index (DI) method also used by Choudhry, (1979). The preceding section chronicles the salient facts about each method.

The proportional Adjustment method begins by subtracting estimated tax revenue in the budget due to discretionary measures from actual tax revenue and multiplying it by multiplicative factors to refine the adjusted revenue data. The Constant Rate Structure has an even more stringent data requirement; it relies on disaggregated data. Here, a simulated tax revenue series for a reference year is needed and estimates of the tax base for ensuing years. If data is provided, the method requires a narrower definition of the tax and its base to authorize the application of the reference year rates to later year tax bases. Dummy variables are employed with the dummy variable technique to capture the discretionary tax changes in tax rates and tax structure. The Divisia Index (DI) approach assumes that the underlying tax function is linearly homogeneous and continuously differentiable. This method is beneficial when information on discretionary measures are hard to establish. It uses only historical data and does not require discretionary tax changes and its associated revenue effects.

In the Ghanaian context, few studies have explored tax buoyancy and elasticity, albeit with some structural challenges. Kusi (1998) explored the relationship between the tax reforms between 1983 and 1993 to evaluate the revenue performance of the reforms and practical ways of raising additional revenue. His study employed the concept of tax elasticity and tax buoyancy and concluded that the reforms had a significant positive impact on revenue generation and improved the efficiency of tax administration. The revenue productivity was experienced on all the individual taxes, but the elasticity of the cocoa export tax was more than unity, which greatly influenced the overall tax buoyancy of the economy. The revenue growth was supported by the devaluation of the exchange rate, and the large inflow of foreign loans, the abolition of price control, and the import licensing regime, and the

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simplification of the tax regimes. The study recommended that revenue options such as VAT, redefinition of income and property taxes be introduced to boost revenue generation in Ghana.

From the trade liberalization angle, Insaidoo and Obeng (2008) also investigated the effect of import liberalization on tariff revenue in Ghana on only one tax revenue (import Tariff revenue). They used a decomposition analysis to measure the comparative impacts of import policy reforms in Ghana. Their study revealed that even though revenue rose because of the exchange rate depreciation, there were revenue losses in reduced tariffs that offset the revenue growth. As such, their findings concluded that the tariff revenue was neither elastic nor buoyant. However, this study also suffers from the narrow perspective within which the study focused. Trade taxes are only a tiny part of taxation in Ghana.

Twerefou et al. (2010) was the study that began to deepen the conversation on tax reforms using Dummy Variable Technique. They controlled for potential effects that discretionary tax measures have on historical time series data for the period 1970-2007 to estimate the tax elasticity of Ghana. Their findings indicated a buoyant and flexible tax system. In the long run, it was found out that the buoyancy was more than the tax elasticity, but the reverse occurs in the short run. Their study was well estimated because of the unavailability of data. However, most of the variables in their model employed proxies that weaken the study's policy recommendations proffered.

Moreover, a drawback of this study was their inability to separate discretionary tax changes by the government from the tax data relied on for the study. Appiah (2013) narrowed his focus to the mining sector to assess the effect of fiscal regimes in the mining sector on revenue mobilization efforts in Ghana by employing the tax elasticity and buoyancy ratios. He discovered that the tax elasticity was lower than the buoyancy estimates and that long-run elasticities were higher than the short-run elasticities. Additionally, discretionary tax measures were found to be effective in mobilizing additional

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tax revenues. However, his study only focused on a small sector of the economy, mining. Bekoe et al. (2016) came closer by examining the tax reforms revenue generation impact. They employed the proportional adjustment technique to estimate tax buoyancies and elasticities in Ghana spanning 1970 to 2013. They observed that the reforms had some positive impact on the overall tax structure and individual tax handles except excise duties. Although Bekoe et al. (2016) expanded the frame of analysis by looking at different tax categories, his study was also deficient because, just like the dummy variable technique, the proportional adjustment method has estimation challenges. According to Rasheed (2006), the proportional adjustment method cannot apply to broad tax categories such as excise or customs; it is only valuable for individual products in these categories. Concerning the dummy variable technique, because of the many tax reforms in Ghana, using the dummy variable method reduces the degree of freedom and the efficiency of the estimators and will likely push the estimation into a dummy variable trap.

We employ the Divisia index approach. According to Andoh et al. (2018), the Divisia index is superior to all the other methods; the method is more robust to the proportional adjustment because the index itself calculates and isolates the automatic responses to the growth in base. It, therefore, does not require alteration in the historical series to discretionary tax changes. However, a drawback of the Divisia index approach is its inability to calculate the revenue impact of specific tax policies.

3.4 Methodology

3.4.1 Empirical strategy

3.4.1.1 The baseline model

Following the works of Osoro (1993) and Muriithi and Moyi (2003), we specify the tax buoyancy baseline model as;

$$Tr = e^{\theta} Y^{\beta} e^{\varepsilon} \qquad [3.1]$$

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$$LnTR_t = \theta + \beta LnY_t + \varepsilon_t \quad [3.2]$$

where $LnTR_t$ is the log of the tax revenue under review at time 't' (we consider total tax *TR*, direct taxes *DT*, indirect taxes *IT,* taxes on goods and services *TGS,* and taxes on international trade *ITT*), LnY_t is the tax base at time 't' (GDP for total tax, consumption for indirect taxes, gross national income in the case of direct taxes), θ is a constant term, β is the tax buoyancy or elasticity coefficient depending on whether the model has been adjusted for discretionary tax policy, and ε_t is the stochastic error term.

The baseline model follows the tradition in the tax buoyancy literature where the base is regressed on the tax understudy without controls (Belinga et al., 2014; Kusi, 1998; Mansfield, 1972; Osoro, 1993; Sobel & Holcombe, 1996; Twerefou et al., 2010; Wawire, 2000; Wolswijk 2009; Andoh et al., 2018). However, we envisage potential specification challenges from omitted variable bias, and therefore make limited adjustment to the function in accordance with Castañeda Rodríguez (2018); Castañeda-Rodríguez (2015); Bird et al., (2008); Le et al., (2012); and Tanzi and Davoodi (2000). Tax compliance is linked to the level of corruption, to the extent that high levels of corruption lower the (psychic) cost of tax evasion for taxpayers (Cullis et al., 2012).

Moreover, Castro and Camarillo (2014), Terefe (2017), and Rodríguez (2018) have provided ample evidence to suggest that tax revenue tend to persist over time. For instance, if taxes are invested in a way that tends to enhance their base, it becomes the basis for further growth in taxes. Therefore, we control for persistence by including the lag dependent variable.

Equation 3.2 is re-specified to include corruption and the lag dependent variable as;

$$LnTR_t = \theta + \psi LnTR_{t-1} + \beta LnY_t + \alpha LnV_t + \varepsilon_t \quad [3.3]$$

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Where ψ is the coefficient of the lag dependent variable, LnV_t is the log of the level of corruption at time 't', and α is the coefficient of corruption as indicated already.

3.4.1.2 The long-run cumulative buoyancy coefficient

We argue that the buoyancy coefficient β does not offer much for tax policy recommendation and formulation. This is because β is a static representation of the effect of Y_t on TR_t, the presence of persistence, if proven, is an indication that the effect of Y_t on TR_t, is not instantaneous; it emerges slowly, there is an opening shock that decays after a period, and a new effect takes over iteratively. Thus, there is an initial effect where the base affects taxes and a snowball effect where taxes reversely affect the base, directly or indirectly. In such a reality, there is the need to capture the buoyancy cumulatively. We fall on the work of Koyck (1954), who introduced a first-order autoregressive lag model which regresses one lag of the dependent variable (y) on the right-hand side in addition to the current value of x. The model is expressed as;

$$Y_t = \beta + \phi_1 Y_{t-1} + \theta_0 X_t + \mu_t \qquad [3.4]$$

observably, the estimation of the above equation will encounter challenges because, Y_{t-1} is not strictly exogenous and, except μ_t is white noise, it not even be faintly exogenous. We, therefore, fall on a system that is synonymous to those applied in examining autoregressive processes to evaluateY_t. According to Koyck (1954), the long-run cumulative effect of X_t on Y_t is estimated as $\frac{\theta_0}{1-\phi_1}$ where θ_0 is the coefficient of the independent variable, and ϕ_1 is the coefficient of the lag dependent can suffice. The Koyck cumulative effect has found usefulness in applied economics.[30]. We, therefore, apply it to estimate the long cumulative tax buoyancy and the cumulative tax elasticity in Ghana for optimum

[30] It is applicable in many economic relationships and can be applied in equations with more than one regressor, such as our baseline tax models. For instance, Akorsah et al. (2020) applied it to determine the Central Bank of Ghana's reaction to deviations of inflation and output gap from their optimal levels.

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policy recommendation. Based on the baseline model expressed earlier, we will estimate the cumulative tax buoyancy as $\frac{\beta_0}{1-\psi_1}$.

3.4.2 Data

This study sets out to estimate the tax elasticity and buoyancy of five different tax types in Ghana. First, we interrogate the research problem focusing on total tax, direct tax, and indirect tax, and then scales down to taxes on goods and services and taxes on international trade. To do this, we rely on time series data on taxes and their associated bases from 1984 to 2018. We also rely on verifiable data (1984-2018) from the international centre for tax and development's government revenue dataset for all data on the five taxes under study (total taxes, direct taxes, indirect taxes, tax on goods and services, and international trade taxes), and GDP. We also employ the personal household consumption expenditure and imports (all in local currency unit, the Ghana cedi) from the World development indicators (WDI) dataset. Finally, we also rely on international country risk data for data on corruption. Table 3.2 below gives a detailed description of the variables employed and their respective sources.

Table 3.2: Definition of variables employed.

Variable	Proxy tax base	Definition
Total tax	Gross domestic product (Yousuf and Huq (2013)	Total tax revenue is made up of the sum of direct and indirect taxes but excluding social contributions. ICTD
Direct tax	Gross national income (GNI)	Total direct taxes exclude social contributions but include resource taxes. It also includes taxes on income, profits and capitals gains, taxes on payroll and workforce and taxes on the property. ICTD
Indirect tax	Consumption Cotton (2012)	Indirect Taxes include resource revenues, taxes on goods and services, taxes on international trade and other taxes. ICTD
Taxes on goods and services	Consumption Cotton (2012)	Taxes on goods and services includes (but is not necessarily always equals to) sales taxes and excise taxes. ICTD
International trade taxes	Imports	It includes both import and export taxes. In some cases, this figure may also include VAT collected at the

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	(Yousuf and Huq (2013)	border, where countries consistently report revenue in this way. ICTD
Gross domestic product		Data is in millions of LCU and almost always comes from the IMF's WEO (Apr 2020). ICTD
Gross national income		The sum of value added by all resident producers plus any product taxes (fewer subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. WDI
Consumption		Final consumption expenditure is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure WDI.
Imports		It represents the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. WDI
Corruption		This is an assessment of corruption within the political system. It is more concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favour-for-favours', secret party funding, and suspiciously close ties between politics and business. It ranges from 1 to 6 based on the assessment by the international country risk guide.

Source 16: Author's construct

3.4.3 Estimation technique

Chaudhry (2010), Gobachew (2018), and Aggrey (2013) employed the Ordinary Least Squares, Correlation Analysis, and the Auto-Regressive Distributed Lag (ARDL) to estimate the buoyancy relationship. Whiles Twerefou et al. (2010) employed the Engel Granger cointegration technique, and an error correction model, Bekoe et al. (2016) relied on the OLS technique, and Andoh et al. (2018) used the dynamic OLS technique (DOLS) to conduct the estimations. Unfortunately, these estimation techniques are not robust enough to deal with endogeneity challenges.

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Tax revenue if used well, has the propensity to spur growth in its base. The base is also the foundation for raising tax revenues. This presupposes the potential feedback effect between tax revenue and its base, which needs to be toned down or eliminated for optimum policy recommendation. To cure this, we employ the Generalised Methods of Moments (GMM) initially developed by Arellano and Bond (1991) and Arellano and Bover (1995). The GMM estimator takes care of endogeneity issues and unobserved heterogeneity in regressors. Its ability to syndicate the central equation in different form using the lagged levels of endogenous variables as instruments for subsequent first differencing. According to Ackah and Aryeetey (2012), the estimator relies on the validity of the assumption that there is no serial correlation in the error term and the validity of the instruments used. We proceed by expressing the general buoyancy function taking account of equation 3.1, and 3.3 in the following model specification:

$$TR_t = \alpha + \gamma x_t + \mu_t \quad [3.5]$$

Where x_t captures all the regressors, and μ_t is the disturbance term. Let μ_t denotes a vector of instruments known at any given level of TR_t (i.e. $\mu_t \epsilon\ \Omega_t$). Then, equation (3.4) implies the set of orthogonality conditions hold at all time:

$$E(\mu_t) = 0, \quad [3.6]$$

$$E(\mu_t, x_t) = 0 \quad [3.7]$$

Where, $\mu_t = TR_t - (\alpha + \gamma x_t)$ [3.8]

The basis for estimating the parameters (α, γ) is provided by equation (3.8) with the help of the Generalised Method of Moments (GMM). The GMM procedure has an optimal weighting matrix to take care of possible serial correlation in the disturbance term μ_t. We test the validity of the overidentification restriction with the Hansen (1982) test. In addition, we carry out an endogeneity

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test on critical variables to satisfy equation (3.7). In line with the GMM literature, we employ the lags of the regressors as instruments for the models. Finally, we test for robustness with the two-stage least squares method, a distinct form of instrumental variables regression. The underlying concept behind the 2SLS is to swap the endogenous regressors with a linear combination of the variables in the model. We then employ the combination as the regressors instead of the original endogenous variable (Odior and OsiAlenoghena, 2014).

3.4.4 Estimation of tax elasticity: The Divisia index approach

The theoretical framework for the Divisia Index is analogous to the concept of total factor productivity advanced in growth literature. In the total factor productivity theory, there is assumed a stable relationship between factor inputs and growth such that increases in inputs result in increased growth. Similarly, the Divisia Index framework assumes an institutional relationship between the tax base and tax revenue. Akin to technical change in the production function, discretionary tax changes also encourage shifts in the tax function. Whiles movement along the tax yield curve is associated with increases in the tax base; a discretionary tax change shifts the tax yield curve. This is because, according to Millwood (2011), it alters the existing tax system. Thus, without any discretionary changes, the tax system remains constant. This approach constructs an index of discretionary revenues over time. Whiles tax elasticity is a movement along the tax yield curve; the Divisia Index is used to construct a measure to derive the built-in flexibility estimate. Technically, the index is calculated as the percentage change in total tax yield divided by the percentage change in total tax yield due to the built-in response to an increase in the bases. It must be noted that the growth in tax revenue is ascribed to growth in the tax base if there are no discretionary tax changes within the period of analysis. A change in the index thus reflects the revenue effect of discretionary measures. Its invariance properties make the index appropriate. Two assumptions underlie this approach;

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1. First, it is assumed that there is a continuously differentiable aggregate tax function for "k" number of tax bases $f(y_1,(t)\ldots\ldots y_k(t))$
2. The tax function f is linearly homogeneous. Therefore, it has a constant return to scale.

In respect of the assumptions stated, the aggregate revenue 'T' function is specified as a homogenous function of GDP (y) as:

$$T = \beta y(t)^{\mu} \qquad [3.9]$$

Where T is the tax revenue, y is the tax base, the economy, 't' is time and a proxy for discretionary tax measures, and the μ is the buoyancy coefficient. From equation 3.9, it can be inferred that as the tax base of the economy $'y'$ rises over time, the tax ratio remains the same or increases when the value of μ remains the same or exceeds unity (1).

Following the work of Choudhry (1979) and Milwood (2011), we set the tax function as specified in the assumptions as;

$$T(t) = f(y_i(t)\ldots\ldots y_k(t);t) \qquad [3.10]$$

Taking the log form of equation 3.10, and differentiating it with respect to time, we arrive at,

$$\frac{f_t(t)}{f(t)} = \frac{\dot{T}(t)}{T(t)} - \sum_i^k \frac{f_{i(t)y_i(t)}}{f_t}\frac{\dot{y(t)}}{y_i(t)} \qquad [3.11]$$

$$\text{Setting } \frac{f_i(t)y_i(t)}{f(t)} = \alpha_i(t) \text{ and } \frac{f_t(t)}{f(t)} = \frac{\dot{D_{(t)}}}{D(t)} \qquad [3.12]$$

Where $\dot{D(t)}$ is the Divisia index of discretionary change. It must be noted that a shift in the $\frac{\dot{D_{(t)}}}{D(t)}$ ratio represents an increase in tax revenue as a result of the discretionary tax measures. Equation 3.12 is re-arranged as;

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$$\frac{\dot{D_{(t)}}}{D(t)} = \frac{\dot{T}(t)}{T(t)} - \sum_i^k \alpha_i(t) \frac{\dot{y(t)}}{y_i(t)} \quad [3.13]$$

The index can be generated by integrating equation 3.13 over an interval period of $(0, n)$

$$\frac{D(n)}{D(0)} = \left[\frac{T(n)}{T(0)}\right] exp\left(\sum_i^k \int_0^n \alpha_i(t) \frac{\dot{y(t)}}{y_i(t)}\right) \quad [3.14]$$

Normalising to set $D(0) = 1$, the $D(n)$ may be seen as the revenue growth index ascribed to discretionary tax changes at the time $'n'$.

Observably, $\alpha_i(t)$ in equation 3.14 is time-varying which makes the computation of the Divisia Index challenging. Following the procedure employed by Star and Hall (1976), this hurdle is overcome by transforming the time-variant $\alpha_i(t)$ into a constant $\widetilde{\alpha_\iota}$. This is a weighted average of $\alpha_i(t)$, which yields;

$$\int_1^n \widetilde{\alpha_\iota} \frac{\dot{y(t)}}{y_i(t)} dt = \int_0^n \alpha_i(t) \frac{\dot{y(t)}}{y_i(t)} dt \quad [3.15]$$

Equation 3.15 is further transformed into;

$$\widetilde{\alpha_\iota} = \frac{1}{n} \int_0^n \alpha_i(t) \frac{\rho_i(t)}{\bar{\rho}} dt \text{ Where, } \rho_i(t) = \frac{\dot{y(t)}}{y_i(t)} \text{ and } \overline{n\rho_\iota} = \int_0^n \frac{\dot{y(t)}}{y_i(t)d} dt = log \frac{y_i(n)}{y_i(0)}$$

The$\widetilde{\alpha_\iota}$'s represent the fluctuating $\alpha_i(t)$'s weighted average. The weights represent the ratio of the instantaneous rates of growth of all the bases to their average growth rates in the specified time interval$(0, n)$.

When the left-hand side of equation 3.15 is integrated, it results in;

$$\widetilde{\alpha_\iota} log \frac{y_i(n)}{y_i(0)} = \int_0^n \alpha_i(t) \frac{\dot{y(t)}}{y_i(t)} dt \quad [3.16]$$

$$D(n) = \frac{T(n)}{T(0)} / \prod_{i=1}^k \left[\frac{y_t(n)}{y_t(0)}\right]^{\widetilde{\alpha_\iota}} \quad [3.17]$$

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In equation 3.17, the index is seen as the index of the total growth of tax revenues divided by the index of automatic growth of tax revenues as indicated in the denominator. Equation 3.17 could be put in a log form as;

$$logD(n) = \log\left(\frac{T(n)}{T(0)}\right) - \sum_1^k \widetilde{\alpha_i} \log\left(\frac{y_i(n)}{y_i(0)}\right) \quad [3.18]$$

In equation 3.18, the growth rate of discretionary tax revenues is expressed as the gap between the rate of growth of total tax revenues and its automatic tax revenues growth rate is a weighted sum of the growth rate of the bases (the $\widetilde{\alpha_i}$'s).

Observably, a shortfall advanced by various authors is that the $\alpha_i(t)$ is likely to contain some discretionary effects because of its discrete nature. According to Choudhry (1979), the bias may be upward if the discretionary effect induces the adverse revenue effects. Thus, depending on the effect of the discretionary measure, on revenues, the automatic growth of tax revenues may be overestimated or underestimated. Irrespective of the challenge, the Divisia Index provides a reasonable estimate of the effect of discretionary tax measures under normal circumstances. Also, given the informational gaps on tax reforms in Ghana, this method seems reasonably appropriate.

Concerning the Estimation of the buoyancy of the tax revenue, recalling the homogeneity assumption earlier advanced, the tax function was stated as;

$$T(t) = f(y_i(t) \dots \dots . y_k(t); t) \quad [3.19]$$

Assuming the degree of homogeneity $h > 0$, it is proven that when the bases' growth rate equals that of the GDP, the form of the tax function will be

$$T(t) = ay(t)^h D^*(t) = ay(t)^{\mu} \quad [3.20]$$

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Where y is the GDP, D^* is an index of the revenue growth ascribed to the discretionary manoeuvres in the time interval $[0, t]$and μ represents the tax buoyancy yield. D^* is a variant form of the index, D wth the same structure as in the time interval $[0, n]$ expressed mathematically as;

$$D^*(n) = \frac{T(n)}{T(0)} / \left[\frac{y(n)}{y(0)}\right]^{\widetilde{\alpha_i}} \quad [3.21]$$

$\tilde{\alpha}_i^* = \frac{1}{n} \int_0^n \alpha(t) \frac{\rho(t)}{\bar{\rho}} dt$ where ρ is the growth rate of GDP.

Building on equation 3.21, D^*can be expressed in the interval $[0, n]$ as,

$$D^*(n) = \left[\frac{y(n)}{y(0)}\right]^{\mu - h} \quad [3.22]$$

D^* becomes invariant to the extent that, in the absence of any discretionary tax change within the interval $[0, n]$, the tax elasticity 'h', which also doubles as the degree of homogeneity of the tax function will equal the buoyancy μ of the tax yield. This presupposes that $D^*(n) = 1$

The tax elasticity (h) is subsequently estimated from the historical data. To do that, the buoyancy 'μ' of the tax yield is determined from historical revenue data within the time interval $[0, n]$ through the Estimation of the tax function $T = ay^{\mu}$. Secondly, because the D^* is derived from the underlying tax function f as in the case of D, the tax function can be substituted into equation 3.23 as;

$$\hat{h} = \mu - \frac{\log D(n)}{log\left[\frac{y(n)}{y(0)}\right]} \quad [3.23]$$

This is the elasticity of the tax. Similarly, the index D^* can be calculated from historical data using the tax yield and the GDP to arrive at an alternative estimate of the tax revenue elasticity from equation 3.24 as;

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$$\hat{h}^* = \mu - \frac{\log D^*(n)}{log\left[\frac{y(n)}{y(0)}\right]} \qquad [3.24]$$

In distinguishing between $\hat{h}\ and\ \hat{h}^*$, $\hat{h}$ can be a disaggregated way of estimating the Divisia index, whiles $\hat{h}^*$ is based on the aggregate level. However, if the bases grow at the same rate, both $\hat{h}^*$, and $\hat{h}$ will be equal. Thus, this work will go both the aggregative and the dis-aggregative way for a thorough study.

3.4.5 Robustness and diagnosis of the model

We acknowledge the challenges that serial correlation and Heteroskedasticity pose to each model. Because of that, all estimations are conducted with Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) estimators. In addition, we employ the Newey-West estimator for models with both Heteroskedasticity and autocorrelation (Newey & West, 1994; 1987). Thus, the result should be devoid of any of these challenges should they suffice.

The stationarity test connotes testing for the existence of unit root or otherwise. The aim is to investigate the presence or otherwise of a stochastic or a deterministic trend in the series. Generally, the output of using non-stationary time series data to estimate regression equations is a spurious result. The study will overcome this by employing the Augmented Dickey-Fuller test (ADF) by Dickey and Fuller (1979), based on MacKinnon (1996) critical values and the Phillips–Perron (PP) test by Philips and Perron (1988). The use of the two tests is meant to produce robust results. The PP test complements the shortcomings of the ADF test. This is especially important as the two tests differ in the mechanism used to correct autocorrelation in the residuals. The ADF test does not perform well in smaller samples (Cheung and Lai, 1993). Beginning with the ADF test, the unit root hypothesis is dropped if the critical *'t'* value at 5% level is more significant than the estimated ADF statistic. The ADF test is conducted on equation 3.25 as;

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$$\Delta Y_t = \rho + \rho_t + \varphi Y_{t-1} + \sum_{i=1}^{k} \gamma \Delta Y_{t-i} + \mu_t \quad [3.25]$$

Y_t is the variable of interest, 't' is the time, β is a coefficient, μ_t is the error term. A unit root is present if $p = 1$, for a non-stationary variable. The equation above allows for both time and deterministic trend. Assuming on an apriori basis that $\rho_t = 0$ (without the deterministic trend), the study will test the null hypothesis that $\varphi = 1$ against the alternative hypothesis that $\varphi < 1$. The null hypothesis' acceptance means that the variable of interest is nonstationary. The ADF test fails to take cognisance of heteroscedasticity and non-normality issues associated with the variable. It does not also discriminate between stationary and non-stationary variables with a high degree of autocorrelation. The PP test by Phillips and Perron (1988) and Perron (1988) is therefore employed to complement the ADF. This technique allows for weak dependence and heterogeneity of the error process, thereby producing robust estimates over the ADF. The test equation is stated as;

$$\Delta Y_t = \alpha + \Omega(t - 0.5T) + \partial Y_{t-i} + e_t \quad [3.26]$$

The null hypothesis of $\partial = 1$, which suggests unit root, is tested against the alternative of $\partial < 1$ (stationarity). Although equation 3.26 denotes the presence of a deterministic trend, a restricted version of the equation will be estimated as in the ADF case. The study will rely on the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) to select the minimum desirable lag length for the two tests (ADF and PP test). According to Bashiru (2011), the AIC and SIC have a common objective of selecting a model that produces errors closer to a white noise process; this is based on selecting the smallest possible lag length to ensure parsimony.

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3.5.1 Results and Discussions

Table 3.3 presents the basic statistics about the data employed. The graphical trend of all the variables is also given in figure 3.3 below.

Table 3.3: Basic statistics of the variables employed in the study.

	Total tax	Indirect tax	Direct tax	Int.trade tax	Goods & Ser. tax	Consumption	GDP	Corruption	GNI	Imports
Mean	0.091734	0.052622	0.091734	0.018227	0.034360	3.71E+10	47569.02	2.483611	4.26E+10	7.95E+09
Median	0.084868	0.050872	0.084868	0.018952	0.033050	3.05E+09	7503.000	2.500000	3.18E+09	3.57E+09
Maximum	0.154427	0.087165	0.154427	0.023367	0.066520	2.44E+11	297219.7	4.000000	2.95E+11	2.39E+10
Minimum	0.023684	0.015533	0.023684	0.010486	0.003928	3461878.	43.00000	1.500000	18239800	2.43E+08
Std. Dev.	0.036479	0.016407	0.036479	0.003121	0.014692	6.49E+10	78301.02	0.667285	7.77E+10	8.09E+09
Skewness	0.266355	-0.087129	0.266355	-0.754386	0.038703	1.886690	1.865755	0.275526	1.998483	0.887367
Kurtosis	2.082919	2.633893	2.082919	2.810718	2.537823	5.428546	5.460162	2.496257	5.853851	2.161054
Sum	3.302408	1.894379	3.302407	0.656166	1.236945	1.34E+12	1712485.	89.41000	1.53E+12	2.86E+11
Sum Sq. dev.	0.046576	0.009421	0.046576	0.000341	0.007555	1.48E+23	2.15E+11	15.58443	2.11E+23	2.29E+21
Observations	36	36	36	36	36	36	36	36	36	36

Source 17: Author's construct

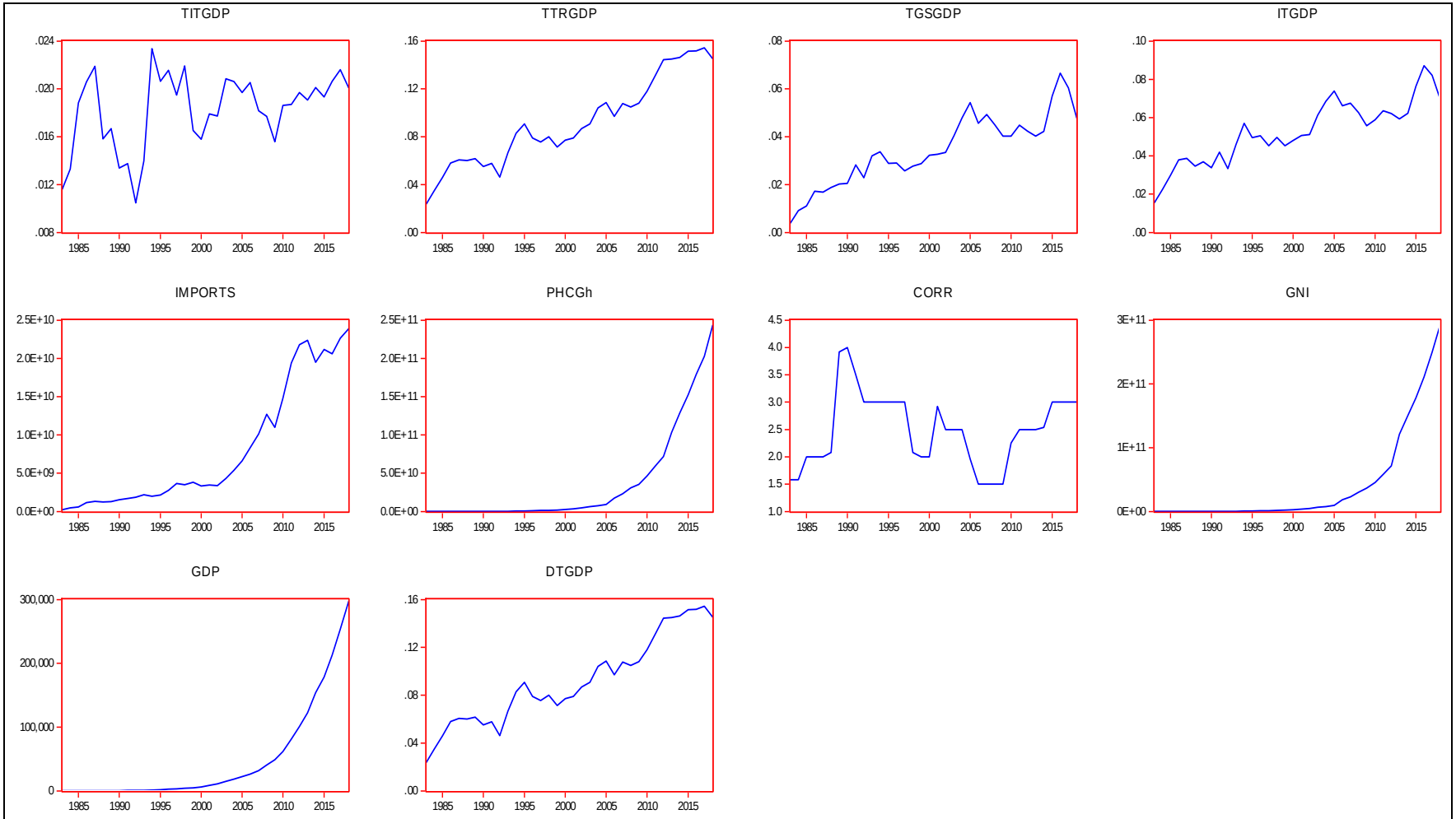
We have expressed all the tax variables as a percentage of GDP. Consumption spending, gross national income, GDP, and imports are, however, in Ghana cedis. The international country risk data estimate corruption; it is an index. All the data spans from 1984 and ends in 2018.

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Figure 3.3 below plots the various domestic revenue mobilisation handles (expressed as a ratio of GDP) and other variables employed in the Estimation. They are total tax revenue TTR, international trade taxes ITT taxes on goods and services TGS, indirect taxes IT, import taxes (Import), Personal consumption expenditure PHC, corruption CORR, and Gross national income GNI. Evidently, from figure 3.3 below, all the variables seem to be trending upwards. An observation that makes the estimation exercise t be undertaken the more relevant. Although trending upwards, it is in the interest of tax policy to find the nature of the alignment between the growth in the bases and the growth in the tax revenue. Corruption, however, experience a sharp drop from the alarming levels experienced in the eighties but picked up between 2010 and 2015.

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Figure 10.3: Trend of variables employed.



Where TITGDP is the tax on international trade, TTRGDP is the total tax, TGSGDP is the tax on goods and services, ITGDP is the trend of indirect taxes, PHCGH is the level of consumption, Corr. is the trend for corruption, GNI is the Gross National Income, GDP is the gross domestic product, DTGDP is the level of direct taxes.

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3.5.2 Stationarity test

Table 3.4 below details the stationarity test outcome of the variables under study. All the variables are tested with a linear trend and or constant. We observe that most of the variables were stationary at their levels as the 't' statistic is higher than the critical 't' at the 5% significant level.

Table 3.4: stationarity tests

Variable	*Levels*		*First difference*	
	Augmented Dicky-Fuller			
	Constant	**Trend**	**Constant**	**Trend**
Total tax	-3.262**	-4.475***	-5.425***	-5.275***
Indirect tax	-3.834***	-4.127**	-3.518**	-4.092**
Direct tax	-3.262**	-4.475***	-5.425***	-5.275***
Tax on G.& S.	-5.397***	-5.990***	-6.811***	-7.140***
Int. trade taxes	-3.552**	-1.988	-6.345***	-6.184***
GDP	-3.591**	-0.913	-2.760*	-4.438***
GNI	-1.820	-2.174	-5.631***	-5.934***
Consumption	-3.891***	-8.602***	-9.276***	-9.707***
Imports	-2.756*	-4.123**	-5.399***	-5.367***
Corruption	-5.13***	-5.068***	-8.549***	-8.416***
	Philips-Perron (PP) test			
	Constant	**Trend**	**Constant**	**Trend**
Total tax	-3.262***	-4.475***	-5.425***	-5.275***
Indirect tax	-3.834***	-4.127***	-3.518***	-4.092**
Direct tax	-3.261**	-4.475***	-5.425***	-5.275***
Tax on G.& S.	-5.397***	-5.990***	-6.811***	-7.140***
Int. trade taxes	-3.552***	-1.988	-6.345***	-6.184***
GDP	-3.591**	-0.913	-2.756*	-4.438***
GNI	-3.552**	-1.988	-6.345***	-6.184***
Consumption	-3.891**	-8.602***	-9.275***	-9.707***
Imports	-2.760*	-4.123**	-5.399***	-5.367***
Corruption	-2.382	-2.345	-5.095***	-5.018***

*Where *, **, and *** denotes significance at 10%, 5%, and 1% level. All tests were conducted in their natural log form.*

However, there are marginal differences in the outcome of the two tests, especially on the GNI and corruption.

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In variables where their ADF test differs from the Philips-Perron (PP) test results, we rely on the PP test because of its strength in resolving autocorrelation in the testing process. Given this, corruption is differenced for Estimation. All variables are tested in their natural logarithm form.

3.5.3 Tax Buoyancy models

The tax buoyancy coefficients by the GMM estimator are displayed in table 3.5 below. Again, Eviews 9 was used for all estimations, and the lags of all the regressors were employed as instruments.

Table 3.5: Tax buoyancy models; General Method of Moment (GMM)

	Model 1	Model 2	Model 3	Model 5	Model 6
	Total taxes	Direct taxes	Indirect taxes	Taxes on goods & services.	International trade taxes
Constant	-1.298***	-2.779***	-2.384***	-1.429***	-3.144***
	(0.344)	(0.508)	(0.558)	(0.434)	(0.497)
Log (Tax_{t-1})	0.658***	0.463***	0.515***	0.731***	0.455***
	(0.091)	(0.097)	(0.105)	(0.0758)	(0.086)
Log GDP	0.053***				
	(0.014)				
Log GNI		0.013***			
		(5.257)			
Log Consumption			0.043***	0.025***	
			(0.012)	(0.009)	
Log imports					0.043**
					(0.016)
Log corruption	0.111	1.196	-0.191	-0.079	-0.128*
	(0.132)	(0.241)	(0.179)	(0.160)	(0.084)
R^2	0.921	0.897	0.783	0.841	0.322
Adjusted R^2	0.913	0.886	0.758	0.823	0.249
DW	2.040	1.762	2.072	2.081	1.946
J-Statistics	4.017	4.773	4.522	6.069	5.249
J-Statistics (prob.)	0.856	0.311	0.874	0.733	0.512
Jack Bera	1.718	0.642	0.451	0.954	4.406
Jack Bera (prob.)	(0.424)	0.726	0.798	0.620	0.111

, **, * denotes significance at 10%, 5%, and 1% level.*

The strength of the various models is commendable in terms of the goodness of fit of the model and the joint significance. The adjusted R^2 of the first four was above 70%, with only the international

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trade tax model recording 32.2%. There were no over-identification problems with the instrument used. Also, the models were all customarily distributed; although the estimation technique employed the Neway HAC method, there was no evidence of autocorrelation in the error terms. Concerning the significance of the other controls employed, we found out that the mean value of all the different tax categories will be negative should all the controls employed assume a zero figure. Thus, all the constants in the models were negative and significant at 1%.

As expected, we established that, overall, there is some level of persistence of previous tax revenues in the tax mobilisation process. Thus, the lag dependent variables were significant in all the five different models at 1%. Generally, the current level of taxes is influenced by previous levels of taxes revenue mobilisation. In practice, this development is due to the target set by the revenue authority, which is usually based on the previous year's target. It is also because each round of yearly taxes, when spent efficiently, improves the tax base on which subsequent year's tax revenue is raised. This means that the subsequent year's target and, in most instance, revenue effort is a function of the past revenue effort.

Focusing on the buoyancy coefficients, our results show that taxes in Ghana are not buoyant. Thus, within the period under review, none of the tax types responded significantly to economic activities in general. This is similar to the findings of (Bayu 2015); it is also in line with Twerefou et al. (2010). This is because most of the buoyancy coefficients are less than unity (1). As shown in Table 3.6, the height of this observation occurred in the indirect tax category, where a negative buoyancy coefficient was recorded. This is an indication that the tax system is not an excellent automatic stabiliser. Thus, the tax system cannot rake in more revenues during periods of economic expansion, and the reverse is also true during contractionary periods (Khadan 2020).

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Concerning the International trade tax category, we find that a percentage change in the base (imports) will result in a meagre 0.43% change in taxes from international trade. This compares poorly with the findings of Twerefou et al. (2010), which estimated the buoyancy on international trade taxes at 0.83% and 0.89% for the short run and long run respectively of export taxes, and 2.15%, and 1.10% for import duties in short, and long-run respectively. It must be noted that Twerefou et al. (2010) employed GDP as the tax base for international trade taxes, which is less than desired. This finding also testifies that the base imports grow more than the growth rate in international trade taxes. The difference in growth may be accounted for by corruption at Ghana's borders which has become a canker, and the exemption regime at the various entry points into Ghana. In 2013, it was estimated that Ghana lost about US$150 million at the port due to the corruption[31]. Various governments have tried to plug the loopholes in revenue administration at the port with appreciable success. In 2017, the paperless system was introduced to eliminate the human element in importing import duties and removing the rigidities that hinder the process. Although corruption still exists, it has been toned down to the admiration of tax analysts. In 2017, it was reported[32] that Ghana's revenue losses at the port have reduced to about US$8.3 million monthly. A departure from the colossal losses in 2013. To reduce the abuse of import duties exemption, the government in 2017 initiated administrative controls aimed at tightening the exemptions regime. The policy response was evident in 2017 a total of GH¢7.22 million was received as import duty in the first eight months of the year compared to a lower figure of GH¢5.95 million recorded in the same period in 2016[33].

Taxes on goods and services also recorded a less than unity buoyancy coefficient of 0.025. This is less than the Excise duties' buoyancy of 0.5 realised by Cotton (2012) for Trinidad and Tobago; the 0.42

[31] https://www.ghanabusinessnews.com/2013/06/14/ghana-loses-150m-monthly-due-to-corruption-at-tema-port-report/
[32] https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Corruption-at-Tema-Port-Government-loses-US-8-3m-monthly-527837
[33] See < https://www.graphic.com.gh/news/general-news/tax-exemption-reforms-yield-results-ofori-atta.html>

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and 1.41 sales tax buoyancy for the short and long-run Pakistan by Bilquees (2004). Bekoe et al. (2016) used the proportional adjustment approach, estimated the sales and excise tax buoyancy of 0.70 and 0.97 respectively between 1970 to 1981 and 2.56, and at 0.92, between 1982 and 2013. This suggests that the tax system became buoyant after the economic recovery program in 1983. Twerefou et al. (2010), on the other hand estimated a VAT buoyancy of 0.42 in the short run relying on the Dummy Variable Technique. Both studies did not address potential endogeneity issues in the relationship. Characteristically, the Ghanaian economy has a large informal sector that does not accommodate an explosion of taxes on the consumption of goods and services when the economy expands. It has been estimated that about 30% of the Ghanaian economy is in the informal sector (Ocran, 2018). Therefore, informality dos do not make consumption instigate a very buoyant consumption tax.

Indirect tax is an amalgamation of taxes on goods and services and international trade taxes. The GMM results indicate that a percentage increase in the level of consumption (base) will result in a less than unity impact of 0.043% rise in indirect taxes. The slow pace of indirect tax revenue concerning developments in the economy results from the combination of the buoyancy challenges associated with international trade taxes and taxes on goods and services.

The direct tax also responded to its base (Gross National Income) less than the desired manner of 0.013%. This does not compare well with the findings of Seerattan and Charles (2004) and Cotton (2012) of 0.38 and 0.97 respectively for Trinidad and Tobago; Bekoe et al. (2016) also estimated it at 0.89, and 0.88 for corporate tax and personal income tax respectively for Ghana. Twerefou et al. (2010) estimated a buoyancy coefficient of 1.08 and 1.17 for the personal income tax in Ghana. The result from our Estimation is not in tandem with our apriori expectation. This is because direct taxes are structured progressively in Ghana, and therefore one would expect a significant growth in direct taxes when the base experiences significant growth.

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3.5.4 Tax elasticity

The tax elasticity was obtained by subtracting the Divisia index from the tax buoyancy coefficient. Table 3.6 presents the elasticities of the various taxes under study.

Table 3.6: Buoyancy, Divisia index, and tax elasticity (GMM)

	Total taxes	Direct taxes	Indirect taxes	Taxes on goods & services.	International trade taxes
Tax Buoyancy	0.053***	0.013***	0.043***	0.025***	0.043**
Divisia index	-2.311	-2.346	-1.600	-1.694	0.304
Tax Elasticity	2.364	2.359	1.643	1.719	-0.261

Note: $\hat{h}^* = \mu - \frac{log\, D^*(n)}{log\left[\frac{y(n)}{y(0)}\right]}$, $\pi_{(n)} = \frac{log\, D^*(n)}{log\left[\frac{y(n)}{y(0)}\right]}$ Where $\hat{h}^*$ is the tax elasticity, μ is the tax buoyancy, and $\pi_{(n)}$ is the Divisia index

Generally, the results demonstrate a very elastic tax system in Ghana. Most taxes registered elasticity that is more than unity (1). We find that almost all the taxes were highly elastic, except for international trade taxes. Traditionally, the buoyancy estimates are higher than the elasticity estimates, but as in Waryoba (2018) for Tanzania, Milwood (2011) for Jamaica.[34], Twerefou et al (2010) for Ghana[35], we find that tax elasticity is higher than tax buoyancy in all the different tax types. This finding resonates with those of Kusi (1998), Twereforu et al. (2010), and Bekoe et al. (2016) that Ghana's domestic revenue drive is strongly supported by the built-in mechanism rather than discretionary measures.

International trade taxes, however, displayed a negative elasticity of -0.261. Bekoe et al. (2016) argue that, although import taxes are levied on every import, the reality tells a different story. Parliament of Ghana has for many years given generous exemptions for the import of many capital goods for many projects in Ghana. The narrative is that the value of imports will not match the level of taxes realised. Moreover, earlier years (before 1983) of the period under review experienced economic challenges that seriously eroded the import base of the economy. Key among them include the severe shortage

[34] In some of the taxes, not all.
[35] For some taxes, not all tax types.

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of forex for import, the overvalued exchange rate regime, the neglect of the use of ad valorem rates in duty assessment, evasion, and bad revenue administration at the port (Bekoe et al., 2016)

We interpret the above with caution because international trade taxes in Ghana also include taxes on exporting some commodities, chiefly cocoa and gold. In such circumstance, there is a substantial part of international trade taxes that will not respond to the growth of the base employed (imports) in a positive manner[36]. In Ghana, cocoa rakes in annual revenue of US$2 billion in foreign exchange (World-Bank, 2015). The consultative board on the world cocoa economy (2007) estimated the optimal export tax on Ghana's cocoa at 16%. A substantial amount of revenues accrues from the sector. Gold exports in Ghana are also subjected to a series of taxes that ultimately tones down international trade tax elasticity to import. Although not the same in terms of the negative sign, the result aligns with the findings of Twerefou et al. (2010), who confirmed that export and import taxes in Ghana are inelastic. Thus, discretionary tax policies are responsible for international trade taxes and not automatism or tax elasticity. Thus, the movement in the tax buoyancy is dictated by the deliberate, ad, hoc and discretionary attempt to improve revenues at the various points of entry into Ghana.

Concerning taxes on goods and services, our Estimation reveals a highly elastic system at 1.719. This suggests that the reforms proffered within the period under review had more impact on the tax elasticity than buoyancy. The early 1990s witnessed significant reforms in sales taxes. This period saw the introduction of the Value added tax in Ghana, which is the main anchor on which taxes on goods and services depends in Ghana. VAT can be a money machine for governments since it is hard to evade while avoiding the cascading of indirect taxes (Keen and Lockwood, 2010; Alavuotunki et al., 2019). In Ghana, VAT has grown to a current rate of 12.5%, with two additional levies added, making it 17.5%. Bekoe et al. (2016) reveal that the restructuring in the administration of taxes, chiefly

[36] Original data source did not separate import levy and axes from export taxes

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establishing the VAT service, also played a significant role in the highly elastic nature of sales taxes in general.

The strength of taxes on goods and services in the indirect tax category was significant and overwhelmed the impact of taxes on international trade in producing a highly elastic indirect tax system of 1.643. This compares very well against the buoyancy estimate of 0.043. Indirect taxes are mainly dominated by sales taxes such as VAT in Ghana. The strong elasticity also indicates that the discretionary measures have little place in indirect tax revenue mobilisation; it is all an elasticity affair.

A similar finding is seen in the direct tax category; the tax elasticity for direct taxes was about 2.359. Although the level of elasticity is relatively high, it reiterates the elastic nature of direct taxes on the continent and other developing countries outside the continent. For instance, Ayoki et al. (2005) found direct tax elasticity in Uganda to be around 1.082. Yousuf and Huq (2013) realised a direct tax elasticity of 1.24 for Bangladesh, whiles Bilquees (2004) also detected a direct tax elasticity of 1.15 for Pakistan; Bekoe et al. (2016) found a tax elasticity of 1.4796 and 1.2411 for the personal income tax and corporate tax categories of direct taxes in Ghana. The high elasticity established by this study is because direct taxes are just about the most compliant in Ghana as they are deducted at source. Moreover, the result reflects the impact of the formalisation agenda of successive governments to rope in more SMEs into the tax net. Tax stamps introduced in 2005 led to the formalisation charge. Micro and small enterprises were to purchase the stamps every quarter and post them on their premises for inspection; this led to the growth of the tax base. Currently, business registration has been made easy, and the tax identification number (TIN) has become compulsory in order to access essential government services such as a bank account, driver's license and filing of cases in court. These strategies have widened the direct tax base and increased mobilisation. Moreover, regular wages by the government and the private sector to take stock of inflationary pressures and the visible growth

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of the share of labour in national income have also necessitated the growth of direct taxes in Ghana. Additionally, the series of steps taken by the government and their development partners during the structural adjustment and the economic recovery programs put the industry on a pedestal for growth. Some of the policies proffered include the review of the mining code, and the investment code, and the setting up of parastatals such as the Ghana Free Zones Board, and the de-regularisation of the foreign exchange sector. These and many more restored the corporate tax base of the economy and hence corporate tax elasticity. In recent years, high GDP growth from the discovery of oil and gas, since 2010, had added hugely to the economy and the tax base compared to when the mining and the agricultural sectors were the mainstays of the economy. The discovery of oil has had a significant effect on direct taxes in recent years as such development increases FDI and economic activities in Ghana. In 2014, Tullow oil alone made a tax payment to the tune of $313.5 million to the government of Ghana.[37]. With discoveries made in other oil fields, there is more prospect for direct tax revenue mobilisation.

There were a series of reforms on the tax administration that also impacted the collection and assessment of direct taxes. Key among them include creating the large taxpayer's unit in 2002 and the medium taxpayer's unit, and the small taxpayer's unit. These offices developed a specialisation in dealing with corporations in the payment of their taxes.

Overall we find a very elastic tax system in Ghana, with an overall tax elasticity of 2.364. Other studies made similar findings. For instance, Kusi (1998) estimated an overall tax elasticity of 1.22 for Ghana, from 1983 to 1993, Twerefou et al. (2010) found an overall elasticity of 1.03 between 1985 and 2007, and Bekoe et al. (2016) estimates an overall elasticity of 1.72 for Ghana between 1983 and 2013. The

[37] See<http://www.reportingoilandgas.org/tullow-pays-313-5m-in-taxes-to-ghana/>

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main implication of the finding is that tax revenue mobilisation in Ghana is instigated by tax elasticity and not tax buoyancy. This means that tax reforms over the years have been effective.

3.5.5 Robustness checks

To add impetus to the result from the GMM models, we estimated the same models with a Two-stage Least Squares method. The results are presented in Table 3.7.

Table 3.7: Tax buoyancy models: Estimates from Two-Stage Least Squares

	Model 1	Model 2	Model 3	Model 5	Model 6
	Total taxes	Direct taxes	Indirect taxes	Taxes on goods & services.	International trade taxes
Constant	-1.993***	-3.023***	-3.171***	-2.963***	-3.684***
	(0.575)	(0.768)	(0.922)	(1.018)	(0.641)
Log (Tax_{t-1})	0.469***	0.431	0.348***	0.482***	0.375**
	(0.149)	(0.134)	(0.167)	(0.169)	(0.142)
Log GDP	0.080***				
	(0.024)				
Log GNI		0.075***			
		(0.202)			
Log Consumption			0.057***	0.056***	
			(0.020)	(0.021)	
Log imports					0.053**
					(0.024)
Log corruption	0.160	0.247	-0.226	-0.182	-0.294
	(0.221)	(0.284)	(0.212)	(0.242)	(0.310)
R^2	0.924	0.917	0.787	0.846	0.243
Adjusted R^2	0.916	0.908	0.763	0.829	0.159
DW	1.855	1.847	1.934	1.881	1.862
J-Statistics	8.688	8.845	2.925	5.389	0.011
J-Statistics (prob.)	0.122	0.115	0.403	0.370	2.842
Jack Bera	0.505	0.018	0.378	1.837	3.596
Jack Bera (prob.)	0.777	0.991	0.828	0.399	0.166

*Where *, **, *** denotes significance at 10%, 5%, and 1% level.*

The tax buoyancy coefficients are not significantly different from the estimates from the GMM model. The different tax categories did not exhibit a buoyant tax system. All the coefficients were less than unity. Table 3.8, on the other hand, demonstrates the highly elastic nature of tax systems in Ghana.

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This suggests that similar to the GMM output, tax policy reforms during the period under review did not address tax buoyancy issues well, and the impact of discretionary changes in the tax system does not ostensibly impact revenue mobilisation. Therefore, tax revenue mobilisation in Ghana is due mainly to automatic responses to the bases and not the discretionary measures.

Table 3.8: Tax elasticity results from Two-Stage Least Square (2SLS)

	Total taxes	Direct taxes	Indirect taxes	Taxes on goods & services.	International trade taxes
Tax Buoyancy	0.080***	0.075***	0.057***	0.056***	0.053**
Divisia index	-2.311	-2.346	-1.600	-1.694	0.304
Tax Elasticity	2.391	2.421	1.657	1.750	-0.251

$\hat{h}^* = \mu - \frac{log\, D^*(n)}{log\left[\frac{y(n)}{y(0)}\right]}$, $\pi_{(n)} = \frac{log\, D^*(n)}{log\left[\frac{y(n)}{y(0)}\right]}$ *Where* $\hat{h}^*$ *is tax elasticity,* μ *is the tax buoyancy, and* $\pi_{(n)}$ *is the Divisia index, and *, **, *** are defined*

A flexible tax system could be beneficial, and it is a significant step in tax policy formulation as it promotes precision in tax revenue modelling and prediction. Moreover, it promotes revenue mobilisation efficiency as the social planner does not have to resort to too many discretionary measures that disrupt the private sector's financial plans.

3.5.6 Long-run Cumulative Buoyancy and elasticity

As borrowed from Koyck (1954), the long-run cumulative buoyancy effect measures the impact of a permanent change in the tax base on the tax revenue. It is handy when the lag dependent variable is a critical feature of the regression equation. We find that the result from the cumulative buoyancy is not significantly different from the baseline model. Tax revenue growth is mainly driven by tax elasticity. Although the buoyancy coefficients improved, they were less than 1, suggesting that the tax system is not buoyant in the long run. A permanent percentage increase in the respective bases will improve total tax by 0.155, direct tax by 0.024%, indirect tax by 0.089%, taxes on goods and services by 0.093%, and international trade tax by 0.079% (Table 3.9).

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Table 3.9: Long run Cumulative tax buoyancy and elasticity

GMM	Total taxes	Direct taxes	Indirect taxes	Taxes on goods & services.	International trade taxes
Tax Buoyancy	0.155	0.024	0.089	0.093	0.079
Divisia index	-2.311	-2.346	-1.600	-1.694	0.304
Tax Elasticity	2.466	2.370	1.689	1.787	-0.225
Two-Stage Least Squares					
Tax Buoyancy	0.151	0.132	0.087	0.108	0.085
Divisia index	-2.311	-2.346	-1.600	-1.694	0.304
Tax Elasticity	2.462	2.478	1.687	1.802	-0.219

$\frac{\beta_0}{1-\psi_1}$, *where* β_0 *is the coefficient of the tax base and* ψ_1 *is the lag dependent's coefficient.*

The respective elasticities associated with these 1% permanent changes in the respective bases are 2.466 for total tax, 2.370 for direct tax, 1.689 for indirect tax, 1.787 for taxes on goods and services, and -0.225 for taxes on international trade. The forgoing goes to reiterate earlier submission that all the significant taxes are very elastic except taxes on international trade. This also means that, in the long run, tax revenue mobilisation is informed by automatism and not discretionary tax policies. Thus, tax reforms have not succeeded in influencing tax buoyancy in the long run.

3.6 Conclusions and policy recommendations

The study has explored the buoyancy and elasticity of tax systems in Ghana. We find the tax system in Ghana not buoyant but elastic. We observed that revenue growth in Ghana is all an elasticity phenomenon. From the long run to the short run, growth in the tax base has a higher chance of raising revenue than mechanical adjustments in tax policy. Thus, the discretionary tax reforms proffered did not support tax revenue growth behaviour at all levels. We also observe that the long-run cumulative buoyancy and elasticity are higher than the buoyancy and elasticity of the baseline model, suggesting that tax policy becomes more efficacious in the long run. Thus, the impact of tax policies informed by both discretionary and automatic response of bases on tax revenue does not wane out rapidly, and it takes time to adjust and gravitate towards its long-run level. This also suggests that there are

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intertemporal outcomes as far as tax policy planning is concerned. Therefore, there is the need to have a short and long-run perspective of the outcomes in mind as far as fiscal policy is concerned.

These findings suggest that tax elasticity offers quick wins for tax revenue generation. We recommend that policy focuses on growing the respective bases on which these taxes are levied. Deliberate policies to garner investment and the flow of foreign direct investment such as making business registration easy, reducing the cost of doing business, and providing investment-friendly infrastructure should be pursued for broadening the bases. Promotion of industry could come in handy; in this direction, the one-district-one-factory policy of the government of Ghana is worth commending. The preceding being pursued, the tax regime must not erode the bases. The focus must shift from direct tax sources of raising tax revenues to indirect sources. This is because direct taxes such as corporate taxes are anti-investment and anti-savings in nature.

Secondly, buoyancy is the combined effect of discretionary tax policy impact and tax elasticity impacts. We suspect that the tax system is not buoyant because discretionary tax policies impede the elasticity impact in erupting a buoyant tax system. Systemic challenges in tax revenue mobilisation include granting exemptions for capital-intensive projects in Ghana, the rampant and overly generous fiscal incentives given by government investment promotion programs such as the Ghana Free Zones scheme, and the rampant evasion and avoidance of taxes could have ramifications on tax buoyancy. We, therefore, recommend a review and tightening of these policies and regulations to mitigate revenue mobilisation risks. In addition, it is essential to continuously implement stringent compliance measures and intensive research to reduce tax evasion and avoidance behaviour in Ghana.

3.7 Limitation of the study

Choudhry (1979) contemplates the potential of overestimation or underestimating the automatic growth of taxes that discretionary changes may produce. Thus, there is potential overestimation when

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the discretionary changes lead to improved revenues and underestimation when the discretionary changes reduce the revenue effect. Irrespective of the above, the estimates do not generally deviate from the actual direction of the study. The pattern of the results is generally confirmed by both GMM and the two-stage least squares methods. As indicated earlier, the result does not deviate from the findings of other studies that employed different methods and tax bases (e.g. Twerefou et al., 2014).

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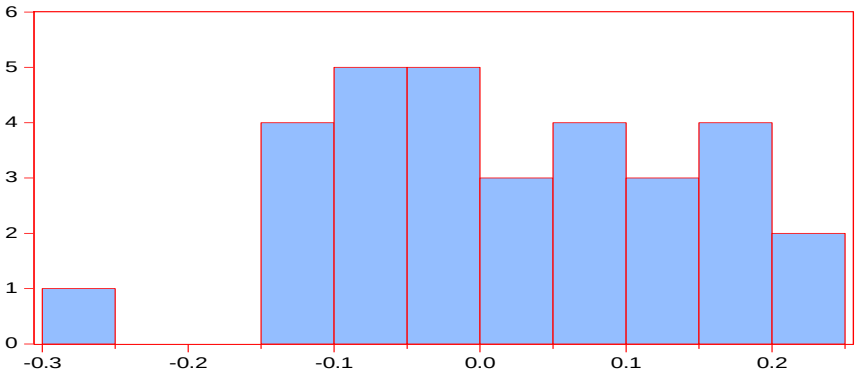
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Appendices

Appendix 3.1: Indirect tax model diagnosis

Normality test



Series: Residuals	
Sample 1988 2018	
Observations 31	
Mean	0.017050
Median	0.010879
Maximum	0.247061
Minimum	-0.252053
Std. Dev.	0.117113
Skewness	-0.006817
Kurtosis	2.409285
Jarque-Bera	0.450960
Probability	0.798133

Weak Instrument Diagnostics

Cragg-Donald F-stat:	0.604701
Stock-Yogo TSLS critical values (relative bias):	
5%	17.80
10%	10.01
20%	5.90
30%	4.42

Stock-Yogo size critical values not available for models with more than 2 endogenous variables.

Moment selection criteria:	
SIC-based:	-26.38350
HQIC-based:	-17.79564
Relevant MSC:	-11.07991

Q-statistic probabilities adjusted for 1 dynamic regressor

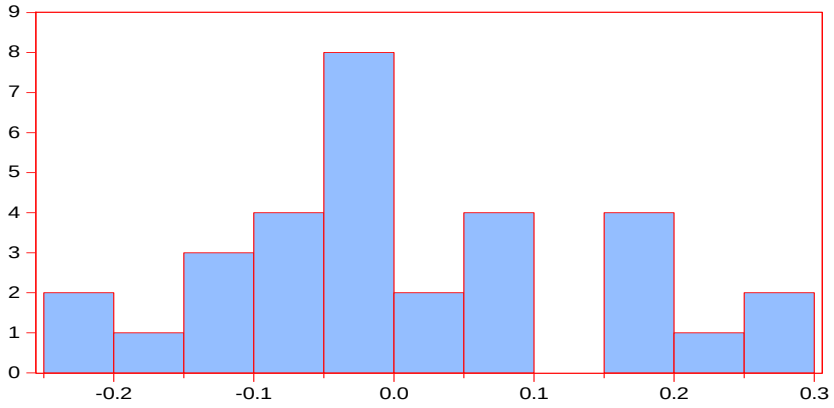
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. *| . |	. *| . |	1	-0.099	-0.099	0.3328	0.564
. | . |	. | . |	2	-0.051	-0.061	0.4241	0.809
.**| . |	.**| . |	3	-0.216	-0.230	2.1260	0.547
. | . |	. *| . |	4	-0.057	-0.118	2.2509	0.690
. | . |	. | . |	5	0.009	-0.048	2.2543	0.813
.**| . |	.**| . |	6	-0.237	-0.333	4.5513	0.603

*Probabilities may not be valid for this equation specification.

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Appendix 3.2: Taxes on goods and services model diagnosis

Normality test



Series: Residuals	
Sample 1988 2018	
Observations 31	
Mean	0.010160
Median	-0.011964
Maximum	0.267749
Minimum	-0.230482
Std. Dev.	0.130831
Skewness	0.304278
Kurtosis	2.392628
Jarque-Bera	0.954854
Probability	0.620378

Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.*| . |	.*| . |	1	-0.092	-0.092	0.2885	0.591
. | . |	.*| . |	2	-0.057	-0.067	0.4051	0.817
.*| . |	.*| . |	3	-0.167	-0.181	1.4282	0.699
. | . |	.*| . |	4	-0.062	-0.107	1.5742	0.813
. | . |	. | . |	5	0.031	-0.015	1.6115	0.900
.*| . |	.**| . |	6	-0.183	-0.238	2.9753	0.812

*Probabilities may not be valid for this equation specification.

Weak Instrument Diagnostics

Cragg-Donald F-stat:	0.629024
Stock-Yogo TSLS critical values (relative bias):	
5%	17.80
10%	10.01
20%	5.90
30%	4.42

Stock-Yogo size critical values not available for models with more than 2 endogenous

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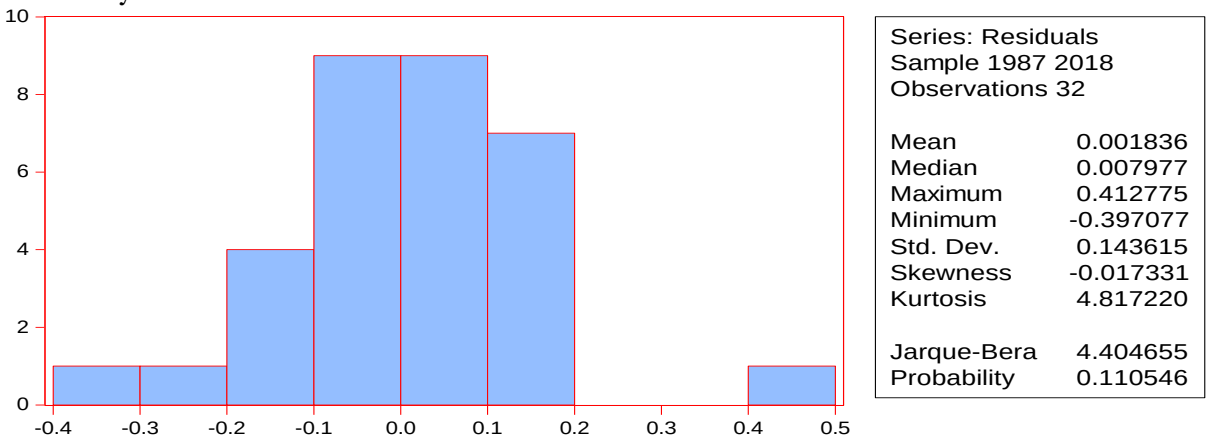
variables.

Moment selection criteria:

SIC-based:	-24.83714
HQIC-based:	-16.24929
Relevant MSC:	-12.18336

Appendix 3.3: International trade model diagnosis

Normality test



Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.002	-0.002	0.0002	0.990
. | . |	. | . |	2	0.058	0.058	0.1228	0.940
.**| . |	.**| . |	3	-0.245	-0.246	2.3752	0.498
. *| . |	. *| . |	4	-0.168	-0.180	3.4684	0.483
. *| . |	. *| . |	5	-0.196	-0.188	5.0109	0.415
.**| . |	***| . |	6	-0.278	-0.382	8.2528	0.220

*Probabilities may not be valid for this equation specification.

Weak Instrument Diagnostics

Cragg-Donald F-stat:	2.927819
Stock-Yogo TSLS critical values (relative bias):	
5%	17.70
10%	10.22

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20%	6.20
30%	4.73
Stock-Yogo critical values (size):	
10%	25.64
15%	14.31
20%	10.41
25%	8.39
Moment selection criteria:	
SIC-based:	-15.54526
HQIC-based:	-9.740521
Relevant MSC:	-11.31209

Endogeneity Test

Null hypothesis: LNIMPORTS DLNCORR are exogenous

Specification: LNTITGDP C LNTITGDP(-1) LNIMPORTS DLNCORR
Instrument specification: C LNTITGDP(-1) LNTITGDP(-2) LNTITGDP(-3) LNTITGDP(-4) LNIMPORTS(-1) LNIMPORTS(-2) LNIMPORTS(-3) LNIMPORTS(-4) DLNCORR(-1)
Endogenous variables to treat as exogenous: LNIMPORTS DLNCORR

	Value	df	Probability
Difference in J-stats	0.504967	2	0.7769

J-statistic summary:

	Value
Restricted J-statistic	5.949346
Unrestricted J-statistic	5.444379

Restricted Test Equation:
Dependent Variable: LNTITGDP
Method: Generalized Method of Moments
Sample (adjusted): 1987 2018
Included observations: 32 after adjustments.
Linear estimation with 1 weight update
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Standard errors & covariance computed using estimation weighting matrix

Instrument specification: C LNTITGDP(-1) LNTITGDP(-2) LNTITGDP(-3) LNTITGDP(-4) LNIMPORTS(-1) LNIMPORTS(-2) LNIMPORTS(-3) LNIMPORTS(-4) DLNCORR(-1) LNIMPORTS DLNCORR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.697353	0.438026	-6.157975	0.0000
LNTITGDP(-1)	0.512934	0.067882	7.556319	0.0000
LNIMPORTS	0.033318	0.012472	2.671430	0.0124
DLNCORR	0.033235	0.064821	0.512715	0.6122

R-squared	0.354984	Mean dependent var	-4.003969
Adjusted R-squared	0.285875	S.D. dependent var	0.174381
S.E. of regression	0.147362	Sum squared resid	0.608035
Durbin-Watson stat	1.929430	J-statistic	5.949346
Instrument rank	12	Prob(J-statistic)	0.652906

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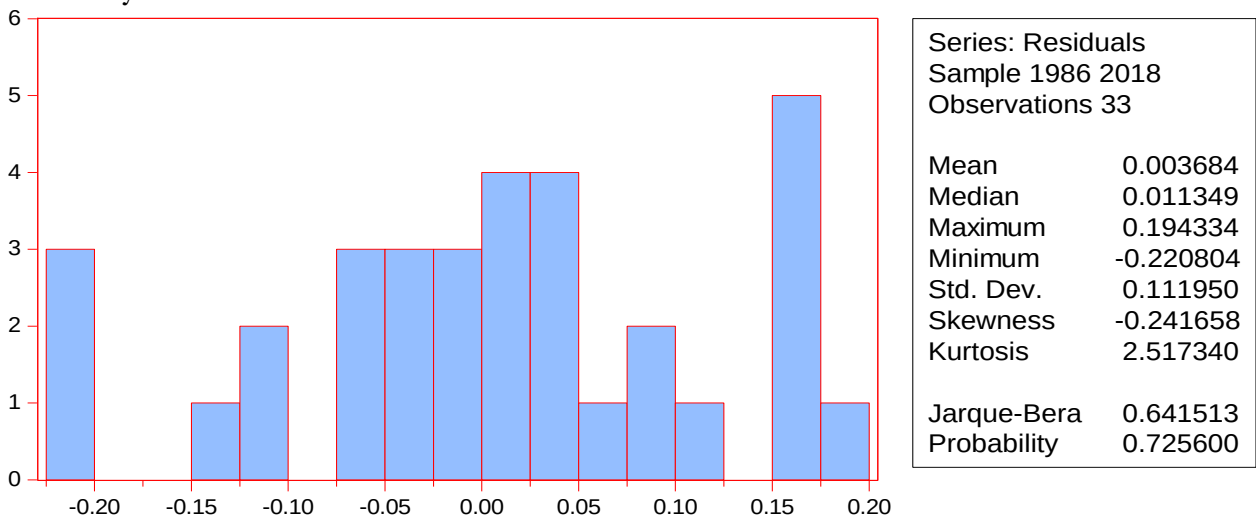
Unrestricted Test Equation:
Dependent Variable: LNTITGDP
Method: Generalized Method of Moments
Date: 09/29/20 Time: 09:46
Sample (adjusted): 1987 2018
Included observations: 32 after adjustments
Fixed weighting matrix for test evaluation
Standard errors & covariance computed using estimation weighting matrix
Instrument specification: C LNTITGDP(-1) LNTITGDP(-2) LNTITGDP(-3) LNTITGDP(-4) LNIMPORTS(-1) LNIMPORTS(-2) LNIMPORTS(-3) LNIMPORTS(-4) DLNCORR(-1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.866975	0.514831	-5.568766	0.0000
LNTITGDP(-1)	0.493126	0.069352	7.110500	0.0000
LNIMPORTS	0.037350	0.015714	2.376906	0.0245
DLNCORR	-0.008907	0.086038	-0.103521	0.9183

R-squared	0.352252	Mean dependent var	-4.003969
Adjusted R-squared	0.282851	S.D. dependent var	0.174381
S.E. of regression	0.147674	Sum squared resid	0.610611
Durbin-Watson stat	1.928595	J-statistic	5.444379
Instrument rank	10	Prob(J-statistic)	0.488205

Appendix 3.4: Direct taxes model diagnosis

Normality test



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Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |*. |	. |*. |	1	0.081	0.081	0.2354	0.628
. | . |	. | . |	2	-0.010	-0.017	0.2391	0.887
.**| . |	.**| . |	3	-0.252	-0.252	2.6882	0.442
.**| . |	. *| . |	4	-0.223	-0.197	4.6696	0.323
.**| . |	.**| . |	5	-0.225	-0.228	6.7605	0.239
***| . |	****| . |	6	-0.439	-0.585	14.989	0.020

*Probabilities may not be valid for this equation specification.

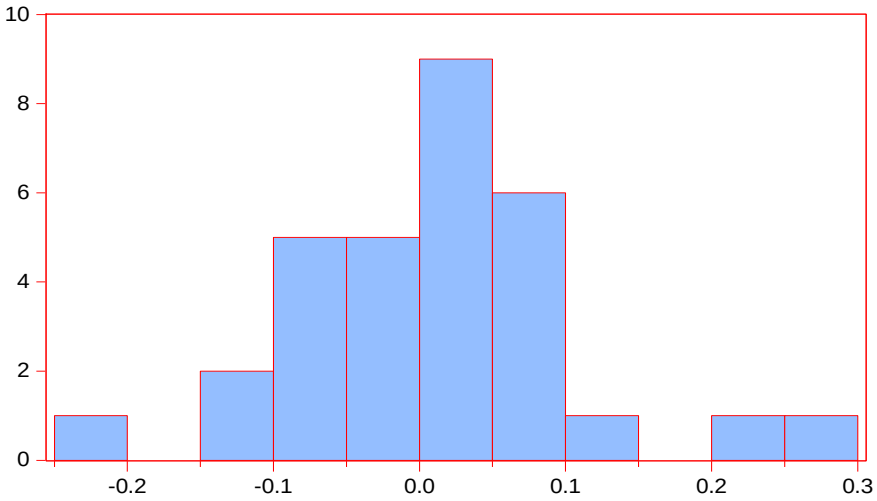
Weak Instrument Diagnostics

Cragg-Donald F-stat:	0.107077
Stock-Yogo TSLS critical values (relative bias):	
5%	15.72
10%	9.48
20%	6.08
30%	4.78
Stock-Yogo critical values (size):	
10%	21.68
15%	12.33
20%	9.10
25%	7.42
Moment selection criteria:	
SIC-based:	-9.212616
HQIC-based:	-5.290773
Relevant MSC:	-11.24553

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Appendix 3.4: Total tax revenue model diagnosis

Normality test



Series: Residuals
Sample 1988 2018
Observations 31

Mean	0.007927
Median	0.007519
Maximum	0.250136
Minimum	-0.231243
Std. Dev.	0.095433
Skewness	0.249723
Kurtosis	4.039612
Jarque-Bera	1.718228
Probability	0.423537

Weak Instrument Diagnostics

Cragg-Donald F-stat:	0.423986
Stock-Yogo TSLS critical values (relative bias):	
5%	17.35
10%	9.85
20%	5.87
30%	4.44

Stock-Yogo size critical values not available for models with more than 2 endogenous variables.

Moment selection criteria:

SIC-based:	-23.45525
HQIC-based:	-15.82160
Relevant MSC:	-13.17359

Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.040	-0.040	0.0549	0.815
. | . |	. | . |	2	0.005	0.004	0.0559	0.972
.**| . |	.**| . |	3	-0.278	-0.278	2.8708	0.412
. *| . |	. *| . |	4	-0.133	-0.168	3.5442	0.471
. *| . |	. *| . |	5	-0.070	-0.099	3.7352	0.588
.**| . |	***| . |	6	-0.266	-0.407	6.6346	0.356

*Probabilities may not be valid for this equation specification.

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CHAPTER FOUR

DISTRIBUTIONAL IMPACT OF DOMESTIC RESOURCE MOBILIZATION SYSTEMS IN GHANA: SYMMETRIC AND ASYMMETRIC RESPONSE

4.1 Introduction

The concept of resource distribution and economic welfare have for long dominated the development landscape. While economic growth is generally seen as good and desirable, it measures aggregate progress and masks many issues in the thinking around economic growth. Questions about who benefits from the progress made are best addressed by distributional impacts on poverty and inequality. The developed world has consistently kept a keen eye on these indicators to make their interventions more targeted and promote social stability and cohesion for development. Although they are essential for development, discourse on the impact of DRM systems on distribution was biased towards poverty alleviation. Thus, poverty reduction inherently also reduces inequality. For instance, unlike the current global goals, the Millennium Development Goals (MDGs) had as goal one, to reduce poverty by half by the 2015 deadline with no clear goal set for inequality. Development institutions such as the World Bank also prioritized poverty reduction strategies at the expense of inequality. According to Teichman (2014), the neglect of poverty as a development concern has worsened inequality globally since 2004, a development which Milanovic (2010) has revealed is rising within and among countries. Given this, development practitioners and economists have reacted by paying significant attention to it. Current development goals no longer subsume inequality targets in poverty goals; they are treated as two separate concepts. For instance, the current global goals (SDGs) has as goal number 10 "reduced inequalities," and as goal number one (1), "no poverty". There is a paradigm shift away from the fixation on poverty as a single redistribution target to a twin target of (poverty and inequality).

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An important development tool that is also gaining immense attention in development circles is domestic resource mobilization. Indeed, its importance is seen in the place it occupies in the current development agenda (SDGs). Goal number 17 targets number one (1), which requires that countries "strengthen their domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection." This target has significant implications on the twin redistribution concepts of poverty and inequality. The preceding is because of the trade-off between poverty and inequality at one end and the need for a sustained domestic resource mobilization drive (Hoeller et al., 2014) to finance budgets. Whiles significant financial resources are required to provide social protection facilities, transfer payments, and infrastructure which has poverty and inequality reducing tendencies, it is worth noting that the strategies employed to raise resources to finance these projects could have adverse poverty and inequality outcomes. DRM efforts can leave the poor with less cash for basic needs and unequally spread tax burdens by making a section of the society bear more tax burden than others. In the milieu of these observations, the questions that surface for redress are; to what extent do domestic resource mobilization efforts affect the poor? How is inequality affected by domestic resource mobilization? According to Lustig (2016), to study the impact of domestic resource mobilization on these two concepts in siloes could be misleading. The relationships are different. Analyzing the impact on poverty could create a misleading picture. Fiscal systems can reduce poverty, but a substantial part of the poor could be made worse off by the combined impact of the social transfers and taxes. It will also be inadequate to focus on the impact of DRM on inequality in isolation because fiscal systems can promote equality and, at the same time, be poverty increasing. We, therefore, focus on the two concepts of distribution.

What is the problem?

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Mass poverty and widened inequality are threatening the development of Africa (Tita and Aziakpono, 2016). According to Adjasi and Osei (2007), poverty has eroded the economic gains that most populaces live in poverty. Given this, poverty reduction strategies and poverty-oriented growth-enhancing policies have gained attention among governments and development institutions on the continent. Revallian and Chen (2012) also indicate that Africa is the second most unequal continent in the World behind South America. Indeed, Odusola et al. (2017) found out that, out of the most unequal countries worldwide, 19 are in Africa, with seven of the countries being outliers driving this inequality. Poverty and inequality challenges have thus remained high irrespective of the moderate growth gains made in Africa.

The African narrative applies to Ghana. Ghana has experienced an impressive annual growth rate of 7% since 2005. However, akin to many countries in Sub-Saharan Africa grapples with poverty despite the many interventions made. The challenge with poverty is that, although the country met the MDG target of halving poverty by 2015 from the 1991 figure 51.7% to 24% in 2013, it is undesirable in whatever form for 24% of the populace live below the poverty line. Secondly, there are essential disparities in poverty levels between social groups, between urban and communities in the countryside, and between the northern and southern parts of Ghana, which means that development remains unevenly distributed. Whiles, there has been a reduction in urban poverty, rural poverty continues to spur national poverty. Thus, a substantial part of the populace is still under the shackles of poverty, requiring urgent redress. It is in recognition of this that the SDGs aim at eradicating all forms of poverty.

Unlike poverty, where progress has been recorded, the inequality trajectory of Ghana shows worsening signs. The steady growth recorded has not been equally distributed across gender, localities, and quintiles. A look at the Gini index shows that inequality had risen from 37 in 1992 to 41 in 2013 and

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43.5 in 2016. Bastagli and Coady (2012), in an IMF study on inequalities, indicate that Ghana has one of the highest inequalities in Africa. The extent and height of inequality are revealed when we analyze it from the perspective of quintiles. In 1992, the poorest group of the population had only 6.9% of the country's income and further dropped to 5.2% in 2006. However, the richest 20% of the population held almost half of the country's income (Cooke et al., 2012). Concerning the non-income measures, Cooke et al. (2012) suggest that the gap between the rich and the poor concerning child mortality doubled between 2006 and 2011; children in wealthy groups are twice more likely to survive than poor children. Fosu (2009) and Chigano (2012) provide strong evidence that increasing inequality can have a range of negative impacts on a country's growth and development. Bourguignon (2004) has substantial evidence to suggest that inequality can put a brake on poverty. Because of that, Lopez (2004) indicate that interventions to mitigate the impact of inequality should be done earlier when inequality levels are low.

In terms of solutions, Lustig et al. (2014) and Lambert (1993) advocate that taxes be employed to reduce inequality and poverty. For instance, Fellman (1976) and Jacobsson (1976) claim progressive taxing reduces inequality. Whiles Higgins and Lustig (2016) and Enami et al. (2019) confirm the poverty-reducing properties of taxes. The principal problem upon which this study is built is that, although domestic resource mobilization systems (taxes) could be adjusted and has been adjusted to reduce poverty and inequality, the data on Ghana shows less than desired outcomes as far as the two measures of distribution are concerned. In the case of inequality, the data suggests that it is worsening by the day. Given the above, the nature of the relationship between taxes and their composition and poverty on the one hand and taxes and their composition and inequality is worth exploring. We aim to go beyond satisfying academic curiosity to understand the dynamics of all the variables involved and offer optimum policy directions for optimum policy effectiveness.

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Although studies such as Drucker et al. (2017), Mortorano (2016), Atkinson and Leigh (2010), Cornia et al. (2011), and Tsounta and Osueke (2014) have kick-started the conversation in a linear and panel setting, we posit that the impact of taxes and its component on poverty and inequality may have non-linear characteristics and as such, ought to be estimated using non-linear models. We justify this assertion because, whiles tax payments could negatively impact net incomes, and hence livelihoods, benefits in the form of transfers, public goods provision from these resources, and the livelihood support projects have a positive impact on people. From the preceding, it stands to reason that the relationship may no longer be symmetric but asymmetric, and hence non-linear. Moreover, Calhoun and Elliott (2012) assert that "nearly all economic models of the macroeconomy are very non-linear". We, therefore, suggest that, for efficient and reliable estimates, non-linear models could provide a better fit and explanation. We attempt to contribute to the tax policy and distribution literature by filling this gap. We also move away from the fixation on income measures and contribute to the literature by relying on both income and non-income measures of poverty. To drive optimum policy, we also move away from the multi-country panel dominated study to a single country study. The aim is to touch all relevant issues on the conversation, which may not be feasible in panel settings.

4.2 Poverty and inequality profile of Ghana

Ghana's effort towards poverty reduction has been noticeable. Over the years, the government's commitment has reflected in a myriad of policies such as; the Ghana poverty reduction strategy, Growth and poverty reduction strategy; Ghana shared growth development agenda (I&II), the livelihood empowerment against poverty (LEAP), capitation grant, school feeding program, and the free senior high school project. These policies reduced poverty from 31.9% in 2005/6 to the 2012/13 figure of 24.2%, and 23.4% in 2016/17. Urban areas within the urban forest region recorded the lowest poverty rates of 8.7%, 9.9%, and 6.1% in 2005/6, 2012/13, and 2016/17. The Ghana living standard survey report (2017) reveals that poverty in Ghana is essentially a rural phenomenon. It is

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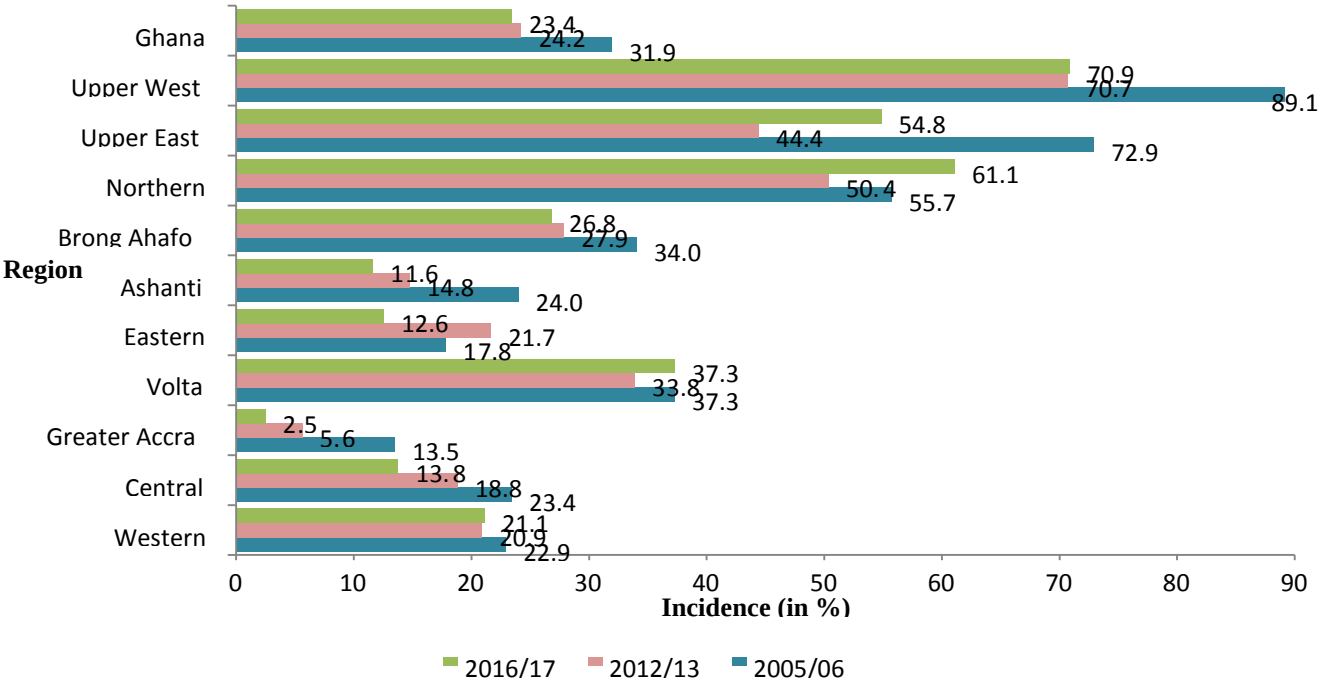
most pervasive in the rural savannah and rural coastal areas, with rural savannah recording 67.7%, as at 2016/17 GLSS survey. On the aggregate, urban poverty has reduced from 12.4% to 10.6% and finally to 7.8% in 2005/6, 2012/13, and 2016/17, respectively. Rural poverty, on the other hand, experienced mixed records. From 43% in 2005/06, it reduced to 37.9% but quickly rose to 39.5% in 2016/17.

Non-monetary poverty indicators have also seen improvements; McKay et al. (2015) indicate that there has been improvement in non-monetary poverty indicators such as; infant mortality between 1998 and 2012/13, from 57 death per 1000 to 41 death. According to Mohini and Paci (2015), other non-monetary measures such as attendance rate in secondary schools and access to social amenities also improved within the 1991/92 and 2012/13 period. Concerning the national distribution of poverty, the Northern, Upper East, and Upper West regions of Ghana continues to record the highest poverty in Ghana although improvements were recorded in all regions, the Upper West and Northern regions in 2016 were the highlighters with 70.9%, and 61.1% respectively. Clearly, significant differences exist in poverty levels in the most deprived areas (Northern Ghana). Although the Upper West region has the highest poverty, it contributes less than 10% to national poverty mainly because it is the smallest region. However, the Northern region contributed 20.8% (1.8 million) of poor people in Ghana. The three Northern regions of Ghana contributed 67.2% of those living in extreme poverty as of 2016/17[38]. Figure 4.1 below gives a pictorial representation of the regional incidence of poverty in Ghana.

[38] See the Ghana living standard survey 2017 for a detailed report

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Figure 4.1: Poverty incidence by region (Poverty line = GH¢1,314 Per year)



Source 18: GLSS 7 Report on poverty

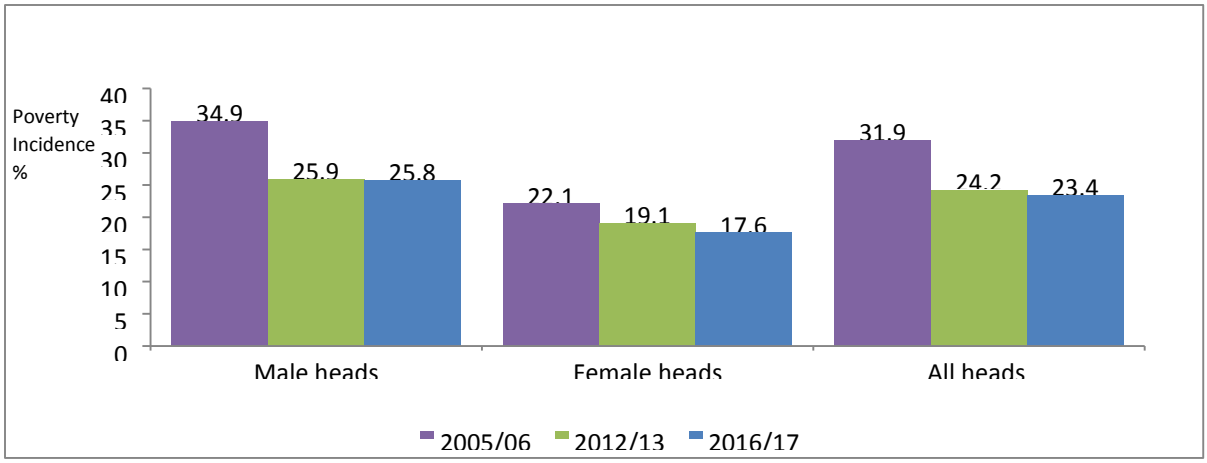
Although the Ghanaian economy has grown on average at 7% from 2005 to 2017, the growth elasticity of poverty has declined from 0.17% between 2006, and 2013, to 0.07% between 2013 and 2017. This means that the growth improved the lives of a small segment of society; intervention must follow the growth process to redistribute the growth to all.

On the poverty incidence on economic activities and gender, the GLSS 7 survey report indicates that household heads who are self-employed in the agriculture sector are the poorest (42.7%). With poverty lowest in households headed by retirees (1.6%) and households headed by public sector workers had the second-lowest poverty incidence of 4.8%. Farming is the major economic activity in rural Ghana. According to the GLSS 7 report on poverty, there was a decline in poverty in households headed by men and women of about 0.1% and 2.5%. However, the poverty incidence in households headed by

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women is smaller (17.6%) than men (25.8%). Figure 4.2 below indicate the poverty incidence by sex of household head.

Figure 4.2: Poverty incidence by sex of household head



Source 19: *GLSS 7 Report on poverty*

Figure 4.2 indicate that the poverty incidence in households headed by women has been declining faster than in households headed by men.

Education is an essential factor in the poverty dynamics of Ghana. It is vital in policy interventions aimed at poverty alleviation. The poverty incidence of households with uneducated heads was 44.3%, 37.6%, and 37% in 2005/6, 2012/13, and 2016/17, respectively. Poverty is a decreasing function of educational qualification. The poverty incidence among households with tertiary education was 0.3%, 3%, and 0.9% in 2005/6, 2012/13, and 2016/17, respectively. Education provides opportunities to household heads and equips them with skills that raise their productivity.

Inequality in Ghana exhibits trends in the character of global inequality. The GLSS 7 report on poverty and inequality indicates that inequality is widening in Ghana. The Gini increased from the 2005/6 figure of 41.9% to 42.3% in 2012/13, and finally to 43% in 2016/17. Akin to the poverty situation, the benefits of growth in Ghana has not been shared evenly with groups and segment of the

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population left out. Inequality is high in rural areas, but the gap between inequality in rural Ghana and urban Ghana is not markedly huge. The GLSS 7 put rural inequality at 41.8% and 37.9% in urban Ghana. In terms of the regional distribution, inequality is highest in the Upper West region (48.1%), with the Northern region being the second highest. On how deep inequality is in Ghana, the Palmer ratio shows that the Northern part of Ghana (Upper West, Upper East, and Northern region) has more profound inequality than the middle belt and Southern Ghana. The Upper West again highlights the severity of inequality in the North with a Palmer ratio of 2.79.

Ghana's performance in other non-income measures of inequality has also worsened. For instance, the gender equality index puts Ghana in the 130th position out of 160 countries. With a human development index of 0.46, which is higher and above the SSA figure of 0.389. The gender equality index (0.72) put Ghana on the same rank (130) out of 169 countries. Policies must address gender balance since it is a problem. Inequality exists in the availability and provision of social amenities such as water and sanitation. The FAO reveals that about 90% of urban dwellers had access to clean water at the expense of rural dwellers (74%). Sanitation was also 17%, as against 7% in favour of urban dwellers.

4.3 Review of related literature

4.3.1 The concept of poverty and its' measurement

Understanding the threat and danger of poverty and inequality is crucial to understand the concepts and their dimensions. The World Bank defines poverty as" pronounced deprivation in well-being" (Haughton and Khandker, 2009). Well-being can be either narrow or broad Rhwarder, 2016). The narrow definition relates to the ability to possess commodities, whiles the broad definition factors in physical and material conditions, relationships, agency, and participation, self-worth and values (well-being and pathways, 2013).

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Hume (2010) define poverty by comparing people's well-being in society at the same time (relative poverty). Because poverty is multi-dimensional, well-being could also be defined in relation to a lack of a specific consumption good. This is where non-monetary poverty finds expression. Within this context, poverty could be defined as a deprivation of food, shelter, asset, health or education.

One of the front-burning issues in the poverty literature is its measurement. The challenge is how to develop an index that captures the multi-dimensional nature of poverty. Bourguignon and Chakravarty (2003) argue that, although a higher income or consumption budget can improve the well-being and position of some non-monetary attributes of people, it is not the case that non-monetary welfare attributes have markets, and in some cases, some markets are imperfect. The most commonly used measures of poverty in tax analysis centres on consumption and income measures. They are; poverty headcount and poverty gap. In some cases, inequality of poverty is also included. Calculated as a percentage of the population, the poverty headcount measures the population that earn incomes below the poverty line. The poverty line could be defined nationally or internationally. According to the GLSS 7 report on poverty and inequality, the upper poverty line for Ghana was estimated at GHc 792.05 per year. Internationally, the World Bank put the poverty line at U.S$ 1.90 from U.S$ 1.25 a day. It has been argued that this may not be enough as basic human survival will require more financial resources. The poverty gap measures the depth of poverty. It measures the average income of those living in poverty relative to the set poverty line. The World Bank refers to it as the mean shortfall from the poverty line. (Counting the non-poor as having zero shortfalls) as a percentage of the poverty lines. The gap is based on the poverty line in place. Inequality of poverty analysis measures the dispersion of incomes within the group generally classified as poor. According to Gemmell and Morrissey (2003) in Foster et al. (1984), the above income measures of poverty are captured in the general class of measures of poverty given as;

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$P_\beta = \frac{1}{N}\sum_{i=1}^{n}\left(\frac{Y_i}{l}\right)^\beta$ Where ($\beta \geq 0$) and β is an integer parameter that measures the sensitivity of the overall index to poverty. l measures the poverty line. The poverty gap of the i^{th} individual is given by the poverty line l minus the value of the expenditure per capita of individual $i's$ household h_i, i.e. $Y_i = l - h_i$ (with $Y_i = 0$ when $h_i > l$). It must be noted that, when $\beta = 0$, P_0 equals the headcount index. It would be inferred that for all $\beta = 1$ the index P_0 equals the poverty gap index P_1, and when $\beta = 2, P_2$ becomes the poverty severity index. It would be inferred that for all $\beta > 0$ the index becomes a decreasing function of the living standard of the poor, and when $\beta > 1$ the higher will be the level of poverty measured by the index. The index is therefore strictly converse to income. This class of poverty measures is also known as the Foster, Greer and Thorbecke models. It has the additional benefit of decomposing the population into units to determine the contribution of each unit to global poverty.

However, Sen (1976) has criticized the poverty headcount ratio and the poverty gap on two bases; first, he contends that the two measures are insensitive to income redistribution among poor people. The poverty gap also does not experience variation when the condition of the poor worsens. Additional questions suffice on the optimal value of β. Given this, he proposes an index that combines the gross effect of the number of poor, the height and severity, and its distribution within the group. It is modelled as within the group;

$$P_s = p_0\left(1-(1-g^p)\frac{\alpha^p}{l}\right)$$

Where the poverty headcount is given by α^p represents the mean income or expenditure of the poor. Furthermore, g is a measure of inequality, in this case, the Gini index.

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Deaton (1997) criticizes the Sen Index because it cannot decompose poverty according to the contribution of different sub-groups. It is also practically limited and has been restricted to the academic setting due to its lack of intuition compared to the simpler indices. Because of the preceding, attempts have been made to alter the index. The most widely accepted variation is the conclusion reached by Thon (1979) and Shorrocks (1995), which has been classified as the Sen-Shorrocks-Thon index. The strength of this class of poverty measure is in its ability to give directions on the areas that account for the variations in poverty over time. It permits the decomposition of poverty into three aspects. In a question-like-form, Haughton and Khandker (2009) identified these three areas as; are there more people? Are the poor poorer? Furthermore, does higher inequality exist in the poor? The index is given as;

$$P_{SST} = P_0 P_1^p (1 + \hat{g}^p)$$

It is obtained by multiplying the poverty headcount by the poverty gap (for the poor only) and the whole population; a variable measuring the Gini coefficient of the poverty gap ratio (g) is also included. Osberg and Xu (1999) and Osberg and Xu (2000) demonstrate that the changes in percentage overtime of the SST index can be calculated as the percentage changes in the constituent elements. To make poverty distribution sensitive, Watts (1968) developed an index that satisfies almost all the theoretical properties needed in an index (Haughton and Khandker, 2009). The Watt index is given by;

$$W = \frac{1}{N} \sum_{i=1}^{p} [\ln(l) - \ln(y_i)]$$

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Where N is the total population arranged in ascending order of income. l is the poverty line and y_i is income. Although some additive measures of poverty are also distribution sensitive, these indices form the main income measures of poverty.

Attempts to measure multi-dimensional poverty (i.e. poverty beyond income) started in 2006 when the Mexican government in 2010 started measuring poverty as the proportion of the population deprived simultaneously of some monetary measure and one measure of the six social indicators or social right (Alkire and Santos, 2010). Alkire and Foster (2011) indicate that the national multi-dimensional poverty indexes (MPIs) developed by the UNDP and Oxford Poverty and Human Development Initiative (OPHDI) continues to be adopted by countries to complement the traditional monetary measures of poverty. The multi-dimensional poverty indicator focuses on monetary well-being education, access to basic infrastructure, health and nutrition, and household security. Although these measures were primarily selected for the index, they are also inherent in the UNDP (1990) Human Development Index. Ravallion (1996) identifies four set of indicators that should form the foundation of a sensible approach to multi-dimensional poverty. They include real expenditure per adult on market goods (access to non-monetary indicators), measures of intra-household distribution such as nutrition, and [personal characteristic indicators that can constrain an individual's ability. Thus, there should be a blend of income and non-income variables. Bourguignon and Chakravarty (2003) argue that well-being, the primary focus of every measure of poverty, is intrinsically multi-dimensional but from the viewpoint of "capabilities" and "function". To them, functioning focuses on what a person can do, and capabilities deal with the freedom enjoyed by a person in functioning. Sen (1985) and Sen (1992) posit that it is not income measures that should be looked at from the viewpoint of capabilities and functioning but attributes such as; literacy, life expectancy, etc. Given this, Bourguignon and Chakravarty (2003) suggest the Human development index by the UNDP as a good multi-dimensional (a measure of poverty).

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What are the economic theories of poverty? Davids and Sanchez- Martinez (2015) analyses theories on poverty under four different economic thoughts. They include the Classicals, Neoclassicals, Keynesians or Liberal School, and Marxists or radical school. Classicalism generally sees poverty as the outcome of bad choices that impact productivity. This is based on the premise that, based on this school's premise, market exchanges are efficient, and as such, payments (wages) are the outcome of individual productivity. Poor choices could thus lead people to find themselves in a "poverty trap or welfare trap". As a result, classicalism frown upon state intervention beyond a level to prevent destitution.

Two theories can be identified under the classical school. First is the sub-culture of poverty theory. Lewis (1965) in Townsend (1979) suggests that the poorest group of societies tend to have similar and peculiar characteristics that are "self-perpetuating" in nature. In that, poverty becomes a way of life for this group of people. It is thus passed down from one generation to the other. The underlying dictate of the theory suggests that behavioural tendencies are handed down across generations due to genetic inheritance or upbringing. According to Blank (2010), 'poverty begat poverty' because children from dysfunctional families inherit the deviance of their parents. Poverty alleviation in this context must be tackled from the perspective of character reformation and attitudinal change. Market-oriented solutions may not be so helpful. Poverty is therefore viewed as a person or family phenomenon and not a society-wide problem. However, Jung and Smith (2007) assert that empirical evidence on the dictate of this theory remains scarce. The second theory under the classical school is the behavioural or decision-based theory. Based on the free market principle, individual's outcome (well-being) is based on their own economic decisions. Therefore, individual poverty is due to bad work ethics, low education, or lack of skills. It further contends that; state intervention is needless, especially as the market determines the factors responsible for poverty. However, the drawback of this theory is that there may be involuntary forces that account for unemployment and hence poverty.

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The Neoclassical view on poverty was pioneered by Marshall (1980). They build upon the classical' view that initial endowments of skills, talents, and capital for productivity that provide an escape route from poverty within a market system are unequally distributed. Thus, those disadvantaged are trapped by poverty. According to Davids (2007), poverty created under these conditions is aggravated by market failures, moral hazard, adverse selection, asymmetric information. Although the role of government may be welcome to provide targeted interventions, generally, scepticism remains on the frequent and permanent government role. Six main theories suffice under the neoclassical view on poverty. First is the monetary approach in tandem with the utility maximization assumption that consumption can be relied on to measure welfare. Second, it relies on income to measure and define poverty. As such, the proponent of this theory, such as Bhalla (2002), advocates that attention should focus on income-generating mechanisms when poverty alleviation policies are in focus. Finally, according to Denis and Sanchez – Martinez (2015), economists following this theory believe that well-being can be quantified by looking at individual consumption via income and expenditure data. Poverty is therefore defined as a shortfall of the minimum consumption.

The second theory in the neoclassical class is the asset and financial income risk theory. This theory was developed to shore up the monetary approach. The incident of asset scarcity continues to be cited as a primary cause of poverty. Households with adequate levels of asset experience minimum effect as a result of fluctuations in their income. This is because asset holdings can be varied. Asset-poor households will be highly affected by income fluctuations as compared to asset-rich households. Poor diversification of income by way of few assets acquisition could affect the length of staying poor and the probability of becoming poor, especially when the main job of the household head is not secured and unstable (Ulimwengu, 2008). Relatedly, poverty is not privy to only private assets but social asset such as education and health. Similar to the classical view, because an asset is transferred across

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generations, the initial stock of wealth of a household might play a role in perpetuating and causing poverty.

Thirdly, the theory based on the neoclassical tradition is the incentive, market failures, and access to credit theories. Here, poverty is due to three things. First, certain constraints are faced by individuals, which gives them adverse incentives to make certain choices that make them poor. Secondly, market failures such as mismatch between skills and the labour market requirements (Pemberton et al., 2013). Lastly, lack of access to credit is also recognized as an additional cause of poverty. This is because it reduces the chances of an impoverished or poor person accessing funds to escape poverty.

Fourthly, the human capital theory traditionally assumes perfect competition and market equilibrium that strikes a strong relationship between wages and marginal productivity. However, demand for labor depends on specific characteristics or skills that can be supplied. Therefore, this theory ascribes poverty to the differences in skills and education possessed by the people. Those with the skillset with low demand will not be hired and end up in the poverty trap. Other theories such as; ethnic minorities, and immigration challenges (Trackey et al., 2011), and health and demographic factors by Bddelmeyer and Cai (2009) exists to explain the relationship.

The Keynesians or liberal school move beyond market distortions. They argue that it is not only market failure that causes poverty, but there are broad underdevelopment issues in many facets that cause poverty. Some of the issues include poor human capital, private capital and infrastructure. This school of thought also identify specific macroeconomic challenges such as inflation and unemployment as critical causal factors. To change the underdevelopment narrative, Keynesians advocate for government intervention at the macroeconomic level to tackle unemployment.

Marxists have for long argued based on class division. The centrality of their argument is that capitalization and political factors are the primary cause of poverty. The capitalist unnecessarily keeps

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wages low compared to the value-added through the fear of unemployment. Therefore, according to the Marxist theory, poverty alleviation strategies must focus on regulating the labour market. These are the major theories of poverty, although others, such as the social exclusion, and social capital theories of poverty, exists.

4.3.2 The concept of inequality, measurement and theory

The scope of inequality is more comprehensive than poverty. Inequality puts the whole distribution in perspective, while poverty focuses on the lower end of the distribution under review. The complexity of the measures of inequality is a result of this. We review the measures based on income and consider non-income measures of inequality subsequently. We also classify the income-based measures into three (3)—measures based on curves, indices, and ratios.

Lorenz (1905) was the first to develop a graphical technique for observing inequality. Ranking income recipients from highest to lowest, the Lorenz curve plots cumulatively the proportion of income recipients against the proportion of the overall income received. On the nexus of tax impact on inequality, the curve is significant in comparing pre-tax to post distributional tax impacts. Another graphical measure of inequality is the concentration curve. Though similar to the Lorenz curve, it defines income differently on each axis compared to the Lorenz curve, which relies on the same measure of income.

Indices are the most used measure of inequality; the Gini index is the oldest of the indices. Gini (1914) developed an index that measures inequality as depicted by the Lorenz or concentration curve. It measures the area between the 45% line and the relevant Lorenz curve (Gemmell and Morrissey, 2002). The index assigns equal weight to incomes at all levels irrespective of whether they are received by the rich or poor. The extended Gini coefficient, however, assigns greater weight to lower incomes compared to high incomes. Jenkins (1998) represents the Gini coefficient with the covariance term;

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$$G(v) = v\,\mathrm{cov}(y, \{ f(y)\}^{v-1} / \overline{y}$$

The relevant income is given by y, and $\bar{y}$ is its mean, $f(y)$ is the proportion of people with income equal to or less than y. v is the distributional or inequality prevention term; when it is set at 2, the conventional Gini is obtained. The generalized Gini has many advantages as the evaluator's value judgement can be made explicit through alteration in the v_1 through the parameter than v when the distributional impact of taxes are being worked on.

About the indices that factor in value judgement, Atkinson (1970) developed one that factors in aversion to inequality. He began by posing how much one is willing to surrender in income transfer to achieve global income equality. The income that is shared is referred to as 'the equally distributed equivalent income' 'ye' this income depends on ones' inequality aversion captured by the β in the expression below for 'ye';

$$ye = \left\{ \frac{1}{n} \sum_{i=1}^{n} y_i^{1-\beta} \right\}^{\frac{1}{1-\beta}}$$

In line with Gemmel and Morrissey (2002), we define the Atkinson index as;

$$A_t = \frac{1 - y_e}{\bar{y}}$$

This is the cost of inequality. When β=0, there is no concern about inequality. The Atkinson index presents total income in percentage, which society needs to forgo to have an equal income distribution between citizens. The measure can be decomposed between and within groups. Like the Atkinson index, the Hoover index, or Pietra ratio, measures the proportion of all income that must be distributed to attain perfect equality or zero inequality. It gives the share of income to be transferred from households above the mean income to those below the mean.

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Theil (1967) developed an index that belongs to the general class of entropy inequality measures. It measures the entropic gap between the ideal level of income everyone should have and the current level. It improves upon the Gini index because the Gini cannot decompose inequality within a group from that which is due to 'between groups'; this index is suited to analysing disparities between two groups.

Although they do not provide enough information on the depth and causes of inequality, ratios are the basic inequality measures. Decile dispersion or inter decile ratios dominate this class of measures. Decile ratios compare the income of a specific percentage of the rich to the same percentage of the poor. Decile ratios are, however, vulnerable to extreme values. Common examples include the; D9/D1, D9/D5, D5/D1, the Palmer ratio and the 20/20.

According to Anand and Sen (1994), even though income and wealth are important for human survival and development, they do not directly measure living standards. Non-income or monetary measures can provide more important and relevant measures of inequality (Peterson, 2014). The measures for non-income inequality are not markedly different from the income-based methods. It is only the subject of the inequality that differs (non-income). For instance, the Gini and Palmer index can measure inequality in education and health. Goldberg et al. (2004) indicate that health inequality can be determined by legal barriers, availability of health providers, language barriers, and literacy. Waystaff and Van Doorslaer (2000) all perceive concentration indices[39] the most efficient indicator for health inequality. The ratios and deciles could be employed to measure non-income inequality. Peterson (2004), however, considers the inequality-adjusted human development index as the most efficient non-economic measure of inequality.

[39] Similar to the Gini index

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What economic factors theoretically mediate inequality? Sahota (1998) recognizes two broad themes on the theories of the income distribution. The first theme views inequality as a result of voluntary choice and inheritance systems. The second theme, referred to as the fatalist group, comprises three main sub-theories; inequality based on abilities, inequality based on chance, luck, stochastic factors, and the third, life cycle theories that place a premium on age. According to Bigsten (1983), Friedman's choice theory combines stochastic impact with individual optimizing behaviour. According to Friedman, income differentials are a result of risk elements. Thus, individuals that are not risk-averse control a large share of income. The money lost in taking risk is smaller than money gained by the small group for taking risks. Therefore a society with many risk-averse people will have less income inequality than one with a community with many risk-neutral people. Within the voluntary choice and inheritance class of thought is the human capital approach. The proponents of this theory, led by Mincer (1978), employs explanations that look at the reasons behind job earning differentials as the cause of inequality. They postulate that high paying jobs require skills that entails long periods of training. Thus, the discounted present value of earnings are the same across occupations and job; the only observable difference is that high-income earners have been on the job for a shorter period (Cline, 1975). The job competition approach represents another stretch of the theory. The central tenet of the theory is that the marginal productivity of workers determines wages through skills acquired on the job. Thus, inequality could exist between people with identical education. Gallo (2002), however, contend that this theory is flawed because it does not account for the effect of education on on-the-job skills acquisition.

On abilities and stochastic forces, individuals reflect different productivity and hence reward and remuneration. Sahota (1978) argues that neglecting the role of property incomes and inheritance in a list of theories explaining inequality will not be complete. Meade (1964, 1976) summarizes inheritance as consisting of four primary things; genetic attributes, educational level of parents and training, social

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contract, and physical properties. Gallo (2002) reveals that the interaction of these factors affects income and savings formation. Therefore, different endowments in these resources reflect inequality in the lives of the bearers.

4.4 Empirical Reviews

3.4.1Tax-Growth literature

The thrust of the tax-growth literature hinges on whether tax revenues enhance economic growth and the economic conditions of citizens. Although prevailing literature is not conclusive on the exact relationship, interest in it has heightened as the development world is keen on leveraging taxation to reduce poverty and inequality. According to Stoilova (2017), investigations have focused on unravelling two issues; first, to find the impact of various tax levels on growth, and to study the impact of tax structure on growth. Concerning the first, Agell et al. (2006), Paparas and Richter (2015), Barro (1990), and Foslter and Henekson (2001) have all studied the relationship in a panel setting but arrived at different conclusions. The different conclusions arise because tax revenue systems have two main opposing effects on growth. While higher taxes can cause distortions in investment and reduce growth, higher taxes also means high public spending, which may enhance economic growth. A significant critique of the aforementioned panel studies is that they could not account for cross-country heterogeneity in their analysis. This inefficiency is seen in the US economy, where a positive relationship between taxation and growth was found in the separate works of Koester and Kormendi (1989), and Devaranjan et al. (1996), but Mertens and Ravn (2013), Barro and Redlick (2011), and Romer and Romer (2010) found a negative relationship for the same country. On a single country level, Greenidge and Drakes (2009), focusing on Barbados with data spanning 1960 to 2005, and using an ARDL model, confirms the negative relationship. However, Koch et al. (2005), using the three-stage least squares, found a positive relationship with data from 1960 to 2012. In Côte d'Ivoire, Keho (2010), found a negative relationship using scully regression models. Saiba (2015) also found a negative

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relationship between tax burdens and growth in South Africa and Nigeria. In the case of Ghana, Takumah (2014), applying the Granger cointegration and causality test, discovered a positive relationship between tax revenues and economic growth in both the long and short run.

According to Stoilova (2017), the conversation on the impact of tax structure on growth has also centred on the relative strength of direct as against indirect taxes on their abilities to midwife investment and growth. According to Phiri (2016), researchers have resorted to the 'tax structure mix' to measure the relationship between tax structure and growth and indirect taxation is favoured by prevailing literature. Karagianni et al. (2013) support this method of deepening knowledge on the relationship because it is essential to distinguish between distortionary and non-distortionary taxes as average tax is a wrong tax indicator. It is highly correlated with public expenditure. Policy conclusions advocates for a shift from income taxation to indirect taxes (Myles, 2009). In terms of the type and kind of indirect taxes, literature favours taxes on consumption over taxes on labour and capital. Studies that find a negative relationship between direct taxes and growth include; Kneller et al. (1999), who investigated 22 countries from the OECD between 1970 and 1995. The study classified taxes on income and property as distortionary taxes. Gemell et al. (2006) confirmed the same finding in the OECD by extending the data from 1970 to 2004. Lee and Gordon (2005) discovered a negative correlation between corporate tax rates and economic growth between 1970 and 1997 in 70 countries. Dackahag and Hanson (2012) also had a similar result for 25 OECD countries between 1975 and 2010. They found out that corporate tax rates and personal income tax negatively impacted investment and productivity. Nevertheless, Arnold (2008) discovered that property taxes were growth-friendly in 21 OECD countries between 1971 and 2004. Canavire-Bacarreza et al. (2013), focusing on Latin America, did not find the negative relationship established earlier in the OECD. In Bulgaria, Tancher (2016), using OLS between 2004 and 2012, progressive income tax confers positive impacts on growth.

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Phiri (2016) also identified a third strand of the tax-economic growth conversation. This strand investigates the possibility of non-linearity in the tax-growth relationship. Two sub-strands are worthy of review. First, a cohort of studies mimicked Scully's (1995, 1996, 2000, and 2003) ideas, which focused on deriving theoretical and empirical models for optimal tax rates that are growth-enhancing. Key among these studies were the works of Chao and Grubel (1998), Hill (2008), and Schoeman and Van Heerden (2009). The findings of these studies differ across countries and within countries, but it has relevance for policy reforms. Hill (2008) and Kennedy (2000) critique this approach to estimating optimal tax as the underlying model has defects in the functional form. The second sub-strand corrected the misspecification by employing tax returns as a percentage of GDP or its square as a measure of the tax structure. Dackehag and Hansson (2012), Stoilova and Patonov (2013), Nantob (2014), and Hunady and Ovriska (2015) are the major studies that employed this strategy.

3.4.2 Tax systems and redistribution

An alternative benchmark by which the efficiency of tax systems may be assessed is how it corrects inequality and affects the life of the poor. This has become necessary as many development programs aim at generating growth that is poverty and equality friendly. This is because, whiles tax systems may be growth-enhancing, the growth may not necessarily be to the advantage of the poor. This also explains why studies on the effect of tax systems on redistribution are growing. The studies have either focused on the relationship between tax systems and inequality, or poverty and in some cases, the two have been studied. Some studies accomplish this by comparing the potency of tax systems with government transfers or social spending in achieving poverty reduction and equal society.

Concerning inequality/tax systems studies, Okner (1975) was one of the early studies that started comparing government transfers and tax systems concerning their ability to redistribute income efficiently. While the study acknowledged that progressive taxes redistribute income, it also commends

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government transfers in income distribution. Engel et al. (1999) also focused on Chile and employed data at the household level to estimate the distributional impact of variation in the tax structure on income distribution. Their study revealed that, indeed, taxes are poor in redistributing income. The study thus advocates for the use of an expenditure targeting approach for different income groups. Chu et al. (2000), in a follow-up to Engel et al. (1999), set out to study the distribution of income in transitioning and developing countries. The study affirmed their findings that, indeed, developing countries have not been able to use tax systems and transfer policies to solve inequality problems. Bird and Zolt (2005) also argue that the personal income tax has done little to reduce income inequality in developing countries. Their findings are based on the fact that the personal income tax is so slight that it would be unrealistic to play a role in redistribution. Obadic et al. (2014), using fixed effect and random panel models from 2000 to 2011, looked at the impact of some taxes on income inequality. Their study revealed that social contributions and labour taxes reduce inequality, but consumption taxes do not influence inequality reduction. Smistak et al. (2015) found out that indirect taxes such as VAT are regressive in Poland. The study set out to investigate the impact of the reduction in the VAT rate in Poland as a countermeasure against the ills of the financial crisis in 2011. They found out that an attempt to promote progressivity through a reduction in VAT rate would be ineffective. The cost of such an exercise outweighs the small gains made. They, therefore, recommend a broader base VAT and a more progressive income tax for redistribution.

On the poverty/tax mediation narrative, Dafina and Thanawala (2004), focusing on seventeen developed countries, looked at the effect of taxes and transfers on poverty. They estimated the poverty headcount ratio before and after the policy change and concluded that transfers by government and tax policies could reduce poverty. In Ghana, Bhasin and Annim (2005) examined the effect of trade taxes on income distribution and poverty. They employed the computable general equilibrium (CGE) model. The study found that, should import taxes be replaced by VAT, poverty will be reduced while

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improving income distribution. On the other hand, when export taxes are replaced with VAT, poverty increases, and inequality is adversely affected. This study only looked at trade taxes; we examine all the tax systems for a thorough and comprehensive policy prescription. Adukonu and Ofori-Abebrese investigated the effect of tax policies in Ghana on poverty using Johansson's cointegration technique with time-series data from 1984 to 2013. The results demonstrated that indirect tax policies in Ghana raise the level of poverty. On the other hand, direct tax policies and remittances were found to mitigate poverty. However, it is worthy of note that this study treats all components of the tax system in one equation; they also used the per capita consumption level to measure poverty, which does not make the distributive and the relativeness of poverty come out for measurement. We improve the study by incorporating a non-linear dimension and employ more robust poverty data.

On the studies that focused on inequality and poverty, Lustig et al. (2013) sought to determine how distribution and poverty reduction have been achieved through social spending, subsidies, and taxes. They employed the standard fiscal incidence analysis in five Latin American countries (Argentina, Brazil, Bolivia, Peru, and Uruguay). Using a comparable methodology, they found out that direct taxes and cash transfers reduce poverty and inequality significantly in Argentina, Brazil, and Uruguay, but trivially in Bolivia, Mexico, and Peru. However, they also observed that direct taxes' redistributive impact is insignificant because they are small as a share of GDP. Also in Kenya, Maina (2017), investigates low consumption taxes' effect on income distribution with two OLS models for each, inequality and poverty. The study revealed that consumption taxes are regressive in Kenya. However, it also established a positive relationship between consumption taxes and GDP per capita.

Does growth have an impact on poverty reduction? Literature has gone to an appreciable length to link economic growth to poverty reduction. Dollar and Kraay (2002), focusing on 92 developed and developing countries over forty years, revealed that average income rises proportionally as the

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national average income rises. The study did not find evidence that growth-oriented policies and institutional factors affect the poor's income after controlling average income. Dollar and Kraay (2004) followed up their study by examining the effect of trade on poverty and inequality. They employed the average income of the bottom 20% and the Gini coefficient in this study. They found no relationship between trade volume, inequality and poverty. Ravallion and Chen (1997), Besley and Burgess (2003), and Kraay (2006) relied on absolute poverty measures to study the effect of variation in average income and income distribution on poverty. These studies revealed a negative relationship between poverty and average income. The findings confirm that the driving force behind poverty reduction is faster and sustained economic growth. For instance, Kraay (2006) employed data from developing countries from the 1980s to 1990s to test the importance of change in income distribution against growth variations in absolute poverty. The decomposition exercise revealed the significance of growth in poverty reduction. The study found out that a significant part of the reduction in poverty across countries was accounted for by growth performance.

Following Senbeta (2009), we evaluate the effect of tax systems on poverty after adjusting for income and redistribution (the main elements of poverty). Previous studies controlled for only one of them. The current study also differs from the prevailing literature in many respects. First, we assume a non-linear relationship between tax systems and poverty on the one hand and inequality. This seems to be missing in the literature. We also move beyond the regular non-linear treatment and test whether the relationships are asymmetric or not. Again, this is missing in the empirical conversation. Second, we deepen understanding by decomposing the tax into direct and indirect, and finally, we consider the total tax effect. This should bring to fore deeper insight into the relationship.

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4.5 Data and Methodology

3.5.1. Data sources and coverage

We resolve the objectives of this chapter by employing the tax systems data from the International Center for Tax and Development's (ICTD) government revenue dataset. We resolve it on the aggregate level and the disaggregated level. We employ indirect tax, direct tax, and total tax of Ghana's central government. This is important for policy as we track the performance of different tax systems as far as poverty reduction and promoting an equal society is concerned. We rely on tax as a percentage of Gross Domestic Product (GDP) as defined in the dataset. Tax/GDP ratio has been used by Maina (2017). Scaling tax revenues by GDP is reasonable as it provides a better gauge of the trend of taxes.

On poverty indicators, due to the lack of acceptable internationally comparable data on poverty in the past, researchers resorted to the use of relative variables such as health, education, and other measures that strikes a relationship with poverty. Illiteracy rate, infant mortality, and per capita consumption were some of the variables employed to proxy poverty. For instance, Masud and Yontcheva (2005) and Boone (1996) employed infant mortality to measure poverty. Kosack (2003) also used the human development index (HDI), whiles Arvin and Barillas (2002) employed per capita income. However, Whiles these variables give some sense of direction on poverty, they assume away the distributional properties subsumed in a proper measure of poverty (Senbeta, 2009). Thus, a reduction in infant mortality or an increase in the literacy rate and per capita income evades understanding on questions such as the reduction in the mortality rate benefits the poor. Attribution is, therefore, a problem in such studies.

We employ both absolute and relative measures of poverty. Foster, Greer, and Thorbecke's (1984) FGT class of poverty is the basis of the absolute measures. We rely on the poverty headcount ratio, the poverty gap, and the squared poverty gap ratio. The international poverty line set by the World

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Bank is U.S1.90 per day for extreme poverty. However, this study measures the poverty line by taking Ghana's status as a lower middle-income country into account. We, therefore, employ the poverty line applicable to a lower-middle-income country (U. S$3.20 per day). This provides a more accurate measure of the poverty status of Ghana. Although the headcount ratio is famous for its simplicity, it is deficient because it ignores the distribution of the poor as no weight is assigned to the distance of those described as 'poor' from the poverty line under study. Thus, it describes all those below the U.S$3.2 per day poverty as poor without any further classification. To counter the faults of the headcount ratio, we use the poverty gap (Gap) or the poverty depth. This measures the mean shortfall as a percentage of the poverty line. It looks at the average income needed to bring the poor to the poverty line. It is expressed as a percentage of the poverty line. It thus takes cognizance of how the poor are distributed. We move the distribution agenda forward by employing the squared poverty gap index (Sqgap), which improves the poverty gap's weakness of assigning even weight to the poor's income shortfall from the line. The squared poverty gap squares the shortfall and gives more weight to those described as poor. This index amplifies poverty by revealing the poorest among the poor. We take these data from WDI.

The absolute measures of poverty indicated above are not without limitations. It masks a lot of the details on the level of poverty. A reduction in poverty revealed by any of these indices does not necessarily mean a reduction in the number of poor. The number of poor people could be the same or increase. To counter this weakness, we also rely on the Historical Human Development Index (HHDI) as a fourth measure of poverty. This is a relative measure as the index evolves. It is more robust than the Human Development Index used by Kosack (2003); we obtain this data from "our world in data". Since poverty data for Ghana in the WDI dataset starts from 1987, employ the per capita income to backwardly estimate the poverty data for 1983, 1984, 1985, and 1986. We employ this technique to lengthen the poverty time series to cover more years. The intent is to produce robust

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regression estimates that meet the requirements of the central limit theorem. We employ per capita income because it shows a trend that depicts poverty in Ghana (periods of high per capita income has seen poverty reduction). Moreover, we also notice that poverty data is available in 4 years intervals; in the case of Ghana, we, therefore, use reference year's poverty for the interval years (as average).

Concerning the control variables for the model, we employ the Gini index[40] as a measure of inequality, GDP per capita measures the effect of growth on poverty, inflation, and the contribution of agriculture to growth. All this data is taken from the WDI. In addition, we include total government spending from the ministry of finance, Ghana, and gold price from the Bank of Ghana. Table 4.1 below details the variables employed in the poverty model.

[40] We use the Gini equivalent for 1983, 84, 85, and 86, using per capita income as an adjuster, and we interpolate for the intervals with Eviews 10.

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Table 4.2: List of variables in the poverty model

Symbol	***Variable***	***Description and source***
Pov	Poverty incidence	Poverty incidence at U.S $3.50 Source: WDI
Gap	Poverty gap	Poverty gap at the U.S $3.50 line Source: WDI
Sgap	Squared poverty gap	Squared poverty gap at the U.S $3.50 line Source: WDI
HHDI	Relative poverty	
GDPPC	GDP per capita	Natural log of GDP per capita. I.e. Gross domestic product divided by midyear population. It is calculated in constant 2010 dollars. Source: WDI
Ag	Agriculture value added % of GDP	It includes forestry, hunting, fishing, and the cultivation of crops and livestock production. Source: WDI
GI	Gini index	Natural log of the Gini index. Source: WDI
GS	Total government spending	Natural log of Government of Ghana consumption and capital expenditure. Source: Ministry of Finance, Ghana
GP	Gold Price	Natural Log of the price per ounce of Gold.

Concerning the inequality model, we employ the Gini index, which is the most commonly used measure of inequality and has advantages, as stated earlier. We estimate this data with WDI dataset on income inequality. Like the poverty data, we employ the per capita income as an adjuster to work out the series equivalent for 1983, 1984, 1985, and 1986. Because inequality data is available on a four-year basis, we follow Sanbeta (2009) and use the reference year inequality as average for the interval years. This applies to all the different indices chosen. To estimate the effect of tax systems on inequality, we include; GDP per capita, inflation all from the WDI dataset as control variables. We also include government spending as a percentage of GDP from the ministry of finance, cocoa price

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per ton from the Bank of Ghana, minimum wage from various online sources. Table 4.2 below describes the variables in the inequality model.

Table 4.3: Description of variables in the Inequality model

Symbol	***Variable***	***Data description and source***
GI	Gini Index	The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Source: WDI.
LnCPI	Cocoa price	Log of the price per ton of cocoa in the world market. Source: Bank of Ghana
LnMW	Minimum wage	Natural log of the daily minimum wage of Ghana. Source: WageIndicator.org
Inf.	Inflation	Inflation rate of Ghana dictated by the consumer price index. Source: WDI

Table 4.3 below shows the basic statistics of the variables employed in the poverty model; we exclude the tax systems data for now. The contribution of Agriculture to growth has averaged 36%, while the Gini index, government spending, and the poverty rate has averaged 40%, GHC6808 million, and 61%. We collect the variables from 1983 to 2016. The government expenditure, gold price and the human development index are in their levels, with the share of agriculture, Gini index, poverty gap, squared poverty gap, and the poverty incidence in percentages. Table 4.3 below details the basis of statistical information about the variables in the poverty model.

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Table 4.4: Basic statistics of variables in the poverty model

	AG	GI	GS	POV	GAP	SQGAP	GDPPC	GP	HHDI
Mean	36.346	39.812	6808.337	61.482	27.311	827.321	1058.828	605.746	1.394
Median	36.280	40.679	626.481	63.300	28.100	789.610	963.6078	384.810	1.482
Maximum	59.731	43.500	51125.040	78.600	37.500	1406.250	1659.484	1678.820	1.588
Minimum	20.000	31.314	1.509	30.500	11.100	123.210	701.536	248.440	0.576
Std. Dev.	10.101	3.335	12598.27	16.007	9.160	462.257	294.761	405.701	0.305
Skewness	0.090	-0.975	2.172	-0.658	-0.526	-0.155	0.928	1.363	-2.261
Kurtosis	2.420	2.927	6.870	2.211	1.999	1.636	2.621	3.654	6.339
Jarque-Bera	0.523	5.395	47.934	3.333	2.986	2.771	5.082	11.139	44.773
Probability	0.770	0.067	0.000	0.189	0.225	0.250	0.079	0.004	0.000
Sum	1235.754	1353.602	231483.5	2090.381	928.566	28128.92	36000.15	20595.38	47.384
Sum Sq. Dev.	3366.831	366.965	5.24E+09	8455.389	2769.076	7051503.	2867171.	5431589.	3.064
Observations	34	34	34	34	34	34	34	34	34

We interpret the high standard deviation to depict the current rising spate of government spending concerning government spending. Expenditure is on a high in Ghana because of the massive infrastructure carried out in recent years. This could be seen by comparing the minimum value with the maximum and the mean value. It also means that Ghana experienced episodes of hyperinflation within the period under review. Five of the variables (Gini, poverty rate, poverty gap, squared poverty gap, and the human development index) are all skewed to the left, with the remaining being positively skewed. This is because government spending, human development index, gold price, and consumer price index were not normally distributed. This can be seen in the Jack Berra probability values. For this reason, we employ their

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natural log values in the models to be estimated. Table 4.4 below details the basic statistical information on the variables in the inequality model.

Table 4.5: Descriptive statistics of variables in the inequality model

	PR	GDPPC	GS/GDP	Gini	REM	CP	MW	INF
Mean	1.071	1058.828	0.216	39.340	0.052	1855.342	1.544	24.794
Median	1.064	963.608	0.225	40.100	0.004	1682.895	0.355	17.743
Maximum	1.216	1659.484	0.307	43.500	0.659	3301.000	8.000	122.875
Minimum	0.839	701.536	0.080	31.314	5.18E-05	794.640	0.003	7.126
Std. Dev.	0.120	294.761	0.065	3.315	0.147	637.443	2.219	21.120
Skewness	-0.216	0.928	-0.452	-0.673	3.246	0.486	1.563	3.164
Kurtosis	2.144	2.621	1.970	2.535	12.335	2.347	4.367	14.880
Jarque-Bera	1.303	5.082	2.658	2.872	183.151	1.943	16.496	256.688
Probability	0.521	0.079	0.265	0.238	0.000	0.379	0.000	0.000
Sum	36.421	36000.15	7.351	1337.552	1.783	63081.63	52.504	843.001
Sum Sq. Dev.	0.399	2867171.	0.137	362.587	0.715	13409027	162.464	14720.400
Observations	34	34	34	34	34	34	34	34

We employed 34 data points in this model. The dependent variable to be deployed (Gini) is normally distributed.

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We employ government expenditure as a percentage of GDP to measure government spending. We record a high standard deviation for GDP per capita and cocoa prices. This is because Ghana has made progress in recording higher growth over the last decade compared to the 90s, which has reflected in the country reaching a lower-middle-income country status. The progress has been noticeable, especially in the per capita income growth over time. Observably, government spending and the Gini index are skewed to the left, with the remaining variables skewed to the right. Table 4.5 below presents the descriptive statistics of the variables of interest over time.

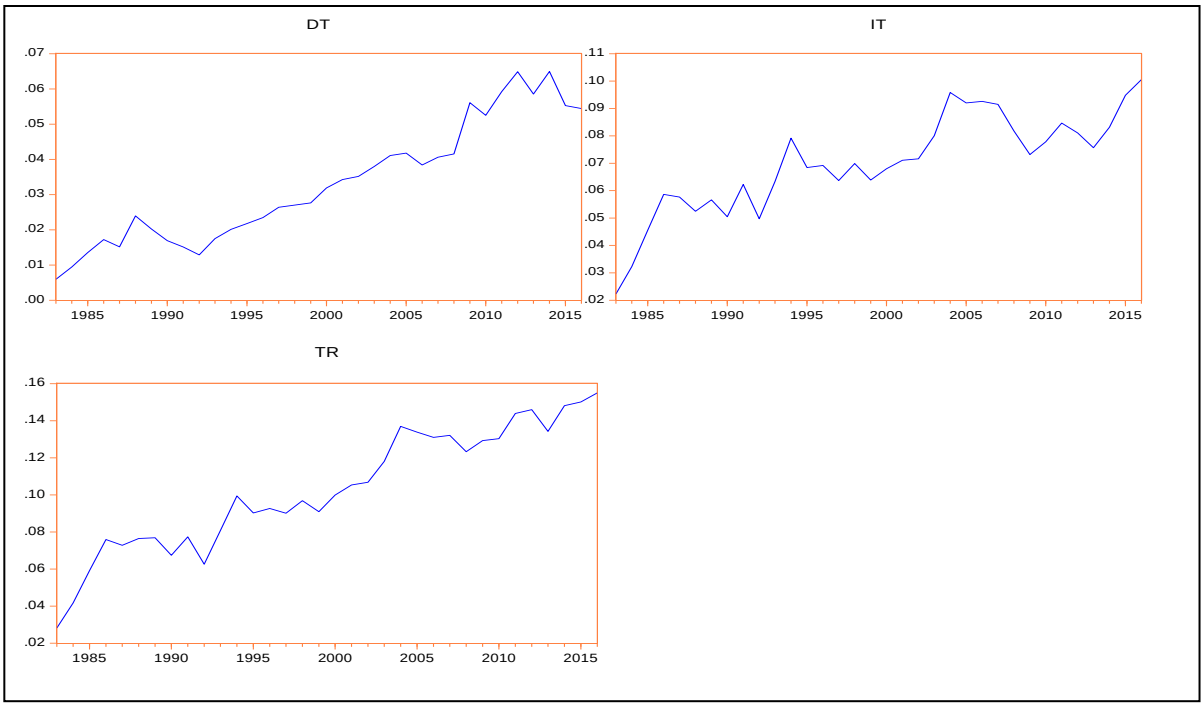
Table 4.6: Descriptive statistics of tax systems variables

Statistic	Indirect taxes (IT)	Direct taxes (DT)	Total taxes (TR)
Mean	0.070	0.033	0.103
Median	0.070	0.030	0.010
Maximum	0.101	0.065	0.155
Minimum	0.022	0.006	0.028
Std. Dev.	0.018	0.017	0.033
Skewness	-0.541	0.377	-0.244
Kurtosis	3.174	1.959	2.193
Jarque-Bera	1.701	2.343	1.259
Probability	0.427	0.310	0.533
Sum	2.381	1.123	3.503
Sum Sq. Dev.	0.011	0.010	0.036
Observations	34	34	34

We notice in table 4.5 that we have a moderate standard deviation for all the variables, although variability in total taxes is higher. We also record normally distributed variables with the indirect tax and total tax skewed to the left. The forgoing is understandable, particularly as indirect taxes are higher than direct taxes. Thus, their movement is most likely to affect total taxes. Figure 4.3 below gives a pictorial representation of the trend of all the tax systems under study.

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Figure 4.3: Trend analysis of tax systems in Ghana



4.5.3 Model specifications

We specify two general models to unravel the objectives of the study. The first model focuses on poverty and tax systems, and the second looks at inequality and tax systems. With respect to the first, we estimate the variant form of the following specification. The basic model employed follows the work of Datt and Ravallion (1992), Besley and Burgess (2003), and Penny et al. (2006) that underpins the growth-poverty relationship. The intent is to test the mediation effect of both growth and income distribution and our variable of interest tax systems on poverty reduction.

$$P_t = \alpha_0 + \beta_1 logY_t + \beta_2 logGI_t + \beta_4 V_i + \varepsilon_t \qquad eqn\ [4.1]$$

P_t is the poverty rate, Y_t is the real per capita GDP, and GI is the Gini index, and V_i is a vector of other control variables that affect poverty. B1 gives the growth elasticity of poverty . It represents the percentage change in poverty associated with a change in income. β_2 is the impact of inequality or

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income distribution on poverty. We augment equation 4.1 to include tax systems (total tax, indirect tax, and direct tax), government expenditure, gold price, the contribution of agriculture to GDP, log of CPI (inflation).

$$P_t = \alpha_0 + \beta_1 logY + \beta_2 logGI + \beta_3 log\frac{tax}{GDP} + \beta_4 logGS + \beta_5 logGP + \beta_6 logAG + \beta_7 logCPI + \varepsilon_t \qquad eqn\ [4.2]$$

The variable of interest is β_3 which measures the impact of the tax system under study on poverty. It is the direct impact of tax on poverty after controlling for income and the distributional aspect of poverty. We employ the natural log of the tax variable to tone down the trend in the tax variables.

On an *a priori* level, we expect growth to relate with poverty negatively, whiles a positive sign is expected between indirect tax and poverty. This is because indirect taxes are regressive. We also expect a negative relationship between direct taxes and poverty. We also envisage that a negative relationship between direct taxes and poverty. This is due to the progressive nature of direct taxes in Ghana. Suggesting that richer paying unit will pay more. We expect government spending to be poverty-reducing. Because Ghana relies on natural resources to support its budget and spending decisions, we expect the price of gold to be also poverty-reducing. We lastly expect inflation to fuel poverty.

Concerning inequality, we set a model that shares a significant resemblance with Martorano and Cornia (2011) and Martorano (2016). The model is given as

$$Ineq_t = \alpha_0 + \beta_1 \frac{tax}{GDP} + \beta_2 Z_i + U_t \qquad eqn\ [4.3]$$

Where ineq is the inequality measure under the microscope tax/GDP is the tax system under study. Z_i is a vector of other control variables that affects the evolution of inequality. The basket of controls employed include; GDP per capita(Y); we expect it to have a negative relationship with inequality.

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This is because the high state of inequality means that growth benefits a few people. We also include Government expenditure as a percentage of GDP. On an *a priori* level, we envisage that it bridges the inequality gap, especially as the government of Ghana makes large financial outlays in social spending. Remittances are added to the control factors. We agree with Aceredo and Cabera (2012), Campus – Vasquez et al. (2012) that remittances have the potency to reduce inequality. We, therefore, expect a negative relationship. Given the significance of agriculture, especially cocoa farming, in supplementing incomes in Ghana, we include the price of cocoa as a control variable and expect that a higher price per ton of cocoa will go a long way to bridge the income of those in the countryside who are often marginalised. The minimum wage is also included in line with the work of Martorano (2016). This is especially important in adjusting the wages of the poor to a level that can cater for their basic need. We envisage that a higher minimum wage will lift those in the bottom half of the income ladder to catch up with those with higher earnings to satisfy their basic needs. Lastly, we include inflation in the control basket. In agreement with Sun (2011) and Maestri and Roventini (2012), we expect a negative relationship.

Concerning the variable of interest tax systems, we fall on the international centre for tax and development's government revenue dataset for the data. We employ the tax GDP ratio as a measure of tax systems. We expect a negative relationship between direct tax systems and inequality, mainly because direct taxes are progressive. The seemingly regressive nature of indirect taxes inspires a positive relationship on an apriori level between indirect taxes and inequality. Since indirect taxes account for a larger share of taxes in Ghana, we expect a negative relationship between total tax systems and inequality. We alternate the inequality measure with various measures discussed earlier. We set up the primary model to be estimated as;

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$$Ineq_t = \alpha_0 + \beta_1 \frac{tax}{GDP} + \beta_2 Y + \beta_3 GS_i + \beta_4 logRem + \beta_5 logCP + \beta_6 MW + \beta_7 Inf + \varepsilon_t U_t$$

eqn [4.4]

4.5.3 Estimation strategy

This section details the econometric strategy deployed for estimation purposes. We have access to data from 1983 to 2016, with data points of 34. We employ the cointegration technique to estimate the models. We move beyond the usual linear cointegration technique to non-linear estimations. We rely on the Non-Linear Autoregressive Distributed Lag model (NARDL) by Shin et al. (2014). Thus, we build upon the strength of the previous chapter's estimator and incorporate a non-linear dimension in our estimation. This method is superior to the linear ARDL According to Romilly et al. (2001), the NARDL can detect cointegration faster than ARDL. It also performs better in smaller samples compared to the standard ARDL. According to Babatunde (2017), Bayramoglu and Yildirim (2017), Shin et al. (2013), the NARDL corrects for endogeneity and correlation and allows for possible asymmetric adjustments of poverty and inequality to movements in other variables. The linear ARDL can perform if the variables are integrated of order one *I* (1) or zero *I* (0).

Demir (2016) also indicates that the NARDL enjoys significant advantages over other modelling asymmetries and cointegrations in smaller samples. The NARDL develops asymmetric cumulative multipliers that enable the tracing out of asymmetric adjustment patterns emanating from positive and negative shocks to the repressors. We model the asymmetries within the NARDL as;

$$Y_t = \alpha^+ X_t^+ + \alpha^- X_t^- + U_t \qquad eqn\ [4.5]$$

Where Y_t is the dependent variable, and X_t is the independent variable of interest. The independent variable can be decomposed into positive and negative partial sums due to the positive and negative

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variations in the explanatory variable. This was developed by Schroderet (2001). The negative and positive partial sums are given by;

$$X_t = X_0 + X_t^+ + X_t^- \qquad eqn\ [4.6]$$

Where X_t^+ and X_t^- are the positive and negative charges. Equation 4.6 corresponds to;

$$X_t^+ \sum_{i=1}^{t} \Delta X_i^+ = \sum_{i=1}^{t} \max(\Delta X_i, 0) \qquad eqn\ [4.7]$$

$$X_t^- \sum_{i=1}^{t} \Delta X_i^- = \sum_{i=1}^{t} \min(\Delta X_i, 0) \qquad eqn\ [4.8]$$

Granger and Yoon (2002) were the first to work on the concept of hidden cointegration. They constructed cointegrating relationships by relying on the negative and positive constituent of the independent variables. Schroderet (2003) relied on this earlier work and described the stationery and linear amalgamation of the partial sums to be;

$$V_t = \alpha_0^+ Y_t^+ + \alpha_0^- Y_t^- + \alpha_1^+ Y_t^+ + \alpha_1^- Y_t^- \qquad eqn\ [4.9]$$

From equation 4.9, we establish asymmetric cointegration between Y_t and X_t when the stationarity of $V_t$is established.

4.5.4 Non-Linear ARDL Model

We move on to expand equation 4.7 above because it harbours many applications that need further exposition. First, equation 4.7 fails to accommodate the prospect of serial correlation and endogeneity. The two are important factors that affect the asymptotic properties of the estimator and smaller samples. Shin et al. (2014) indicate that hypothesis testing in the traditional manner is constrained under such circumstance. This is because, though the OLS estimator remains consistent, the asymptotic distribution remain non-Gaussian. The two challenges are resolved by re-writing equation 4.6 in a non-linear ARDL (p, q) form that allows for long-run asymmetries as;

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$$Y_t=\sum_{i=1}^{p}\psi_i\, Y_{t-1}+\sum_{i=0}^{q}\left(\phi_i{}^{+\prime}\, X^{+}{}_{t-i}+\phi_i{}^{-\prime}X^{-}{}_{t-i}\right)+\varepsilon_t \qquad eqn\ [4.10]$$

The autoregressive parameters are given by ψ, $\phi_i{}^{+}$ and $\phi_i{}^{-}$. They also denotes the asymmetric distributed lag parameters, and ε_t is the error term which is iid (0,σ^2). We reframe the ECM representation of equation 4.10 in accordance with Pesaran et al., (2001) as;

$$\Delta\, Y_t=\rho Y_{t-1}+\sum_{i=1}^{p-1}\alpha_i\,\Delta\, Y_{t-1}+\phi_i{}^{+\prime}X^{+}{}_{t-i}\phi_i{}^{-\prime}X^{-}{}_{t-i}\sum_{i=0}^{q-1}\left(\phi_i{}^{+\prime}\, X^{+}{}_{t-i}+\phi_i{}^{-\prime}X^{-}{}_{t-i}\right)+\varepsilon_t$$

$$eqn\ [4.11]$$

We depict the long run negative and positive coefficient as;

$$\hat{\beta}^{+}=-\frac{\hat{\phi}^{+}}{\hat{\rho}}\ \text{and}\ \hat{\beta}^{-}=-\frac{\hat{\phi}^{-}}{\hat{\rho}} \qquad eqn\ [4.12]$$

We can estimate equation 4.11 by OLS because it has been linearised. The long and short-run dynamic's adjustment of the variables can be checked simultaneously by the model. This is done by relying on the bounds test with the null hypothesis of no long-run relation ($\rho=\phi^{+}=\phi^{-}=0$). Cointegration can be established by relying on Peseran et al. (2001) and using the F-test or the Wald test irrespective of the order of integration of the variable, whether they are *I(0)* OR *I(1).* According to Demir (2015), the NARDL nests two cases; first, the long run symmetry $\rho=\phi^{+}=\phi^{-}=0$ secondly, the short-run adjustment symmetry $\phi_i{}^{+}=\phi_i{}^{-}$ for all i=1, 2, 3,.. The Wald test is used to test the two restrictions. When they are rejected, the model reduces to the standard linear ARDL (p, q).

$$\Delta\, Y_t=\rho Y_{t-1}+\sum_{i=1}^{p-1}\alpha_i\,\Delta\, Y_{t-1}+\phi X^{+}{}_{t-1}+\sum_{i=0}^{q-1}\left(\phi_i\, X^{+}{}_{t-i}\right)+\varepsilon_t \qquad eqn\ [4.13]$$

Should the symmetric effect be spotted in equation 4.7, the negative and positive shocks can be derived as;

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$$n_h{}^{+} = \sum_{i=0}^{h} \frac{\alpha Y_{t-1}}{\alpha X_i{}^{+}} = \sum_{i=0}^{h} \lambda_i{}^{+}, n_h{}^{-} = \sum_{i=0}^{h} \frac{\alpha Y_{t+1}}{\alpha X_i{}^{+}} = \sum_{i=0}^{h} \lambda_i{}^{-}, h = 1,2,3 \qquad eqn\ [4.14]$$

$n_h{}^{+}$ and $n_h{}^{-}$ converge to the long-run asymmetric coefficient β^{+} and β^{-} when $h \longrightarrow \propto$

The significance of the dynamic multiplier that makes the NARDL a preferable technique is its ability to allow for simultaneous analysis of both short-run and long-run asymmetries whiles magnifying the details of the short-run disequilibrium and long-run equilibrium. We also estimate the ARDL model in addition to the NARDL as a robustness check.

4.5.5 Stationarity test

Every cointegration estimation must begin with exploring the data generating process of the variables in the model. Next, we test for stationarity to ensure that none of the variables is integrated of order two *I* (2). To do this, we employ three different tests; the Augmented Dickey-Fuller test by Dickey and Fuller (1981), which employs the Mackinnon (1994, 1996) critical values. We also employ the Philips and Perron (1998) test, which improves the weaknesses of the ADF test. We finally rely on the Dickey-Fuller test with the GLS de-trending (DF-GLS) test. All the tests have a null hypothesis of no unit root in the variables.

4.6 Empirical results and discussions

4.6.1 Tax systems and poverty in Ghana

In this section, we present the results from both the ARDL and the NARDL poverty models. We first analyse the long run results and the diagnostics. We then decide whether the relationship is symmetric or asymmetric before analysing the short-run dynamics from the selected models. Finally, we begin the analysis by confirming the stationarity properties of the variables used, whether they conform with the dictate of the symmetric and the asymmetric ARDL models. Table 4.7 below illustrate the results from the three stationarity tests deployed for the study.

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Table 4.7: Stationarity Test

Variable	***Levels***		***First difference***	
	Constant	**Trend**	**Constant**	**Trend**
		Augmented Dicky-Fuller		
Log Direct Tax	-2.91	-4.22**	-5.78***	-5.87***
Log Indirect Tax	-4.38**	-5.26***	-5.49***	-5.46***
Log Gini Index	-3.10**	-3.32	-6.02***	-6.29***
Log Total tax	-4.10***	-6.04***	-5.48***	-4.78***
Log Gold Price	-0.67	-1.67	-3.88***	-3.87**
Agriculture	-1.88	-4.12**	-6.59***	-6.48***
Log HDI	-0.54	-1.99	-3.18**	-3.11
Log GDPPC	-3.04**	-4.35***	-8.14***	-7.88***
Log GS	-3.36**	-2.75	- 4.83***	-5.46***
Log Pov.	0.88	-0.87	-0.48	-1.88
Log Gap	-0.13	-1.94	-0.59	-2.82
Log Sqd. gap	-0.13	-1.94	-0.59	-2.82
	Constant	**Trend**	**Constant**	**Trend**
				Philips-Perron (PP) test
Log Direct Tax	-2.83	-4.21**	-5.88***	-5.92***
Log Indirect Tax	-4.38***	-5.33***	-5.82***	-5.73***
Log Gini Index	-4.43***	-3.37	-6.04***	-7.36***
Log Total Tax	-3.82***	-6.04***	-5.48***	-5.57***
Log Gold Price	-0.38	-1.66	-3.88**	-3.87**
Agriculture	-1.91	-4.14**	-12.55***	-12.86***
Log HDI	-0.58	-1.84	-4.109***	-4.07**
Log GDPPC	-3.07**	-4.33***	-9.56***	-8.90***
Log Gov.Spending	-4.87***	-2.75	-4.85***	-8.27***
Log Pov.	1.13	-1.77	-6.01***	-15.86***
Log Gap	0.18	-1.86	-5.94***	-9.20***
Log Sqd gap	0.18	-1.86	-5.94***	-9.20***
	Constant	**Trend**	**Constant**	**Trend**
				Elliott-Rothenberg-Stock DF-GLS test
Log Direct Tax	-0.28	-2.76***	-7.39***	-7.48***
Log Indirect Tax	-1.00	-2.81***	-1.67	-4.96***
Log Gini Index	-0.41	-2.18**	-3.79***	-5.86***
Log Total tax	-0.78	-2.90**	0.03	-4.76***
Log Gold Price	-0.73	-1.57	-3.56**	-3.92***
Agriculture	-0.33	-3.33**	-2.95**	-4.21***
Log HDI	0.19	-1.96	-2.99***	-3.23***
Log GDPPC	-3.03***	-3.73***	-2.05*	-7.39***
Log GS	0.46	-1.61	-3.28***	-5.15***

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Log Pov.	-0.90	-1.56	0.76	-1.75*
Log pov. Gap	0.07	-1.90*	-5.95***	-6.05***
Log Sqd. P. gap	0.07	-1.90*	-5.95***	-6.05***

Where, **, and *** denote significance at the 10%, 5%, and 1% level.*

In order to prevent the estimation of spurious regressions, we tested for the unit root or otherwise of the variables. As a result, we observed that none of the variables to be deployed in our first model is integrated of order 2.

4.6.1.1 Cointegration results

Following the success of the stationarity test, the NARDL and ARDL models were estimated and cointegration assessed. Focusing on the NARDL model, we establish cointegration for all the models estimated. This is done with the help of the F-test for cointegration, as reported in tables 4.8 and 4.9. This means that the variables will equilibrate at some point in the long run. This is, however, not the case with the symmetric ARDL model. We observe that whiles all the absolute measures of poverty have a long-run relationship, the relative measure (human development index) has no long-run equilibrium. Table 4.8 and Table 4.9 below indicate the long-run relationship in the models.

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3.6.1.2 Long-run Results

Table 4.8: Long Run Asymmetric NARDL Results

Variables	ASYMMETRIC NON-LINEAR ARDL MODEL											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HHDI		
Log GDP per capita	-1.92***	-2.78***	-4.25***	-2.53***	-2.41***	-3.6***	-5.06***	-4.81***	-7.20***	0.19**	0.31*	-1.28
	(0.14)	(0.61)	(0.87)	(0.29)	(0.52)	(1.15)	(0.57)	(1.04)	(2.30)	(0.06)	(0.16)	(2.96)
Log Gini	-1.57*	4.55***	1.22	-3.25**	4.09***	3.43**	-6.50**	8.19***	6.86***	0.45***	-0.95	1.51
	(0.76)	(0.64)	(1.06)	(1.22)	(0.77)	(1.31)	(2.44)	(1.55)	(2.63)	(0.06)	(0.98)	(2.63)
Log Direct Tax **(+)**	0.31***			0.36**			0.71**			0.01		
	(0.09)			(0.14)			(0.29)			(0.01)		
(-)	-0.55***			-0.87**			-1.75***			0.07**		
	(0.10)			(0.14)			(0.27)			(0.02)		
Log Ind. Tax **(+)**		-0.30*			-0.08			-0.17			0.07***	
		(0.12)			(0.16)			(0.32)			(0.08)	
(-)		-1.44***			-2.53***			-5.07***			-0.04	
		(0.24)			(0.24)			(0.48)			(0.09)	
Log Total Tax **(+)**			-0.95***			-1.0***			-1.99***			-0.34
			(0.20)			(0.18)			(0.35)			(0.65)
(-)			-3.59***			-0.7***			-9.42***			-0.26
			(0.39)			(0.70)			(1.40)			(0.79)
Log Gold Price	0.06***	0.51***	0.81***	0.00	0.54***	0.85***	0.00	1.08***	1.71***	0.00	-0.04	0.200
	(0.02)	(0.09)	(0.13)	(0.04)	(0.08)	(0.19)	(0.08)	(0.16)	(0.38)	(0.01)	(0.04)	(0.43)
Agriculture	0.01*	-0.01	0.01	0.01	0.02**	-0.00	0.02	0.03**	-0.01	-0.00**	-0.03*	-0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)	(0.00)	(0.01)
Log Government Sp.	-0.02	-0.18***	0.05	0.02	-0.33***	-0.16*	0.035	-0.67***	-0.33*	-0.01	0.02*	0.073
	(0.03)	(0.04)	(0.06)	(0.04)	(0.05)	(0.08)	(0.07)	(0.10)	(0.16)		(0.01)	(0.13)
F-test for cointegration	8.75***	11.25***	8.69***	8.33***	11.21***	7.92***	8.33***	11.21***	7.92***	13.33***	11.22***	14.86***

*Where *, **, and *** are the level of significance at the 10%, 5% and 1% level.*

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Table 4.9: Long Run ARDL results

Variables	SYMETRIC LINEAR ARDL MODEL (p,q)											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HHDI		
Log GDP per capita	-2.51***	-4.60***	-3.49***	-4.33***	-5.97***	-4.75***	-8.67***	-11.93***	-9.51***	-0.56	-0.35	-0.33
	(0.67)	(1.26)	(1.03)	(0.86)	(1.12)	(1.37)	(1.73)	(2.24)	(2.75)	(0.50)	(0.41)	(0.39)
Log Gini	3.10***	5.77***	4.68***	6.78***	7.13***	7.11***	13.56***	14.26***	14.22***	1.43	0.81	0.73
	(0.56)	(0.96)	(0.85)	(1.78)	(0.92)	(1.12)	(3.55)	(1.85)	(2.25)	(1.24)	(0.64)	(0.58)
Log Direct Tax	0.03			0.34			0.68			0.04		
	(0.10)			(0.25)			(0.50)			(0.07)		
Log Ind. Tax		-0.80***			-0.65**			-1.31**			-0.03	
		(0.19)			(0.25)			(0.51)			(0.04)	
Log Total Tax			-0.63***			-1.02***			-2.05***			-0.03
			(0.19)			(0.23)			(0.46)			(0.05)
Log Gold Price	0.14**	0.50***	0.36**	0.29**	0.54***	0.48**	0.57**	1.09***	0.95**	0.13	0.09	0.09
	(0.07)	(0.15)	(0.13)	(0.10)	(0.06)	(0.16)	(0.20)	(0.26)	(0.33)	(0.09)	(0.01)	(0.07)
Agriculture	-0.03**	-0.02***	-0.02**	-0.06**	-0.04***	-0.03**	-0.13**	-0.08***	-0.05**	-0.01	-0.00	-0.00
	(0.009)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)
Log Government Sp.	-0.08	0.02	0.01	-0.25*	-0.00	0.01	-0.50*	-0.00	0.02	-0.03	0.00	0.00
	(0.06)	(0.06)	(0.06)	(0.13)	(0.06)	(0.08)	(0.25)	(0.12)	(0.16)	(0.04)	(0.01)	(0.01)
F-test for cointegration	4.62***	7.34***	5.33***	4.28***	4.86***	5.65***	4.28***	4.86***	5.65***	2.70	3.57	3.39

3.6.1.3 The Effect of Tax systems on poverty

In this section, we present and analyse the effects of the different tax systems on the different poverty measures. We analyse the results presented in both the symmetric and asymmetric models in tables 4.8, and 4.9. Column 1 lists the various measures

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of tax systems that we employ for our study. The rest of the columns details the poverty measure that we adopt for the ensuing model. The log-linear nature of the models means that the variables are interpreted as elasticities of poverty. Depending on the type of tax system we are dealing with, taxes enter the model differently. Generally, direct taxes exhibited asymmetry in all the NARDL models estimated. The positive shocks indirect taxes impacted poverty positively, and the negative shocks also impacted poverty negatively. A positive shock of 1% in direct taxes raises poverty by 0.31%, 0.36%, and 0.71% when we rely on the poverty headcount index, poverty gap, and the squared poverty gap as poverty measures, respectively. Though positive, the effect of the positive shock on the human development index is not significant. A 1% reduction in direct taxes (reduction) reduces poverty by 0.55%, 0.87%, 1.75%, and 0.07% when we rely on the poverty headcount index, poverty gap, the squared poverty gap and the human development index as measures of poverty respectively. The symmetric ARDL results do not show any significant coefficient as far as direct taxes are concerned. The results are practically reasonable, although direct taxes are progressive, positive shocks affect the earnings of all taxpayers, although it puts lower burdens on the poor[41]. It is therefore not surprising that a positive shock raises the level of poverty. A positive shock reduces the extra cedi that a taxpayer may have used on consumption to meet his/her basic needs to escape poverty.

Indirect taxes generally exhibit a negative effect; thus, positive and negative shocks produce the same outcomes. Although the signs for the negative shocks are negative none of the models that relied on any absolute poverty measure produced significant results. The human development in the results demonstrates that a 1% negative shock in indirect taxes raises poverty by 0.07%. This is because indirect taxes are regressive, as such increment in indirect tax systems negatively affects the poor's income and hence basic needs requirements more than the rich. On the other hand, a 1% negative

[41] Maboshe and Woolard (2018) found out that the top three deciles income group bears progressive taxes in South Africa.

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shock in indirect taxes reduces poverty by 1.44%, 2.53%, 5.07% when we rely on the poverty headcount index, poverty gap, the squared poverty gap as poverty measures respectively. The coefficient of the negative shock is insignificant in the human development model, although it produced a negative coefficient. It means that both positive and negative shocks have a negative impact on poverty. We find a similar result in the symmetric ARDL model. The result generally established a negative relationship between indirect taxes and poverty in Ghana. A 1% increase in indirect taxes will reduce poverty by 0.8%, 0.65%, and 1.31%. This is based on using the poverty line, poverty gap, and the squared poverty gap respectively as dependent variables. The negative relationship may be accounted for by the myriad of factors that is inherent in multi-dimensional poverty in Ghana. Thus, the revenue generated from indirect taxes could have been used to finance public goods that improve lives and social conditions in Ghana. Thus, indirect taxes may be used to finance public goods that greatly supports poverty reduction projects in Ghana. It must be noted that, as far as the Ghanaian economy is concerned, indirect taxes manifests in the form of consumption taxes. Since consumption is required for survival, it is difficult for the poor to avoid them. In this case, it may not be cast in stone that a hike or positive shock in indirect taxes necessarily reduces poverty, but the response may be due to the inability of man to avoid consumption for fear of human survival. Indirect taxes in theory and practice does not inure to poverty eradication and alleviation. The probable cause for the negative relation is through indirect tax revenue, but that will be addressed by the government expenditure variable in the model.

The poverty elasticity of total tax is negative throughout all the models. Both the negative and positive shocks produce a negative effect on poverty in the NARDL model. The reason is that total taxes are made up of both direct and indirect taxes. It is worth noting that because revenue from indirect taxes is more than direct taxes, the effect of direct taxes on poverty is dwarfed by the strength of the indirect taxes. As indicated above, the effect of indirect taxes on poverty is primarily negative, which has been

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assumed by the total tax coefficients. The results indicate that a positive shock of 1% on total tax systems in Ghana will reduce poverty by 0.95%, 1%, 1.99%, when poverty headcount index, poverty gap, and the squared poverty gap are used as measures of poverty, respectively. A 1% negative shock will also reduce poverty by 3.59%, 0.71%, and 9.42% when the same indices for measuring poverty are employed. The result magnifies the weak effect of positive shocks in direct taxes on poverty in Ghana, as depicted in the NARDL model. We find similar results in the standard ARDL model. As shown in Table 4.9 above, the coefficients from the positively shocked direct models are smaller than the indirect tax. We, therefore, conclude that, as far as the long run is concerned, taxes in Ghana are poverty friendly.

Concerning the other control variables, the real GDP per capita and the Gini index confirmed the *a priori* expectation. The poverty elasticity of growth is highly elastic in both NARDL, and ARDL models. From the NARDL model, a 1% rise in per capita income reduces poverty by; 1.92%, 2.78%, 4.25%, when direct tax, indirect tax and total tax are respectively included in the poverty line model but reduces by 2.53%, 2.41%, 3.60% respectively when the same variables are controlled respectively in the poverty gap model. Growth, however, is more effective in reducing poverty in the squared poverty gap model with elasticities of 3.60%, 4.81%, and 7.20% when direct, indirect, and total taxes are controlled, respectively. When the human development index is invoked, the significance of growth in poverty reduction reduces. It is significant in the direct tax model (0.19%) but insignificant in the indirect tax (0.31) and total tax models (1.28). The symmetric ARDL models depict the same results generally, as far as the poverty line is concerned, 1% increase in GDP per capita will reduce poverty by 2.51%, 4.60%, 3.49%, when direct tax, indirect tax, and total tax are included in the poverty line model on a by compass basis. When the poverty gap model is considered, growth spurs 4.33%, 5.97%, 4.75% reduction in poverty. The intensity of the reduction is experienced when the squared poverty gap model is employed; we realised a reduction in poverty of 8.67%, 11.93%, and 9.51% for

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a 1% reduction in growth. The results are generally in conformity with Senbata (2009) work and Ravallion and Chen (1997). The result also means that the growth elasticity of poverty is positive for Ghana. It is important to note that economic growth is critical in lifting the poorest of the poor, as it is more efficacious in the poverty gap and squared poverty gap models looking at the magnitude of the coefficients.

The sign of the coefficient of the Gini index also resolves the old age debate about the effect of income distribution on poverty. The results generally indicate a positive relationship between inequality and poverty in Ghana. From the asymmetric models, we observe that a 1% increase in the Gini index will raise the level of poverty when indirect tax and total taxes are considered by; 3.25%, 4.09%, and 3.43% in the poverty gap model, and by 8.19%, and 6.86% when the squared poverty gap is considered. In the poverty line model, the Gini is significant when indirect taxes are considered (4.55%). We also found out that when direct taxes are employed as a measure of tax systems, the sign of the inequality variable changes to negative, thereby suggesting that inequality reduces poverty. This finding may be due to the nature of direct taxes; it is progressive and depresses the role of the Gini in the model. We record a coefficient of -3.25 and -6.50 in the poverty gap and squared poverty gap models. However, the positive sign is maintained in the human development model when direct taxes are employed to measure tax systems. A percentage increase in inequality raises poverty by 0.45%. The symmetric ARDL model, however, records positive coefficients for the Gini index throughout the poverty models. Thus, a 1% increase in inequality raises poverty by 3.10%, 5.77%, and 4.68% when a direct tax, indirect tax, and total taxes are considered. The same magnitude increase in inequality will spur poverty by 6.78%, 7.13%, 7.11% when direct tax, indirect tax, and total taxes are controlled, respectively, in the poverty gap model. In the squared poverty gap model, the growth in poverty is 13.56%, 14.26%, and 14.22%, respectively, when direct tax, indirect tax, and total tax are controlled in the regression. The results generally indicate that deeper inequality heightens the spate of poverty

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in Ghana. Thus, higher inequality only exacerbates the poverty challenges of Ghana. In this regard, a policy to tackle inequality is also a policy to tackle poverty. If the policies proffered to reduce inequality are well designed, they will contribute to growth and poverty reduction. Such policies have the potential to stimulate skills development and employment.[42].

On the significance of the natural resource sector to poverty reduction, we found out that the sector fuels poverty in Ghana. From the NARDL model, we found out that a percentage increase in the price of gold will lead to 0.06%, 0.51%, and 0.81% increase in poverty levels when the poverty line is employed. When the poverty gap is relied on, a percentage increase in gold price results in a 0.54% and 0.85% increase in poverty when indirect taxes and total taxes are controlled for in the model. The same magnitude of change in gold prices triggers 1.08% and 1.71% when indirect taxes and total taxes are controlled for respectively in the squared poverty gap model. We also find similar signs in the standard ARDL model; the signs are positive. Undoubtedly Ghana is blessed with natural resources from which significant revenues in resource rent are collected for development. It is expected that such revenues will be spent on social expenditures that will reduce the spate of poverty in Ghana. However, the result points to the opposite. Many reasons suffice. First, it is possible that mineral revenues are not applied to pro-poor expenditures in Ghana. Unlike the petroleum sector that has a petroleum revenue management law that earmarks revenues for certain expenditures. The revenues from gold and other solid minerals are at the discretion of the social planner. Revenues from gold production must be applied to pro-poor expenditures to reduce poverty in Ghana. Secondly, whiles the minerals and mining Act 703 of Ghana gives a carried interest of 10% to the government on all mining blocks awarded, this is too small for windfall gains in the price of gold to impact government finances. The sector's contribution to GDP is less than 3% annually; as such, the impact on poverty

[42] See <https://www.weforum.org/agenda/2014/02/want-end-poverty-tackle-inequality-first/>

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is negligible. Secondly, because poverty is a multi-dimensional concept, the consequences of mining in Ghana offsets the little gain it has on poverty reduction. First, the price of gold drives gold production in Ghana. The year 2012 witnessed increased production of gold in Ghana because of the rise of the price of gold. The windfall gains also encouraged gold production from artisanal and small scale miners that sometimes engages in irresponsible mining with untoward effect on the environment, and water bodies that inherently impact human well-being and, hence, poverty. Also, cocoa farming, a venture that sustainably supports livelihoods and poverty reduction, has experienced some of the untoward impacts of small scale mining. This is because, according to a study by ACET[43]Cocoa farmers in Ghana are selling their farms to small scale miners for a one-off windfall payment. This has poverty ramifications for current and future generations. Thus, the adverse side effects of mining spurred by a hike in the price of gold could offset all possible positive impact.

On the effect of the agriculture sector on poverty reduction, we find a minimal effect (negligible). When we employ the relative poverty measure (HDI), we observe that a percentage increase in the agriculture sector will reduce poverty by 0%, 0.03%, and 0% when a direct tax, indirect tax, and total taxes are controlled. Adverse effects are also recorded in the symmetric ARDL model. The result means that any policy that targets agriculture in its current state as a tool for poverty reduction may not yield an optimum policy outcome.

Government spending meets the *a priori* expectation; the relationship is negative. However, the significance is felt when indirect taxes are controlled in the absolute measures of poverty. A 1% rise in government spending will reduce poverty by 0.18%, 0.33%, and 0.67% when the poverty line, poverty gap, and the squared poverty gap models are employed. Although the results confirm some

[43] Refer to <http://acetforafrica.org/programs/impact-of-artisanal-and-small-scale-mining-on-smallholder-agricultural/>

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positive response from Ghana's myriad social protection programs and poverty alleviation expenditures, they are not enough. There is the need to have a more targeted approach towards social spending items that drives down poverty.

3.6.1.4 Diagnostics of the model

The NARDL and ARDL models' diagnostics tests are reported in Table 4.10 below. We test for autocorrelation using the Breusch-Godfrey Serial Correlation LM Test; we also employed the Breusch-Pagan –Godfrey test for the heteroscedasticity condition of the variance of the error term. We confirm the normality or otherwise of the models with the Jarque-Berra normality test. The functional form of the model is tested for by the Ramsey reset test. The diagnostics confirm the absence of normality and functional form problems in the NARDL model. However, there are normality challenges in the ARDL model concerning the relative measure of poverty (HDI). Although both the NARDL and the ARDL models confirm some autocorrelation in some of the models, we avoid the challenges associated with them as we estimated all the models by the HAC method. Thus, all the models are Heteroscedasticity and Autocorrelation Consistent. The standard errors estimated are thus consistent and good. The diagnostics of both the symmetric and asymmetric ARDL models are given in table 4.10 below. We present the asymmetric models' diagnostics first and follow it up with the symmetric models' diagnostics.

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Table 4.10: Diagnostics of the NARDL and ARDL Models

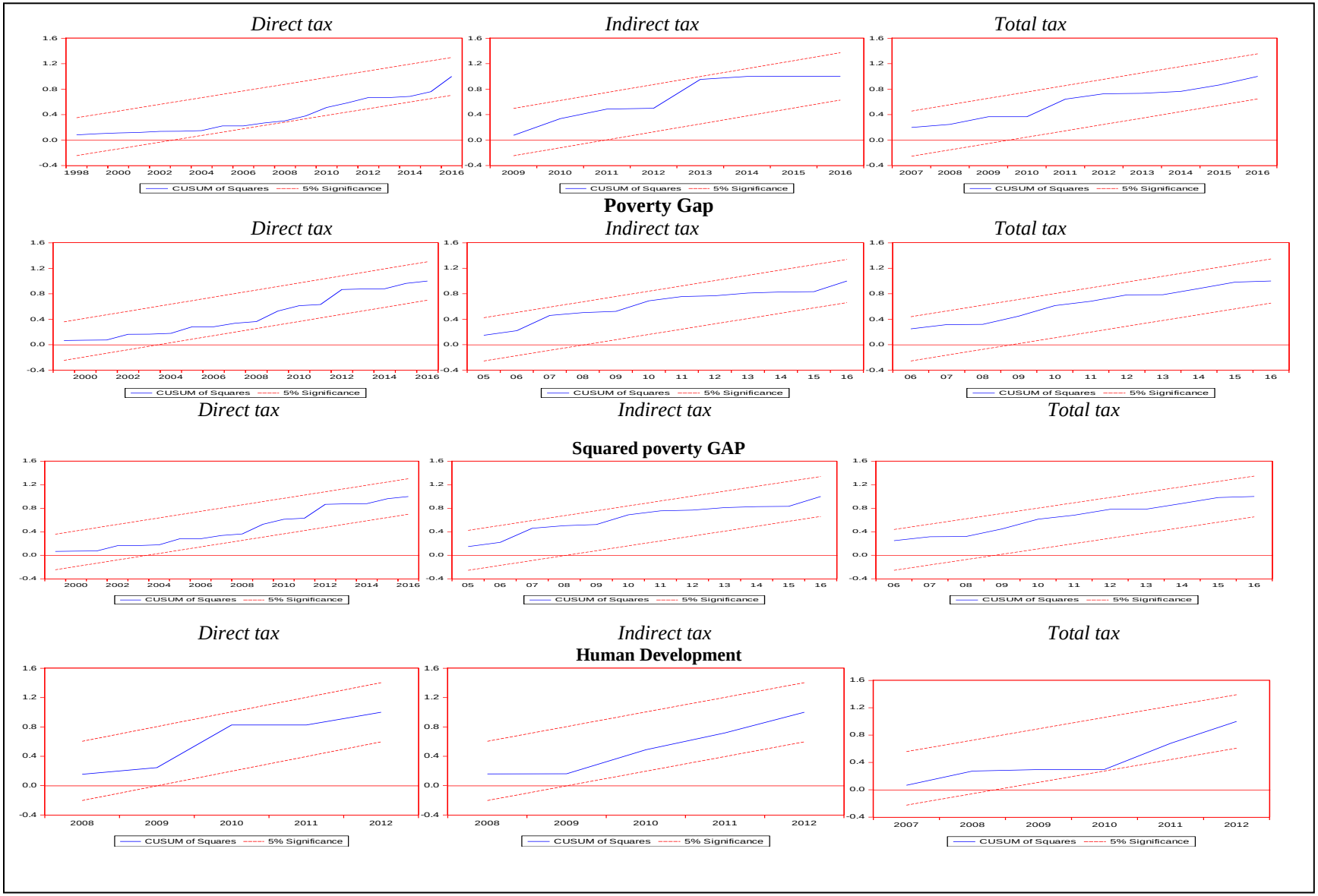
Diagnostic Test	Asymmetric NARDL Diagnostic test for all models											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HHDI		
	Direct tax	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*
Serial correlation LM(2)	6.04 [0.05]	18.92 [0.00]	24.61 [0.00]	5.34 [0.07]	19.89 [0.00]	25.36 [0.00]	5.34 [0.07]	19.89 [0.00]	25.36 [0.00]	22.35 [0.00]	18.23 [0.63]	21.13 [0.00]
Heteroskedasticity	10.65 [0.56]	21.96 [1.00]	18.15 [0.58]	12.14 [0.52]	21.24 [0.27]	17.74 [0.54]	12.14 [0.52]	21.24 [0.27]	17.74 [0.54]	20.03 [0.52]	24.67 [0.00]	22.22 [0.33]
Normality: Jarque-Berra Prob.	0.22 [0.90]	2.40 [0.300]	0.98 [0.61]	0.36 [0.84]	1.04 [0.60]	0.14 [0.93]	0.36 [0.84]	1.04 [0.60]	0.14 [0.93]	0.85 [0.65]	0.82 [0.66]	0.20 [0.90]
Ramsey RESET	0.256 [0.80]	0.45 [0.67]	1.50 [0.17]	0.74 [0.47]	0.32 [0.75]	0.74 [0.47]	0.74 [0.47]	0.32 [0.75]	0.74 [0.47]	2.20 [0.09]	1.37 [0.24]	0.92 [0.40]
Diagnostic Test	**Symmetric ARDL Diagnostic test for all models**											
	Log Poverty rate			**Log Poverty Gap**			**Log Squared poverty GAP**			**Log HHDI**		
	Direct tax	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*	*Direct tax*	*Indirect tax*	*Total tax*
Serial correlation LM(2)	1.94 [0.38]	13.6 [0.00]	7.60 [0.02]	2.43 [0.3]	16.61 [0.00]	8.80 [0.01]	2.43 [0.30]	16.61 [0.00]	8.80 [0.01]	10.88 [0.00]	5.18 [0.07]	20.05 [0.09]
Heteroskedasticity	13.33 [0.21]	19.76 [0.18]	21.72 [0.04]	16.97 [0.05]	18.23 [0.25]	18.95 [0.09]	16.97 [0.05]	18.23 [0.25]	18.95 [0.09]	20.24 [0.21]	20.54 [0.08]	20.05 [0.09]
Normality: Jarque-Berra Prob.	1.40 [0.50]	0.13 [0.94]	0.38 [0.83]	1.40 [0.5]	0.43 [0.80]	0.29 [0.86]	1.40 [1.5]	0.43 [0.81]	0.29 [0.86]	1.05 [0.59]	11.12 [0.00]	10.67 [0.00]
Ramsey RESET	[0.25] 0.80	2.00 [0.06]	0.65 [0.52]	0.60 [0.56]	1.56 [0.14]	0.57 [0.58]	0.60 [0.56]	1.56 [0.14]	0.57 [0.58]	1.09 [0.30]	0.80 [0.44]	1.01 [0.33]

Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) estimators were employed in the estimations.

We present the CUSUM squared test of the NARDL, ARDL models in figures 4.4 and 4.5 below.

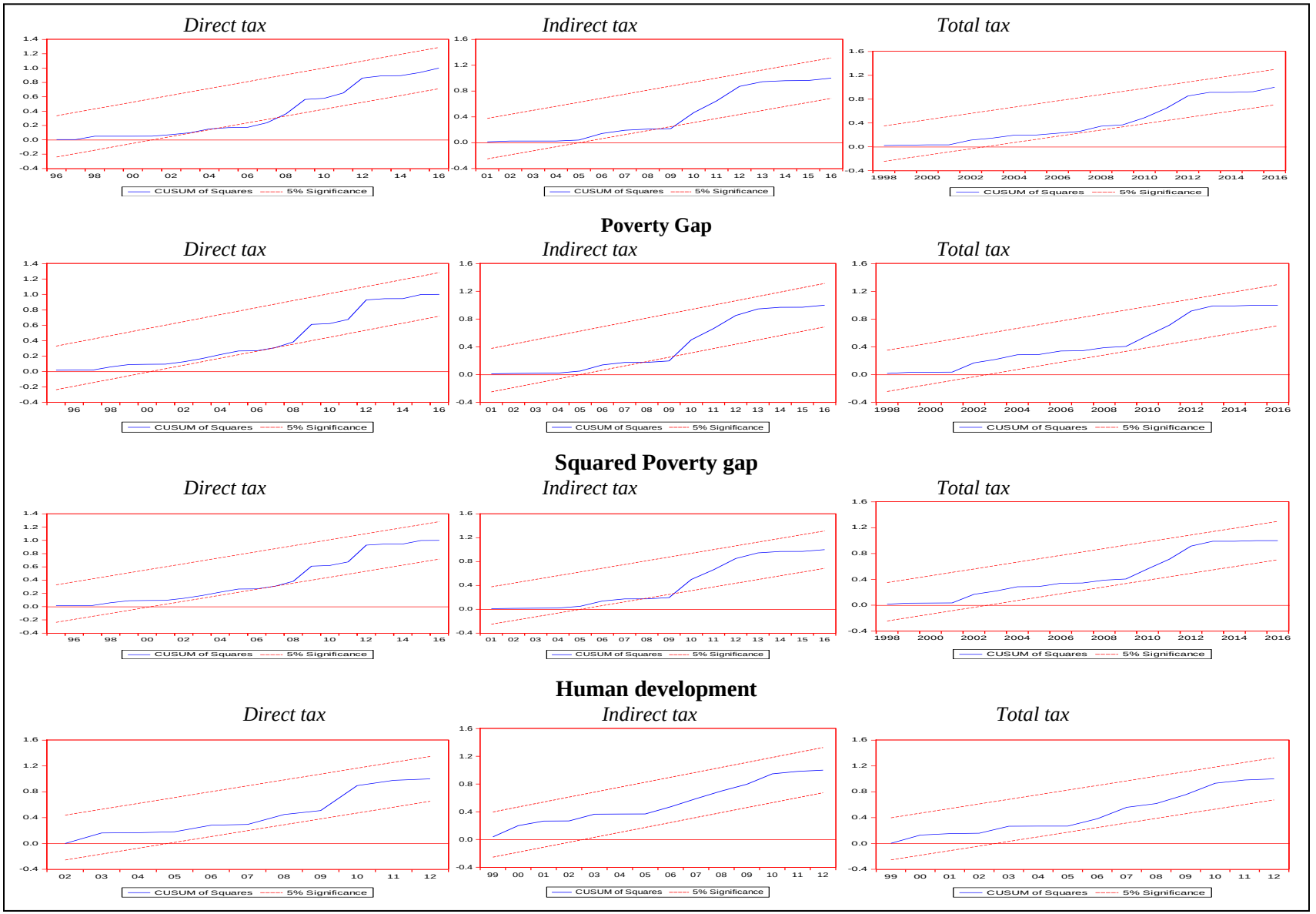
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Figure 4.4: CUSUM Square Plots for the NARDL Model



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Figure 4.5: ARDL CUSUM Square



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We presented only the CUSUM squared test to assess all the models' stability or otherwise because it is more robust than the standard CUSUM test. The recursive CUSUM and CUSUMSQ test the stability of the models against the breakpoint with a null hypothesis that parameters are unstable. The figures are plotted to establish the significance of the trajectory at the 95% confidence level. In this manner, figure 4.4 generally demonstrates the rejection of the null hypothesis and hence establishes the models' stability. Thus, the results depicted in figures 4.4 and 4.5 indicate that the NARDL models are more robust than the standard ARDL models. This is seen in the highly unstable nature of most of the ARDL models beyond the permissible 95% confidence level demonstrated by the red bounds. The result of the RDL model can therefore not be relied on for policy design.

3.6.1.5 Is the relationship between tax systems and poverty symmetric or asymmetric?

Although the CUSUMSQ test generally leans towards the NARDL models as depicting the most acceptable relationship between DRM systems and poverty, we resolve this central question with the Wald test for asymmetry, as depicted in Table 4.10 below. The Wald test evaluates the long run asymmetry effect by testing the hypothesis of no asymmetry against the alternative hypothesis of asymmetry. The rejection of the null hypothesis indicates asymmetrical effects of the outbound tax system on poverty.

The results indicate that when the lower-middle-income poverty line is used to measure poverty, the model is asymmetric when direct taxes systems are controlled. The model is, however, symmetric when indirect and total taxes are in perspective. This could be confirmed from the long run NARDL results. Indirect taxes and total taxes enter the model negatively irrespective of the mode of the shocks. Direct taxes, on the other hand, has both negative and positive shocks effect on poverty. Asymmetry is, however, proven in the poverty gap and squared poverty gap models.

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Table 4.11: NARDL test for asymmetry

Variables	Wald Test for long run Asymmetry											
	Log Poverty rate			**Log Poverty Gap**			**Log Squared poverty GAP**			**Log HHDI**		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
F-Statistic	21.70***	0.60	0.57	24.82***	33.18***	3.24*	24.82***	33.18***	3.24*	85.74***	18.68***	4.52**
	asymmetric	*symmetric*	*symmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*	*asymmetric*

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This means that tax systems affect the poor and the poorest of the poor differently, and hence, strategies mounted to curtail poverty should factor in the policy. Tax reforms must focus on making taxes more progressive. This will ensure that the less privileged in society and the poor pay less in taxes. Is it possible to make tax systems in Ghana more progressive? Gemmel and Morrissey (2002) assert that there is enough evidence in Ghana and other African countries that some aspects of their current tax systems can be reviewed and reformed to make them more progressive. This is particularly true for excise taxes which has been classified as highly regressive. The level of dispersion of trade taxes can also be reviewed. However, greater care and dexterity is needed in engineering such policies as it could engender administrative difficulties and distortions in the tax system. In the words of Gemmel and Morrissey (2002), "Where public expenditures can be targeted at the poor, they are likely to provide a more potent, and less distorting, anti-poverty instrument than a highly non-proportional tax."

3.6.1.6 Do the signs of the NARDL models change in the baseline models?

Because we relied on the NARDL models, it is essential to check the sensitivity of the models. We do this by relying on three regressors that form the primary foundation of the main models (***Real GDP per capita, Gini, and tax systems***). The aim is to dispel and demystify any doubt of multicollinearity affecting the behaviour variables in the models. Because taxes form the base of government expenditure, it is conceivable that tax revenues and government spending may correlate at some level even if the correlation is not severe. We do this because we only included government spending in the basket of regressors to not miss-specify the models employed. We, therefore, exclude government spending to test for consistency of the models. The results depicted in Table 4.11 below show consistent signs as earlier discovered in the main NARDL models.

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Table 4.11: NARDL Baseline Models for Poverty

Variables	Asymmetric Static Baseline Non-Linear ARDL Model (p, q)											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HHDI		
Log GDP per capita	-1.93***	-1.28***	-1.30**	-2.63***	-1.72***	-1.64***	-5.26***	-3.43***	-3.28***	0.22***	0.13***	0.20***
	(0.15)	(0.20)	(0.17)	(0.17)	(0.26)	(0.15)	(0.33)	(0.51)	(0.40)	(0.06)	(0.04)	(0.06)
Log Gini	-1.86***	1.31	0.80	-2.75***	1.73	1.43	-5.50***	3.46	2.86	0.30**	-0.05	-0.37
	(0.62)	(0.77)	(0.81)	(0.79)	(1.08)	(1.21)	(1.58)	(2.15)	(2.43)	(0.09)	(0.30)	(0.35)
Log Direct Tax (+)	0.24***			0.34***			0.69***			-0.01		
	(0.09)			(0.10)			(0.21)			(0.01)		
(-)	-0.50***			-0.73***			-1.45***			0.10***		
	(0.06)			(0.09)			(0.17)			(0.03)		
Log Ind. Tax (+)		-0.41			-0.56			-1.12			0.06	
		(0.15)			(0.19)			(0.37)			(0.06)	
(-)		-0.36			-0.58			-1.16			0.07	
		(0.25)			(0.31)			(0.63)			(0.04)	
Log Total Tax (+)			-0.28			-0.48			-0.97			0.12
			(0.11)			(0.15)			(0.30)			(0.06)
(-)			-0.53			-0.85*			-1. 70*			0.11**
			(0.28)			(0.37)			(0.73)			(0.05)
F-test for cointegration	5.41***	3.79	3.18	8.85***	3.9	3.77	8.85***	3.99	3.77	7.05***	0.82	2.70

*Where *, **, and *** are the respective levels of significance and or cointegration at 10%. 5% and 1%. The standard errors are given in the brackets.*

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3.6.1.5 Short Run DRM dynamics

The short-run dynamics of the NARDL models are depicted in table 4.12 below. The short-run ARDL dynamics are in the appendix.

Table 4.122: Short run NARDL Dynamics

Variables	ASYMMETRIC NON-LINEAR ARDL MODEL											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HDI		
Log GDP per capita	0.91*	-2.29***	-2.38***	1.51*	-2.95***	-2.75***	3.02*	-5.90***	-5.49***	0.02**	-0.04***	-0.05***
	(0.62)	(0.37)	(0.55)	(0.85)	(0.61)	(0.72)	(1.70)	(0.19)	(1.44)	(0.01)	(0.01)	(0.01)
Log Gini	-2.76*	2.90*	17.04***	-4.86	2.33	21.05***	-9.7**	4.66	42.10***	-0.07**	0.07	-0.04
	(1.59)	(1.55)	(2.76)	(2.21)	(2.50)	(3.56)	(4.41)	(5.00)	(7.11)	(0.02)	(0.04)	(0.05)
Log Direct Tax (+)	0.46***			0.57***			1.14***			0.01***		
	(0.12)			(0.16)			(0.33)			(0.00)		
(-)	-0.95***			-1.25***			-2.49***			0.02***		
	(0.21)			(0.29)			(0.58)			(0.00)		
Log Ind. Tax **(+)**		0.21*			0.32*			0.64*			-0.02***	
		(0.11)			(0.15)			(0.30)			(0.003)	
(-)		-0.32**			-1.15***			-2.30***			0.01***	
		(0.12)			(0.20)			(0.40)			(0.00)	
Log Total Tax **(+)**			-0.20			-0.25			-0.50			-0.02***
(-)			(0.14)			(0.18)			(0.36)			(0.00)
			-1.44***			-1.86***			-3.72***			0.01***
			(0.21)			(0.28)			(0.56)			(0.00)
Log Gold Price	0.11	0.43***	0.66***	0.01	0.69***	0.85***	0.25	1.38***	1.71***		0.01**	0.01***
	(0.08)	(0.05)	(0.09)	(0.11)	(0.09)	(0.12)	(0.21)	(0.19)	(0.24)		(0.00)	(0.00)
Agriculture	0.016**	0.01*	-0.01	0.01*	0.02***	-0.01	0.02*	0.04***	-0.01	0.00***	-0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
Log Gov't Sp.	-0.01	-0.05	-0.00	0.07	0.02	0.01	0.14	0.04	0.02	0.00	0.01***	0.02***
	(0.08)	(0.05)	(0.07)	(0.11)	(0.08)	(0.10)	(0.22)	(0.16)	(0.19)	(0.00)	(0.00)	(0.00)
C	32.4***	4.28***	13.33***	44.61***	1.69***	11.70***	89.21***	3.38***	23.41***	-2.55***	0.41***	0.87***
	(4.14)	(0.34)	(1.37)	(5.27)	(0.15)	(1.16)	(10.53)	(0.30)	(2.32)	(0.08)	(0.02)	(0.06)
ECM (-1)	-1.51***	-1.41***	-1.18***	-1.45***	-1.27***	-1.12***	-1.45***	-1.27***	-1.12***	-1.66***	-0.47***	-0.30***
	(0.19)	(0.11)	(0.12)	(0.17)	(0.11)	(0.11)	(0.17)	(0.11)	(0.11)	(0.05)	(0.03)	(0.02)

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The error correction term in the model is significant at a 1% level; it is also correctly negatively signed. Bannerjee et al. (1998) has indicated that when the error correction term is highly significant, it is further proof that there is a stable long-run relationship between the variables. In line with the findings of; Loayza, and Ranciere (2004), Narayan, and Smyth (2006), Akmal (2007), Shittu et al. (2012), Bildirici (2012), Ofori-Abebrese (2017), and Baris-Tuzemen (2019), we find error correction terms lesser than -1 in the absolute measures of poverty. According to Narayan, and Smyth (2006), an error correction term that is less than -1, indicates that, instead of the model monotonically congregating to the long-run equilibrium path directly, the error correction mechanism oscillates around the long-run value in a reducing manner. Convergence to the long-run equilibrium path becomes rapid when the process ends. Thus, the high error correction terms in the absolute poverty models mean that, in the inception stages of the correction process, the model corrects itself in a fast manner, but it normalises as the period elapses.

Regarding the variable of interest (tax systems), we find that positive shocks in direct taxes in the short run produce positive impacts. A 1% increase in direct taxes will raise the number of people under the lower-middle-income poverty line by 0.46% from the results. The same magnitude of change in direct taxes will raise the number of people under severe poverty by 0.57%, and the poorest of the poor, as indicated by the squared poverty gap, will be raised by 1.14%. When we rely on the relative measure of poverty, the human development index, 0.01% of the population will fall into poverty when direct taxes are increased by 1%. These are all short-run effects phenomenon. On the other hand, a negative shock in direct tax systems in the short run produces negative effects on poverty at all levels. A 1% negative shock will reduce the number of Ghanaians under the lower-middle-income poverty line by 0.95%, but the number of people in the gap will fall by 1.25%, whiles the poorest of the poor defined by the squared poverty gap will also fall bin the gap will fall by 1.15%, whiles the poorest of the poor defined by the squared poverty gap will also fall by 2.49%. Poverty reduction is, however, marginal

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when the human development index is employed (0.03). The finding is in line with both theory and practice. An increase in taxes will impoverish citizens; it reduces disposable income, which has adverse implications on meeting basic needs. On the other hand, a reduction in taxes is good for disposable income and basic needs satisfaction, essential for poverty reduction.

Indirect taxes enter the asymmetric models negatively. Both negative and positive shocks result in poverty reduction. A 1% upwards adjustment of indirect taxes will result in poverty reduction as dictated by HDI by 0.02%. The reduction in poverty has higher potency with negative shocks; 0.32% when the poverty line is in perspective, 1.15% when the poverty gap is considered, 2.30% when the squared poverty gap is considered, and lastly 0.01% when the human development index is considered. The coefficients in these models also have significant implications on policy and meet the *a priori* expectations. A policy to reduce tax in whatever form should bring about some reliefs to taxpayers and hence poverty reduction, but this should be balanced with the need to raise revenue for government activities.

The short-run dynamics does not significantly differ from the long-run static effect. Total revenue also enters the models negatively irrespective of the shock. Positive shocks in total tax systems do not significantly reduce poverty when the absolute measures are in perspective but reduce poverty by 0.02% when the HDI is employed. A 1% negative shock in total tax, on the other hand, reduces poverty by 1.44%, 1.86%, 3.72% and 0.01% in the poverty line, poverty gap, squared poverty gap, and human development models, respectively. The coefficients in the total tax models were reinforced and dictated by the direction of indirect tax systems. This is because indirect taxes revenues are more than direct taxes.

Growth, proxied by real GDP per capita, enters the model negatively as expected. From the models, tax systems are not significant when direct taxes are controlled in the absolute poverty measures in

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the short run. However, a 1% increase in indirect tax and total tax systems will reduce the number of Ghanaians under the poverty line by 2.29%, 2.38%, the same magnitude will reduce the number of Ghanaians who are severely poor by 2.95%, 2.75%, and the poorest of the poor by 5.90%, 5.497%. The same magnitude of increase in direct, indirect, and total taxes will reduce relative poverty by 0.02%, 0.04%, and 0.05%, respectively, in Ghana. The empirical evidence suggests that growth in Ghana has been pro-poor in the short run. Thus, the short-run growth elasticity of poverty is highly elastic.

Inequality coefficients were also consistent with the long-run coefficients. When direct and indirect taxes are controlled in the models, inequality is positively related to poverty. A percentage increase in the Gini index raises poverty by 17.04%, 21.05%, and 42.10% in the poverty line, poverty gap and the squared poverty models in the short run when total taxes are controlled. Inequality is, however, not significant in the poverty models when indirect taxes are controlled. When direct taxes are controlled, multidimensional poverty given by the HDI reduces poverty, but it is marginal.

The price of gold represents the natural resources sector; it enters the model positively in the long run. This means that revenues from the sector to government, artisanal miners, and mining, in general, does not have poverty reduction tendencies in Ghana. On the contrary, the sector promotes poverty because of the negative impact mining (both large scale and small scale) has on mining communities. The negative impact on health, livelihoods, farming and the environment could spur poverty in those areas. The forgoing is practical, visible in many mining communities as after many years of mining, those communities have little to show in terms of progress, the gains are short-lived, but the negative impacts has lifelong implications.[44].

[44] Mining activities intensifies with the rise in the price of hold.

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We also found out that, agriculture sector's productivity in the short run does not support poverty reduction when direct taxes are controlled. Indeed, it does not support the *a priori* expectation. The explanation is forthright, and empirical literature exists to explain the phenomenon. Christiaensen et al. (2006) argue that the direct impact of agriculture on poverty in Sub Saharan Africa is negligible. The direction of effect is through the linkages that it has with other sectors (indirect sector). It is also possible that the poor, the deeply poor, and the poorest of the poor do not have farmlands and farm assets for agriculture. Moreover, the subsistence nature of agriculture in Ghana suggests that the sector might not directly contribute to poverty reduction. Hesselberg (2017) indicate that if farming continues to remain at the small-scale level, it will fail to eradicate poverty. We also found out that the short-run dynamics of government expenditure has no bearing on poverty reduction. It only supports poverty reduction when the HDI is in perspective.

4.6.2 Tax systems and inequality in Ghana

We begin by validating the stationarity properties of the additional variables employed in the models. We then present the cointegration results and the long run results of the asymmetric and symmetric ARDL models. We complete the section by presenting the short-run dynamic ARDL results for the selected models. Finally, policy recommendations are proffered in the following section for the sector. Table 4.14 below demonstrates the stationarity results. None of the variables in the model is integrated of order 2, which implies that the application of NARDL and ARDL is possible.

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Table 4.1313 Stationarity Test for additional control variables in the inequality model

Variable	*Levels*		*First difference*	
	Augmented Dicky-Fuller			
	Constant	**Trend**	**Constant**	**Trend**
Gov. Spending	-2.59	-3.08	-6.02***	-6.19***
Log cocoa price	-2.20	-2.39**	-4.60***	-4.68***
Log min wage	-4.34***	-1.99	-1.69	-5.18***
Inflation	-8.07***	-3.26*	-4.26***	-4.24***
	Philips-Perron (PP) test			
	Constant	**Trend**	**Constant**	**Trend**
Gov. Spending	-3.66***	-3.07	-6.07***	-7.26***
Log cocoa price	-2.23	-2.32	-5.72***	-7.54***
Log min wage	-9.77***	-2.69	-4.83***	-11.32***
Inflation	-8.07***	-9.16***	-26.84***	-24.75***
	Elliott-Rothenberg-Stock DF-GLS test			
	Constant	**Trend**	**Constant**	**Trend**
Gov. Spending	-0.31	-2.26**	-4.21***	-6.00***
Log cocoa price	-2.20**	-2.39**	-4.60***	-4.68***
Log min wage	0.22	-0.99	-1.22	-5.39***
Inflation	-1.84*	-3.66***	0.53	-3.96***

4.6.2.1 Cointegration and Long-run results

Following the establishment of stationarity properties of the variables, we reveal the results of the long run NARDL and ARDL models, as well as the test for cointegration in tables 4.15 and 4.16 below. We demonstrate that strong evidence for cointegration exists in both the ARDL and NARDL models. However, we cannot establish cointegration in the NARDL model when we employ direct taxes as a measure of tax systems. The results of the long run NARDL is depicted in table 15; the Akaike information criteria was relied on to select the most parsimonious models.

4.6.2.2 Is the relationship between tax systems and inequality asymmetric?

We resolve this question with the Wald test for asymmetry. Basing our decision on the F-statistics, as depicted in the last role of table 4.15, we discover no asymmetry in the relationship when all the tax

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system variables are controlled. We, therefore, rely on the symmetric ARDL model in table 4.14 for the long-run relationship.

Table 4.14: Long Run NARDL results

Variables	Asymmetric Static Non-Linear ARDL model		
	Log Gini index		
	Model 1	**Model 2**	**Model 3**
Log Direct Tax **(+)**	0.07		
	(0.05)		
(-)	-0.03		
	(0.03)		
Log Ind. Tax **(+)**		0.12***	
		(0.03)	
(-)		0.08**	
		(0.03)	
Log Total Tax **(+)**			0.11
			(0.08)
(-)			0.09
			(0.10)
Log GDP Per Capita	-0.23***	0.02	-0.07
	(0.07)	(0.04)	(0.05)
Log cocoa price	0.01	-0.02**	0.02
	(0.01)	(0.01)	(0.01)
Log minimum wage	0.02	0.01	0.02
	(0.02)	(0.01)	(0.02)
Inflation	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)
R-Squared	0.97	0.98	0.98
F-test for cointegration	3.05	5.44***	4.64***
Wald Test of asymmetry ***(F)***	0.339	0.004	0.002

*Where *, **, and *** indicate significance at the 10%, 5%, and 1% level. The standard error is given in the bracket; we relied on the Akaike information criteria.*

From table 4.15 below, we found out that cocoa price, growth, direct taxes, and total taxes could not explain the level of inequality in Ghana in the long run. Therefore, on an *a priori* level, we expected direct taxes to be negatively related to inequality as depicted in the model. However, it is insignificant because, although it reduces inequality because of its progressive nature, it is paid by a

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small percentage of the population, making it a small fraction of the overall tax revenue. It is, therefore, not enough to significantly reduce the state of inequality in Ghana.

On indirect taxes, a percentage increase in indirect taxes will raise the level of inequality by 0.08%; the finding is in agreement with the apriori.

Table 4.14: Long Run ARDL Results

Variables	symmetric Static Linear ARDL model		
	Log Gini index		
	Model 1	**Model 2**	**Model 3**
Log Direct Tax	-0.02		
	(0.02)		
Log Ind. Tax		0.08**	
		(0.03)	
Log Total Tax			0.04
			(0.04)
Log GDP Per Capita	-0.06	-0.04	-0.08
	(0.06)	(0.06)	(0.06)
Log cocoa price	-0.02	-0.02	-0.01
	(0.01)	(0.01)	(0.01)
Log minimum wage	0.04***	0.02***	0.03***
	(0.01)	(0.01)	(0.01)
Inflation	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)
R-Squared	0.97	0.98	0.97
F-test for cointegration	5.50***	4.25***	4.05***

*Where *, **, *** denote significance at the 10%, 5%, and 1% level. The standard error is given in the bracket; we relied on the Akaike information criteria.*

We find the minimum wage to be positively related to inequality. A percentage increase in the minimum wage raises inequality by 0.04%, 0.02%, and 0.03% when a direct tax, indirect tax, and total taxes are controlled. This finding is against the *a priori* expectation. This narrative is because minimum wages are so low that upward adjustments do not alter the earnings of people in Ghana. Thus, the

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minimum wage exists only in theory; it lacks practical relevance in Ghana. Inflation was also significant at the 1% level. Again, a negative relationship was struck, as a 1% increase in inflation leads to a negligible decrease in the level of inequality in Ghana. In theory, an increase in inflation should disadvantage low income earning individuals in society. The items in the inflation basket may explain the current revelation. If they are luxuries, higher inflation should not affect the poor and hence reduction in inequality. If, on the other hand, they are necessities, then the state of inequality will widen. However, the current finding should not lead to misguided policy debate as to the coefficients, even though strongly significant, are in the realms of negligible values.

4.6.2.3 Diagnostics of the models employed.

We present the diagnostics of the model in this section. We estimated the models with the HAC method in Eviews, so all the standard errors are heteroscedasticity consistent. This means that all heteroscedasticity in the original model is rendered redundant. Table 4.16 outlines the diagnostics of the symmetric ARDL model for inequality.

Table 4.16: Diagnostics of the study

Diagnostic Test	**Symmetric ARDL Diagnostic test**		
	Log Gini		
	Direct tax	***Indirect tax***	***Total tax***
Serial correlation LM(2)	2.04	4.45	4.32
	[0.36]	[0.11]	[0.12]
Heteroskedasticity	15.42	18.33	21.88
	[0.03]	[0.05]	[0.02]
Normality: Jarque-Berra Prob.	3.16	0.08	0.22
	[0.21]	[0.96]	[0.90]
Ramsey RESET	0.58	0.57	0.69
	[0.57]	[0.57]	[0.50]

Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) estimators were employed in the estimations.

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As depicted in Table 4.17 above, the models were all normally distributed, had no autocorrelation, and had the right functional specifications. The stability of the model as revealed by Ramsey's reset, and CUSUM test[45] were all very stable.

4.6.2.4 Short Run Results

We present the short-run ARDL result in this section of the study in table 4.17. We observe that the error correction terms are all significant and negative, indicating a long-run relationship or convergence.

Table 4.15: Short Run dynamic ARDL Results

Variables	Symmetric Dynamic Linear ARDL model		
	Log Gini index		
	Model 1	**Model 2**	**Model 3**
Log Direct Tax	0.00		
	(0.02)		
Log Ind. Tax		0.00	
		(0.0)	
Log Total Tax			0.00
			(0.02)
Log GDP Per Capita	0.06	0.00	-0.02
	(0.12)	(0.11)	(0.11)
Log cocoa price	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)
Log minimum wage	-0.02	-0.01	-0.02
	(0.02)	(0.01)	(0.02)
Inflation	-0.00**	-0.0007***	-0.00**
	(0.00)	(0.0002)	(0.00)
Constant	2.77***	3.40***	3.28***
	(0.00)	(0.63)	(0.64)
ECM(-1)	-0.66***	-0.79***	-0.73***
	(0.13)	(0.15)	(0.14)

*Where *, **, and *** indicates the significance at the 10%, 5%, and 1% levels. Standard errors are given in the brackets. Estimation utilised the Akaike information criterion.*

[45] See the appendix of this chapter of the study

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We observe that the relationship between tax systems and inequality is a long-run relationship, the short-run coefficients of all the various tax systems are insignificant. This finding also suggests that any policy intended to rely on systems to address inequality should look in the long run for results. The short-run dynamics of inflation is not different from the long run. Inflation has a negative relationship with inequality. However negligible, the coefficients are negligible; this lends credence to the fact that issues of inequality are mainly long-run phenomenon.

4.6.3 Conclusion and policy recommendations

The study sought to study domestic resource mobilisation systems (tax systems) on distribution (poverty and inequality) in Ghana. Specifically, the study investigated whether the relationship is asymmetric or symmetric. Concerning the mediation effect of tax systems and poverty in Ghana, in the long run, we found that, generally, the relationship is asymmetric when all measures of tax systems and poverty are employed. The relationship is only symmetric when indirect taxes and total taxes are employed as measures of tax systems in the poverty line model. We observed that while positive and negative shocks in direct taxes raise and reduce poverty, the negative and positive shocks in all the other tax systems produce negative results. We also found out that negative shocks generally produce more significant impacts on poverty than positive shocks. A poverty reduction strategy that looks at tax reduction at all levels should produce the desired results in the long run. Similar findings were also discovered in the short-run dynamics. We also found out that growth was all poverty enhancing in both the long run and the short run. The significance of growth to poverty, however, increases with profound poverty. Indeed, the OECD[46] Has revealed that economic growth can generate a vicious cycle of prosperity from which the current generation can invest in the future generation to produce

46 https://www.oecd.org/derec/unitedkingdom/40700982.pdf#targetText=Economic%20growth%20is%20the%20most,of%20life%20in%20developing%20countries.&targetText=The%20extent%20to%20which%20growth,and%20share%20in%20its%20proceeds.

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future entrepreneurs. Any meaningful strategy to reduce poverty must have an anchor, a policy to promote rapid and sustained growth. It is also essential that growth-promoting policies are combined with policies that allow the poor to fully participate in the opportunities unleashed by the growth. Therefore, we recommend that the social planner invest in making the labour market work efficiently, promote gender equality, raise the level of financial inclusion in Ghana, and make growth reach the very poorest. Thus, growth must be inclusive to benefit the very poor.

On the mediation effect of inequality on poverty, we observed that inequality generally fuels poverty. However, the relationship is reversed when direct taxes are employed as tax systems because of their distribution prowess. Therefore, we recommend that policies be targeted at making income and asset distribution more equitable to provide the poor with significant opportunities and means to improve their living standards and hence reduce poverty.

The study revealed that the relationship between tax systems and inequality is rather symmetric and not asymmetric. Whiles cointegration exists for the symmetric relationship; we only found a significant positive relationship between indirect taxes and inequality in the long run. There is no short-run relationship between tax systems and inequality. The relationship is partly due to the regressive nature of indirect taxes in Ghana. Direct taxes in Ghana are marginal to strike any significant impact on inequality both in the short and long run. A policy to leverage tax systems to bridge income inequality with a firm foundation in indirect tax systems should be pursued. The policy should thus focus on reducing the level of indirect taxes in Ghana.

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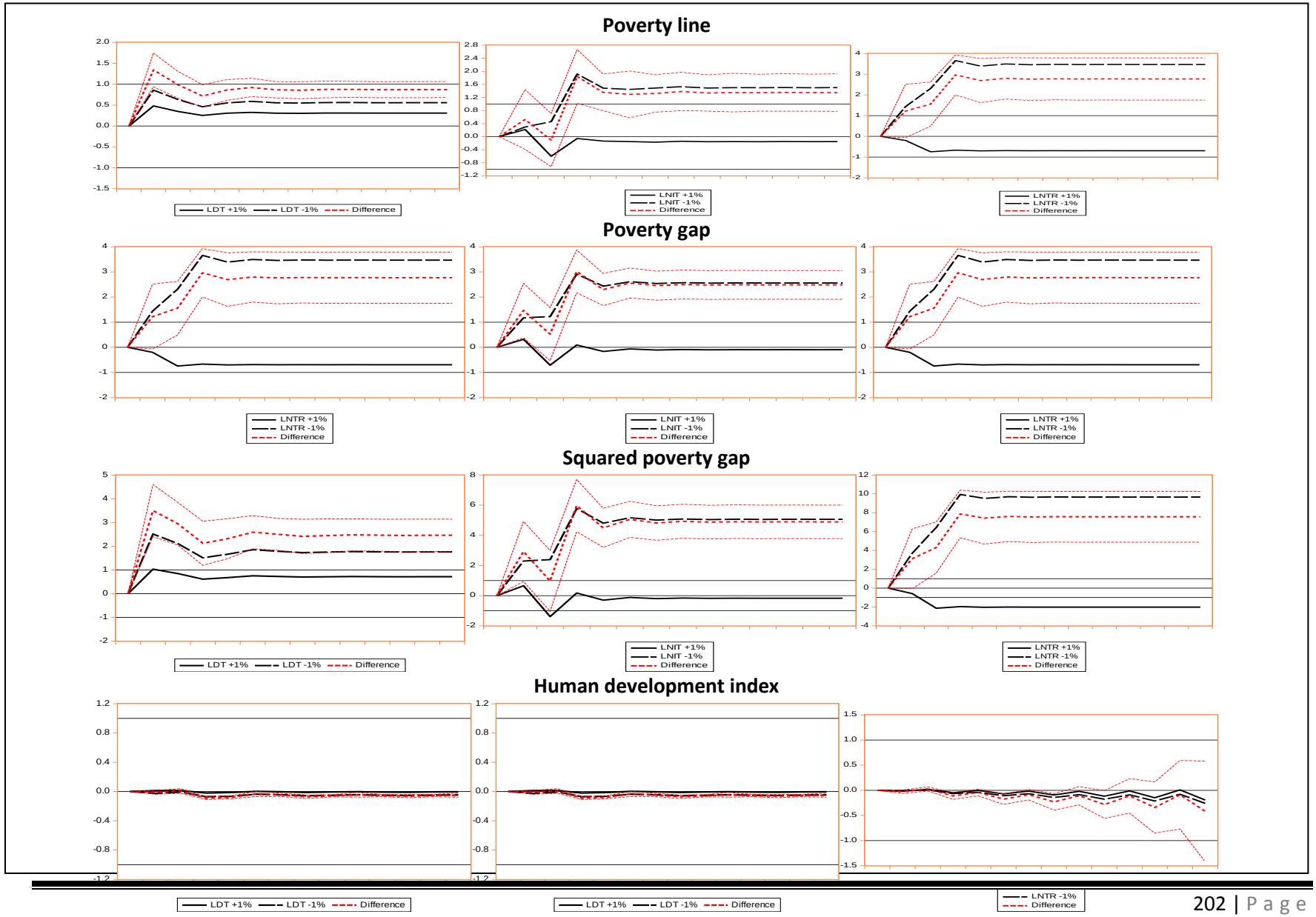
Appendices

Appendix 4.1 Asymmetric Dynamic Non-Linear ARDL model

Variables	Asymmetric Dynamic Non-Linear ARDL model		
	Log Gini index		
	Model 1	**Model 2**	**Model 3**
Log Direct Tax **(+)**	0.03 (0.03)		
(-)	-0.02 (0.05)		
Log Ind. Tax **(+)**		-0.05 (0.03)	
(-)		-0.06 (0.04)	
Log Total Tax **(+)**			-0.06 (0.04)
(-)			0.00 (0.05)
Log GDP Per Capita	-0.04 (0.12)	0.20* (0.04)	0.13 (0.11)
Log cocoa price	0.00 (0.01)	-0.01 (0.00)	-0.01 (0.01)
Log minimum wage	-0.05** (0.02)	-0.0 (0.01)	-0.02 (0.02)
Inflation	-0.00 (0.00)	-0.00*** (0.00)	
Constant	-0.63 (0.13)	3.44*** (0.46)	3.24*** (0.49)
ECM(-1)	-	-0.95*** (0.13)	-0.77*** (0.12)

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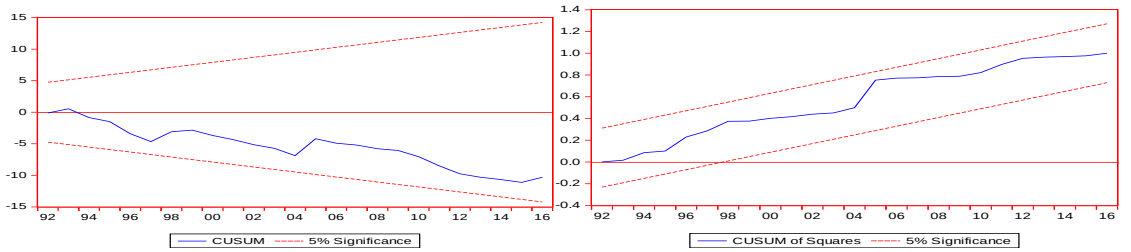
Appendix 4.2: NARDL Graph for poverty models



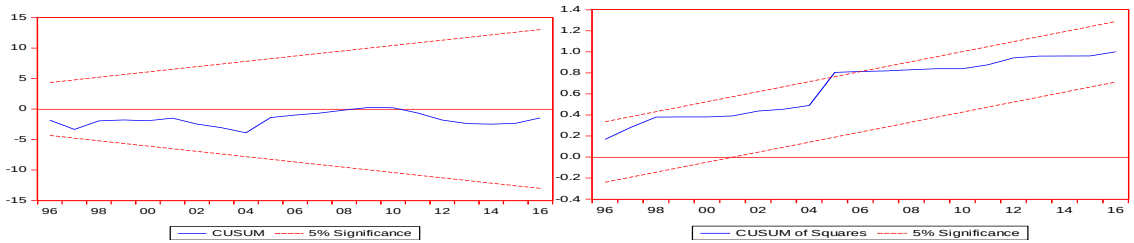
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Appendix 4.3: Cusum, and Cusum Squared for inequality model.

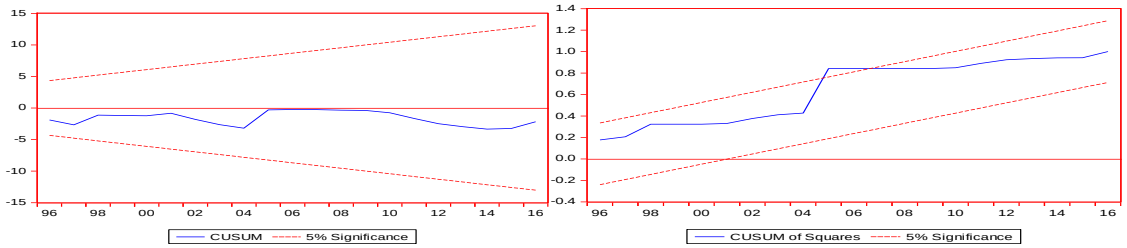
Direct tax



Indirect taxes



Total tax



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Appendix 4.4: Short Run dynamics for symmetric ARDL Poverty Model

Variables	SYMMETRIC DYNAMIC LINEAR ARDL MODEL (p, q)											
	Log Poverty rate			Log Poverty Gap			Log Squared poverty GAP			Log HHDI		
Log GDP per capita	0.17	-1.31**	0.06	0.41	-0.80	-0.21	0.83	-2.19	-0.05	-0.02	-0.01	-0.00
Log Gini	0.04	3.38**	0.08	-0.08	1.06	1.12	-0.15	11.77**	5.28	-0.07	-0.18*	-0.17*
Log Direct Tax	0.09			0.10						-0.01*		
Log Ind. Tax		0.09			-0.18			-0.21			0.01	
Log Total Tax			-0.05			-0.16			-0.04			0.01
Log Gold Price	-0.01	0.21**	0.04	-0.02	0.15	0.10	-0.05	0.55**	0.28	0.01	0.01	0.01
Agriculture	-0.00	-0.01	-0.00		0.00	-0.00	-0.01	-0.02	-0.01	0.00***	0.00***	0.00***
Log Government Sp.	-0.07	-0.02	-0.05	0.08	0.04	0.03	-0.16	0.04	-0.04	0.01**	0.00	0.00
C	6.00***	5.29***	6.46***	5.84***	3.07***	2.32***	11.68***	-10.62***	4.30***	0.24***	0.20***	0.17***
ECM(-1)	-0.72***	-0.86***	-0.70***	-0.66	-0.63***	-0.64***	-0.66***	-0.82***	-0.74***	0.19***	0.24***	0.24***

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CHAPTER FIVE

DOMESTIC DEBT RESOURCE MOBILISATION, AND FINANCIAL SECTOR DEVELOPMENT IN GHANA: A QUANTILE-ON-QUANTILE REGRESSION, AND THRESHOLD APPROACH

5.1 Introduction

External debt drives the conversation on public debt sustainability analysis, both in development and academic circles. This is because foreign liabilities until recently formed a larger component of public debt in developing countries. Because of this, debt relief measures such as the Multilateral Debt Relief Initiative (MDRI), Heavily Indebted Poor Countries (HIPC) initiative, and the joint Fund/Bank Debt Sustainability Framework for LICs (LICDSF) have traditionally focused on external debt (Bua et al., 2014). The narrative, however, is changing as domestic debt has assumed an essential role in the public debt portfolio of developing countries.

Although the definition of domestic and external debt is gradually becoming blur, the debate on which of the two proves more beneficial for the government's fiscal policy rages on. While Kose et al. (2009) make an argument that external debt instruments provide access to sizeable capital and increase financial globalisation, there is a downside; first, Jeanne (2000) and Krugman (1999) indicate that huge, short term external debts are contagious, difficult to manage, and have been responsible for some of the huge financial crises in the world. Secondly, while foreign-denominated debt hedges the position of investors, currency fluctuations are a headache for borrowing countries. As a result, currency depreciation has made many governments with substantial external debts bankrupt. Thirdly, Eichengreen (2001) identified original sin as one of the challenges with external debts. It relates to two negative sides of foreign-denominated debt (currency mismatch and maturity mismatch). Mexico, Uruguay and Colombia are some of the countries that mirror the original sin syndrome. Finally,

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Eichengreen and Hausmann (2005) revealed that original sin is predominant in countries with high exchange rate and macroeconomic volatility.

These inadequacies, coupled with the exigencies of the global financial crisis, have shifted the focus of fiscal authorities from externally denominated debts to domestic debt instruments. İlgün (2016), Maana et al. (2008), and Adetokunbo and Ebere (2018) have all indicated that SSA countries are gradually accumulating more domestic debts in their debt portfolio. According to Vasishtha (2010), domestic debts have grown significantly in emerging markets; they reached US$ 2.8 trillion, from the mid-90s to 2004, a quadruple amount, and the volume of external debt (US$ 0.7 trillion). Indeed, public debts in Africa is moving away from concessional financing sources to market-based domestic debt instruments.[47]. Moreover, irrespective of the rate of the debt instrument, domestic debt has proven to be more advantageous than external debt. According to Hausmann et al. (2006) and Bacchiocchi and Missale (2012), domestic debts has lower exposure to currency risks. According to Calvo (2005), the economy is less exposed to the challenges of capital flow reversals when debts are domestically accessed. Mehrotra et al. (2012) assert that domestic debts arm monetary authorities to undertake countercyclical monetary policy to mitigate the effect of external shocks.

5.2 The problem

The problem that underpins this chapter's research is two-fold. First, while taxation is essential in financing development, the narrow tax base, wide tax evasion, and avoidance in Ghana have adverse implications on revenue leakages, making it impossible to rely entirely on taxation to finance Ghana's development. Second, the debt market is one of the sources of mobilising resources to finance development. While there is wide acclamation for domestic debt, the ability to raise significant domestic debt resources rests on the domestic financial market's strength (Kutivadze, 2011). The

[47] See <https://www.brookings.edu/blog/africa-in-focus/2018/04/26/figures-of-the-week-africas-changing-debt-structure/>

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significance of the domestic financial market to domestic debt resource mobilisation is re-echoed in the agenda 2063 of the African Union, which enjoins countries to strengthen domestic resource mobilisation by strengthening their financial institutions, and the African capital markets for the continent to sustainably finance its development. Regardless of the theoretical significance of financial sector development on domestic debt mobilisation, there is a dearth of literature on the empirical narrative for Africa and Ghana. Christensen (2005) contends that Sub Saharan Africa (SSA) is proliferated with generally small domestic markets, highly short-term instruments, and a narrow investor base. In the ambience of these observations, could the financial sector support domestic debt mobilisation for development? This query makes the need to study the effect of financial sector development on domestic debt mobilisation more critical. However, the nature of the relationship is yet to receive more profound academic attention.

Secondly, we posit that the switch to domestic debt suggests institutional and local banks will absorb large amounts of government debt, which may negatively affect financial sector development. The negative effect arises because the more the fiscal authorities access the finite loanable funds in Ghana, the less capital there is for the private sector, which affects access to credit, thereby crowding out private sector investment (Spencer and Yohe, 1970). Das et al. (2010) also contend that when the market questions the sovereign's debt sustainability, the heightened default risk will translate into a high-interest rate that will be transmitted into the private sector as bond rate forms the lower bound for interest rate. This has an adverse effect on financial sector development. Given this background, the research question that begs for an enquiry is, what is the level of domestic debt that the Ghanaian financial sector can absorb without compromising the sector's stability? Thus, while we acknowledge the need to raise debt resources domestically, we understand the intricacies of the relationship between advancing credit to the government and maintaining a healthy financial sector may not be straightforward. Therefore, there is the need for a threshold analysis to determine the optimal level of

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debt resources that the domestic financial market in Ghana can accommodate without compromising its stability.

While literature exists on the mediating effect of domestic debt on financial sector development, on the one hand, there is also literature that looks at the relationship from the financial sector development channel, albeit scanty (Adetokunbo and Ebere, 2018). This suggests that the existing literature is flawed in the estimation employed because the different channels through which the relationship is viewed means the relationship may be bi-directional. There is the danger that previous estimations on the subject matter of the study may have suffered from the econometric problem of endogeneity. This gap in the literature is resolved in this study, as we employ techniques that look at the effect of the two variables on themselves. Secondly, studies reviewed have relied on estimation techniques based on conditional means, making it impossible for lower and higher outlier variables to be correctly captured by the regression line of fit. In such circumstances, we are unsure whether the coefficients given in the various regression models represent the population character or their character changes along with the distribution. We also contribute to literature by employing a technique that accommodates more lines of fit to provide more information on the character of the relationship.

The rest of this piece is structured as follows; we do a trend analysis of public debt dynamics in Ghana, we then sample the major literature on the relationship between domestic debt, and financial sector development, we describe the methodology that is relied on for the estimation, we present the results of the estimations, and finally, offer some policy recommendation on the results.

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5.3 Public debt dynamics in Ghana

5.3.1 Trend of public debt in Ghana

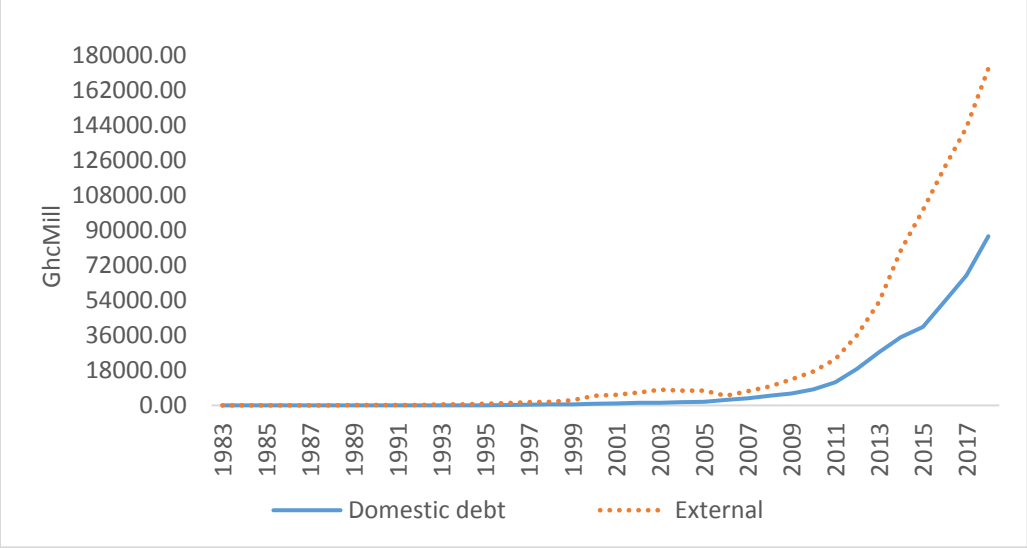
The public debt of Ghana has evolved substantially since independence. Since the late 1950s, the government of Ghana embarked on a transformation agenda to move the economy from purely agrarian to a mixed one. Resources, however, were not sufficient to finance the projects. As a result, external debt in the form of foreign support credit became the order of the day. This began the accumulation of debts in Ghana. According to Urungbodi and Odhiambo (2018), external debt rose from almost nothing to $US600 million. Rising inflation in the 1960s pushed Ghana into a brief debt crisis. This was, however, resolved by a debt rescheduling plan in 1966, 1968, and 1970s. Ghana did not accumulate additional debts in the 1970s because the international monetary fund blacklisted the country following the repudiation of some of the external debts it owed. During this period and the early 1980s, external debt constituted the majority of debt in Ghana. By 1990 external debt constituted about 85% of the debt portfolio (Fosu, 2001). According to Meng (2004) and Sowa (2008), domestic debts in Ghana started rising in the 1990s. Domestic debt rose sharply from 3% of GDP in the 1990s to about 25% of GDP by the turn of the millennium. This development was mainly due to a reduction in aid and ECOMOG peacekeeping operations in Liberia. By 1996 it was about 11% of total debt.

According to Urungbodi and Odhiambo (2018), Ghana started reaping the benefit of the Economic Recovery Programme (ERP) in the 1990s. Total debt as a percent of GDP reduced from 339.7% in 1990 to 142. 2%in 1999. The end of the year 2000 saw the public debt stock to GDP ratio at 182%. Given the large debt stock (US$5.58 billion), 39% of government spending was devoted to debt servicing in 2000. Debt relief was secured under the HIPC initiative, and about 12.5% of the external debt stock was reduced from US$6.99 billion in 2003 to US$6.12billion in 2004. Under the MDRI in 2006, external debt was further reduced by 62.6% between 2005 and 2006. The year 2007 ushered in the first Eurobond for Ghana to the tune of US$750 million for ten years at a coupon rate of 8.5%.

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In 2013, a second Eurobond was issued for 1billion 2013 with a coupon rate of 7.875%. This was to be issued to refinance maturing domestic and external debt and financing for some government of Ghana pipeline projects. In 2014, the stock of external debt rose as a third Eurobond was issued for an amount of US$1 billion at a rate of 8.125%. The money was to be repaid in 12 years. An additional 1 billion in coupon was issued in 2015 and 750 million in 2016. However, 2017 saw the government issuing the highest Eurobond of US$3 billion in 3 tranches at three different maturity dates of 7 years, 12, and 31 years. Ghana's entry into the Eurobond market is basically because of the low capitalisation of domestic financial institutions. As a result, the Eurobond has in recent years increased the external component of the debt stock. Between 2006, and 2008 domestic debt were more than external debt, but the dynamics have changed even though 2009 remains an exception. Pictorial evidence of the debt dynamics in Ghana is given in figure 5.1 below.

Figure 5.1: Domestic and external debt trends in Ghana



Source 20: Author's construct with BOG data

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5.3.2 From concessional, bilateral debts to private commercial debt, where is Ghana?

A critical analysis of the sources, shape, and trend of debt in Africa and Ghana is the changing course from concessional to commercial and private sector owned market-based debt. In the early 2000s or pre-HIPC and MDRI period, external debt build-ups were mainly from multilateral institutions, but the narrative has changed. Since 2000, about 16 countries in SSA have issued foreign currency bonds (Eurobonds) in the international debt market. Ghana has issued many Eurobonds since it entered the market in 2007. Access to the international financial market is significant for development financing as it diversifies funding sources and subject fiscal policies to the discipline of financial markets. However, debt rollover, financial market swings (on the interest rate, exchange rate) makes such funding sources risky. Caution in the rate at which developing countries issue them is paramount. The short maturity profile of these instruments also makes it difficult to employ them to finance massive infrastructure projects. A push must be made to stretch the maturity period of these bonds to make them a viable source of funding. Noteworthy in Ghana's debt dynamics is the move away from Paris club bilateral creditors to non-traditional lenders such as China. This is a demonstration of China's strong engagement in Africa. Chinese loans have been the main source of infrastructure funding for Ghana and some African countries. Chinese debt in Ghana has, in most cases, been commodity-linked. Notable projects financed by Chinese loans include the Bui dam, which was paid with Ghana's cocoa, the Ghana gas infrastructure, which was to be paid with crude oil, and in recent days the bauxite for infrastructure by the government of the fourth republic from Synohydro. The debt structure in Ghana is fast changing in alignment with the global economic trend; debt policies must be managed in accordance with market conditions.

5.4 Theoretical Reviews

Studies on financial market development garnered attention after the seminal work of Schumpeter (1911), who argued that financial sector development could increase efficiency, and hence economic

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growth by channelling funds to efficient sectors of the economy. His argument was also supported by the work of Patrick (1966), who argued that the development of the sector would help drive the real sector along a convenient growth path through the allocation of scarce resources from surplus spending agents to deficit spending units in line with the highest rate of return. Goldsmith (1969) also contributed to the finance growth literature by commenting on the positive link between financial development and investment efficiency. Finally, McKinnon (1973) and Shaw (1973) perhaps changed the financial development argument and independently worked out proposals that defined and changed the financial landscape in many countries. They advanced an argument for financial liberalisation with the intent of promoting domestic savings for investment. This theory was the main blueprint of Ghana's financial liberalisation advanced by the IMF and the World Bank during the Structural Adjustment Program.

Durusu-Ciftci et al. (2017) have indicated that the theories on financial sector development can be grouped into five. The first strand deals with theories that focus on the allocative role of a developed financial sector. Author's such as Bencivenga and Smith (1991), Greenwood and Jovanovic (1990), Pagano (1993), and Wu, Hou, and Cheng (2010) all supported this argument. The second strand of theories dealt with the role of a developed financial sector in diversifying portfolios for firms, reducing investment risk and, hence promoting economic growth. Levine (1991) and Saint-Paul (1992) typify this group; the third group focused on the ability of a developed financial sector to provide an exit mechanism for agents and thereby improving financial intermediation. Arestis et al. (2001), Rousseau and Wachtel (2000) worked in this direction. The fourth strand looked at the ability of the system to nurture entrepreneurship and foster new technology. Greenwood and Smith's (1997) work took this direction. Finally, the last batch of theories looked at the markets ability to provide changes in incentive for corporate control; Demirguc-Kunt and Levine (1996), Jensen and Murphy (1990) provide the commentary in this direction.

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The subject matter of this study is situated in the first strand of the literature. In that context, the financial sector is seen as a conduit for mobilising (debt) revenue for economic units, including the government. While there seems to be a dearth of theories on government debt, the existence of a relationship between fiscal policy and the financial sector has been explored by Tagkalakis (2014). He indicated that there is a relationship between the financial sector and public finance. A breakdown in the financial sector means a breakdown in financial intermediation. This means that the government as an economic unit may find it difficult to raise any debt instrument to support its programs when the financial sector is weak.

Focusing on the bilateral interactions between public debt and the financial sector, at first, the literature could not establish a direct link but focused on the impact of domestic government borrowing on the private sector, which established the well-known crowding out effect theory. The theory suggests that loose public expenditures result in a financial dearth in an economy, which prevents sufficient private-sector investment and capital accumulation, resulting in economic stagnation. This argument sounds persuasive because an upsurge in public debt can be viewed as a barometer of loose fiscal policy. Thus, financing the public sector budget with domestic debt hikes the real interest rates and subsequently crowds out private sector investment. However, this theory was not in favour of mobilising debt resource internally, especially in developing countries with weak savings.

After many years of inactivity, the theoretical conversation on the bilateral interactions between public debt and financial stability seems to have gathered steam. However, the direction of focus has been on how public debt affects the financial sector directly. According to Ondo (2017), such literature can be grouped into two. The first strand of the literature looks at the direct and indirect link between public debt and financial sector development. Reinhart and Rogoff (2008, 2009, and 2011), and Furceri

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and Zdzienicka (2012a; 2012b), who is the proponent of this strand, revealed that the relationship manifests in two channels; first, when government, through its fiscal policies, offers support to the financial sector. This involves the government providing support in the form of bailouts, capital injections, subsidies, pay-out to depositors, purchases of toxic assets, payments of called upon guarantees etc., to the financial sector seen in Europe during the 2007 financial crisis, and the "PIGS" countries recently. These interventionist policies swelled the domestic public debt. Second, the indirect effect of public debt on financial sector development occurs when government deleverages the financial sector. The process automatically contracts economic activities depending on how big the government is in the economy and hence lowers budgetary revenues and higher budgetary spending.

As discussed by Ilgün (2016), the second strand of the theories, and Janda and Kravtsov (2017), considers a more technical relationship from the point of view of how public debt affects financial stability. From this direction, two views are expressed. First, the safe asset theory postulates that domestic debt is a tool that strengthens and secures the financial sector. According to Kumhof and Tanner (2005), domestic debt resource mobilisation strengthens the liquidity and consistent flow of profits through the issuance of bonds by the state. It thus provides a safe asset for banks. The second view was famously well espoused by Houben et al. (2004), Ilgün (2016) and Janda and Kravtsov (2017), and it negates the first view indirectly. It argues that a rise in domestic debt resource mobilisation can destabilise the financial sector because a rise in domestic public debt can destabilise and raise the risk levels of locally denominated assets and the potential of losses emanating from the revaluation of government bonds (Janáček et al., 2012).

Is the relationship necessarily linear? Theoretically, there seems to be no conclusive thought on the direction of the relationship, but Hauner (2006, 2008, and 2009), in his "Lazy Bank" hypothesis, found a middle ground. He revealed that public debt could be good and bad for the financial sector

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depending on the quantum of debt in the financial sector held by the government and the strength of the financial sector. Thus, large portfolios of domestic debt empower banks to make easy profits with little or no competition. He, however, indicated that a banking sector that holds more public debt could slow the growth of the financial sector. Thus, a financial sector that holds too much public debt complacently does not have the drive to develop the financial sector under the difficult conditions, in effect, Hauner (2006, 2008, and 2009) suggest the possibility of discontinuities in the domestic debt financial development relationship. Thus, non-linearities exist because of the potential existence of a threshold in the relationship. However, in a rebuttal, Abbas and Christensen (2010) have criticised the theory by asserting that the limited or no competition revealed by the "lazy bank hypothesis" does not exist because of the competition offered by non-bank participation in public debt issuance; also the need for risk diversification may not encourage full investment in public debt by banks. The inconclusiveness, in theory, calls for empirical investigation in the issues at hand.

5.5 Empirical reviews

Whiles we are yet to encounter a specific study on the effect of financial sector development on domestic resource mobilisation, there are empirical studies, albeit scanty, and unspecific that focus on some the effect of financial sector development on some handles of DRM. A significant part of this literature has focused on tax revenue as a measure of domestic resource mobilisation.

For instance, Bohn (1990) discovered a positive relationship between financial sector development and tax revenue. Boyd (2009), in his "What Will Happen to State Budgets When the Money Runs Out", revealed that, since the financial market help determine the level of investment, they have a relationship on tax revenues. A downturn in investment negatively affects the level of tax revenue and, hence, domestic resource mobilisation. His study looked at the indirect link between financial market development and tax revenues without paying attention to the direct link. A void that Taha et al.

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(2010) will fill. Taha et al. (2010) moved the conversation forward by establishing a two-way relationship between direct tax revenue and financial sector development. They indicated that capital markets development also has a relation with tax revenue. Akram (2016) was the study that directly interrogated the subject matter of this study to some extent. Using time-series data, from 1975 to 2014, the study revealed that the number of bank branches, and the capitalisation of the banking sector, has a significant positive relationship with tax revenue in Pakistan. With bank branches and market capitalisation having a significant impact on tax revenue in the short run. The study also found that credit to the private sector has a bi-directional relationship with tax revenues in Pakistan. Ilievski (2015), using 96 countries' stock market variables as a proxy for financial sector development, revealed that higher stock market and total value traded are associated with higher revenues. Akçay et al. (2016) explored the nexus between financial sector development and taxes in Turkey by using the Johansen and Juselius (1990) and Hatemi-j (2008) cointegration techniques they established that direct taxes and financial sector development are co-integrated. Their results also show that banking and non-bank financial sector development granger causes direct tax revenue in Turkey. It is worthy of note that the methodology used for the test of causality is problematic. This is because an essential requirement for that method is the need for all the variables to be stationary, which becomes problematic for some critical variables. The properties of the variables are usually lost when the need for treating and transforming them arises. Loganathan et al. (2017) looked at the dynamic impact of financial sector development, inflation, and economic growth on tax revenues in Malaysia. They employed Maki's cointegration test with various structural breaks, bootstrap rolling window causality applications, and the Lind and Mehlum technique to capture the U-shape condition of tax-led-growth fundamental theory. A key finding in the study was that taxation and financial development has a unidirectional causality running from taxation to financial development. Although their study made some findings on financial market-tax relationship, it was not enough as important variables were omitted in the

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estimation technique. Ebi (2018) explored data from the Nigerian economy to determine if financial market development can raise tax revenues. He employed eight (8) measures of financial sector development from the World Bank's conceptual 4x2 framework of measuring financial sector development. He found out that, in general, financial sector development increases tax revenue. Concerning the variables used to measure financial sector development, access and depth of financial institutions development were discovered to be major determinants of revenue collection in Nigeria, followed by depth and stability of financial market development.

However, is there a relationship between domestic *debt* and financial sector development?

The above literature demonstrates a concentration on the role of financial sector development on the taxation aspect of DRM, with the role of financial sector development on domestic debt resource mobilisation left unexplored. Whiles tax revenue may be the major source of DRM, fiscal authorities in developing countries have demonstrated an appetite for domestic debt resources to make up gaps in public revenue to meet their budgetary requirement. A developed domestic financial market holds the key to mobilising domestic debt resources for development.

Concerning the debt/ financial sector development relationship, several studies (Ayadi et al., 2015, Bua 2014, Emran and Farazi 2009, Caballero and Krishnamurthy 2004) have investigated it at the aggregate level. Though mixed, the empirical relationship has been studied at the disaggregated level; For instance, Hauner (2008, 2009) revealed that the profitability of domestic banks is enhanced by domestic borrowing, but the borrowing reduces the efficiency of banks in developing countries. Domestic banks that invest heavily in the domestic debt market are prone to slow growth. These studies lend support to the `lazy bank' hypothesis, especially in developing countries. Kutivadze (2011) found a positive relationship between domestic debt and financial development in a panel setting, Altayligil and Akkay (2013) discovered a negative relationship in country-specific settings. Ilgün (2016)

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employed the second generation cointegration technique to study the long-run relationship in 18 emerging economies. The study found a negative relationship between domestic debt and financial sector development for the economies.

The above studies employed mainly conditional mean models, making it challenging to see the relationship from different parts of the debt distribution. The relationship may be different when domestic debts are lower compared to when they are higher. This study introduces that aspect of the conversation into the estimation and conducts a threshold analysis as far as the optimal domestic debt is concerned.

5.6 Methodology and data

This chapter addresses two sub-objectives. The first looks at the effect of financial sector development on domestic debt mobilisation, and the second assesses the threshold of domestic debt resources that fiscal authorities in Ghana can mobilise without jeopardising the financial sector in Ghana. We sequence the methodology and analysis in accordance with these objectives, respectively.

5.6.1 Theoretical model

The foundation of the model employed to unravel the first objective could be traced from the government budget constraint model. We follow the works of Budina and Fiess (2004) and Pirtea and Nicolescu (2013) to specify the domestic debt model as;

$$D_t = (GE_t - GR_t) + (1 + i_t^L) \cdot D_{t-1}^L + (1 + i_t^F) \cdot D_{t-1}^F \cdot S_t + \Delta MB \qquad [5.1]$$

Equation 5.1 suggests that changes in domestic sovereign debt at the time $'t'$ in cedies $D_t$is explained by the primary deficit (total non-interest government spending minus government revenue GR), the previous sovereign debt, and changes in the monetary base. In recognition of the government's commitment to raising debt revenues from both local and foreign sources. We split the lag of the

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sovereign debt into D_{t-1}^{L} for local currency-denominated debt and D_{t-1}^{F} for foreign currency-denominated debt. Where i_t^F the nominal is interest rate applicable to the foreign debt, and i_t^L applies to the local currency-denominated debt. S_t represents the nominal exchange rate, and MB is the monetary base. We then express the budget constraint as a ratio of GDP in terms of the primary balance, the real interest rate and the growth rate of GDP to yield;

$$d_t - d_{t-1} = (ge_t - gr_t) + (i^L - \pi_t - y) \cdot d_{t-1}^{L} + (i_t^F - \pi_t - y_t + S_t) \cdot b_{t-1}^{F} \quad [5.2]$$

Where; π_t is the inflation rate, y_t is the real GDP growth rate, and S_t is the percentage change of the exchange rate. Equation 5.2 suggests that the debt/GDP ratio changes is explained by the primary balance, debt dynamics from real interest on debt, and the growth rate of GDP; gains or losses on a foreign-denominated debt owing to exchange rate fluctuation. By a log transformation of the variables, the equation is therefore given by;

$$Ln\Delta DDG_t = \alpha_0 + \alpha_1 LnDDG_{t-1} + \alpha_2 LnPB_t + \alpha_3 LnIR_t + \alpha_4 LnY_t + \alpha_5 LnREXC_t + \theta X_{it} + \mu_t \quad [5.3]$$

Where ΔDDG_t represents changes in the domestic debt/GDP ratio, DDG_{t-1} is the previous years' domestic debt GDP ratio, 'PB' is the primary balance, "IR" is the interest rate, Y_t is the real GDP growth rate, REXC is the exchange rate. We augment equation 5.2 to include a vector of other macroeconomic variables that theoretically and empirically have a relationship with domestic sovereign debt given byθX_{it}. We include the variable of interest (financial sector development indicators) in that category of regressors. We define X_t to include the variables of interest, financial sector development indicators given by FSD, inflation, and the budget balance (BB).

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5.6.2 Data

Concerning the first objective, we employ quarterly time series data from 1983 to 2017 to estimate the model. We rely on the Bank of Ghana for data on the budget deficit, primary balance, and domestic debt. In addition, we employ the interest rate on 1 year Treasury bill bond from the Bank of Ghana. We also rely on the World Development Indicators for data on consumer price index CPI, and Real Effective Exchange Rate, and GDP growth rate for Ghana. Finally, we employ the new broad-based index of the international monetary fund by Svirydzenka (2016), which measures financial development. Since the 1970s, studies on financial sector development have relied on approximated data as financial development measures. However, according to Svirydzenka (2016), financial development is a multi-dimensional process, and hence the uni-dimensional variables employed as proxies in these studies falls short of explaining the totality of the relationship they measure. We thus employ the index by Svirydzenka (2016) that incorporate the multi-dimensional characteristic of financial development. To investigate the relationship more profound, we further employ the two main components of the financial development index (financial markets development FMD and financial institutions development FID).

In order to make sure that the variables are in the same order and scale, we express the budget balance, primary balance, and the domestic as a ratio of GDP. We further divide the growth rate and the interest rate by 100 to express them as ratios. We are selective on the log-transformed variables because some of them are in the negative. We log transform the domestic debt, interest rate, real exchange rate, consumer price index, and financial development variable. A careful analysis of the estimation model deployed suggests the possibility of endogeneity or feedback effect between financial development and domestic debt on the one hand and domestic debt and budget deficit on the other hand. Indeed, this has been proven by the Granger causality test given in the appendix of this chapter. The test strikes a unidirectional relationship between domestic debt and financial development up to

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lag 4, but the feedback effect is established at lag 5 (i.e. beyond one year). Bidirectional causality, however, is established between domestic debt and budget deficit at lag four. Given that, we remove the contemporaneous effect of financial development and budget deficit by employing only their fitted values to tone down or remove the possibility of endogeneity in the variables. Table 5.1 below presents the basic statistics of the variables in the model. The total number of observations in the variables are 140. Because almost all variables are expressed as ratios, their mean values are small except for the real effective exchange rate of 59.61 and the consumer price index of 12.96. The primary balance had the lowest mean (0.00). The mean of the budget balance (BBG) is negative because Ghana rarely runs a budget surplus.

Table 5.1: Basic statistics of the variables under study

	FIDI	**FDI**	**FMD**	**BBG**	**CPI**	**Y**	**IR**	**PB**	**REXC**	**DDG**
Mean	0.03	0.04	0.01	-0.17	12.96	0.01	0.23	0.00	59.61	0.11
Median	0.03	0.04	0.01	-0.23	5.26	0.01	0.23	0.01	27.08	0.12
Max.	0.03	0.06	0.02	8.39	60.18	0.04	0.46	0.03	1322.33	0.27
Min.	0.02	0.03	0.00	-2.16	0.07	-0.03	0.10	-0.05	15.45	0.01
SD	0.00	0.01	0.00	1.53	15.87	0.01	0.10	0.02	154.83	0.07
Skew.	0.36	0.42	0.16	3.39	1.33	-1.17	0.53	-0.98	6.32	0.47
kurtosis	2.16	1.98	2.22	16.90	3.85	14.17	2.53	4.30	45.06	2.69
Sum	3.69	6.12	1.17	-23.58	1814.79	1.81	32.73	0.63	8345.28	16.04
SSD	0.00	0.01	0.00	326.21	35003.42	0.01	1.27	0.04	3332159.00	0.60
Obs.	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00

Where FIDI is the financial institution's index, FDI is the overall financial development index, and FMD is the financial market development index.

Although the maximum and minimum values of some of the financial development variables, interest rate, and domestic debts are not huge, there are huge gaps between the minimum and maximum values of the other regressors such as the real effective exchange rate, budget balance, primary balance, growth and the CPI. This could be seen in the standard deviations of the variables. This means that

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the estimation technique must be strong enough to capture outlier data in the variables. The strategy ought to divide the data into different surrogates for onwards estimation. All the variables are positively skewed, except for economic growth and the primary balance. We report the correlation coefficient in Table 5.2 below.

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Table 5.16: Covariance and correlation matrix

Covariance Correlation	FID	FDI	FMD	BDG	CPI	Y	IR	PBG	REXC	DDG
FID	1.31E-05 1.000000									
FDI	2.09E-05 0.810381	5.05E-05 1.000000								
FMD	5.13E-06 0.321925	-9.18E-06 -0.293831	1.93E-05 1.000000							
BDG	-0.000832 -0.150400	4.57E-05 0.004217	-0.001692 -0.252180	2.330074 1.000000						
CPI	0.034412 0.600320	0.028567 0.254296	0.039520 0.568458	0.585804 0.024270	250.0245 1.000000					
Y	5.33E-06 0.194256	2.15E-06 0.040048	8.39E-06 0.252200	-0.003906 -0.338255	0.029371 0.245560	5.72E-05 1.000000				
IR	-7.51E-05 -0.217210	-0.000151 -0.222192	1.96E-06 0.004680	-0.065402 -0.448987	-0.410932 -0.272338	-0.000174 -0.241651	0.009106 1.000000			
PBG	1.15E-05 0.197259	1.88E-05 0.164184	4.00E-06 0.056508	-0.005917 -0.240845	0.037576 0.147653	-1.12E-05 -0.091728	0.000663 0.432011	0.000259 1.000000		
REXC	-0.143473 -0.256532	-0.049796 -0.045431	-0.234081 -0.345100	198.1144 0.841264	-486.5345 -0.199445	-0.721385 -0.618164	-3.774702 -0.256398	-0.423697 -0.170642	23801.14 1.000000	
DDG	9.22E-05 0.389862	2.96E-05 0.063877	0.000153 0.532813	0.009234 0.092775	0.900716 0.873614	5.67E-05 0.115017	-0.000233 -0.037509	0.000185 0.176289	-0.885810 -0.088057	0.004252 1.000000

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FID, FDI, and FMD refer to different financial development measures that will not be in the same model. We also estimated the correlation in the levels of the respective variables, and hence a log transformation of the variables as deployed in the model changes the relationship. For instance, log CPI will measure the level of inflation. Given that, we detect no severe correlation between the variables.

5.6.3 Empirical strategy

Looking at the nonlinear relationship between macro variables, we employ a nonlinear strategy to estimate the models. We fall on the Quantile-on-Quantile regression approach recently advanced by Sim and Zhou (2015). The traditional quantile regression (QR) technique proposed by Koenker and Bassett (1978), can only estimate the effect of a set of regressors on different quantiles of the dependent variable. It is deficient in distinguishing which quantile of the regressors exerts a positive or negative shock on the dependent variable. However, the quantile-on-quantile regression (QQR) can capture the elaborate features of the effect of regressors on the dependent variable that conventional OLS ignores and the QR. According to Sim and Zhou, 2015, the QQR technique combines traditional quantile regression and non-parametric estimation techniques to solve regression relationship problems. The QQR approach provides a cross-impact analysis of how domestic debt is related to high or low quantiles of the regressors.

We specify the following non-parametric equation to kick-start the QQR process as;

$$LogDD_T = \beta_i^{\phi}(x_{it}) + u_t^{\phi} \qquad [5.4]$$

Where $LogDD_T$ denotes the domestic debt/GDP ratio at period t, and x_{it} denotes the list of regressors which includes the variable of interest (financial development) at the time 't', ϕ represents the ϕ^{th} quantile of domestic debt distribution, and u_t^{ϕ} represents the quantile of the error term with conditional

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ϕ^{th} quantile assumed to be 0. $\beta_i^{\phi}(.)$ is however not known because there is no prior knowledge on the relationship between domestic debt.

The linear regression is therefore employed to examine equation 5.4 around X_i^{ρ} to explore the relationship between the ρ^{th} quantiles of domestic debt to the ρ^{th} quantile of the regressors. Taking into account $\beta_i^{\phi}(.)$, we expand equation 5.1 with the help of first-order Taylor expansion in the X_{it}^{ρ} quantile as;

$$\beta_i^{\phi}(X_{it}) \approx \beta_i^{\phi}(X_{it}^{\rho}) + \beta^{\phi\prime}(X_{it}^{\rho})\,(X_{it} - X_{it}^{\rho}) \qquad [5.5]$$

Where $\beta^{\phi\prime}$ is the partial derivative of $\beta_i^{\phi}(X_{it})$. I.e. the regressors are thus marginal effects, but its interpretation is similar to the slope coefficient in the linear regression framework. Equation 5.5 recognises both ϕ, and ϱ as dual indexed parameters that are seen in forms such as $\beta_i^{\phi}(X_{it}^{\rho})$, and $\beta_i^{\phi\prime}(X_{it}^{\rho})$. Additionally,$\beta_i^{\phi}(X_{it}^{\rho})$ and $\beta^{\phi\prime}(X_{it}^{\rho})$ are recognised as legitimate functions of ϕ and are followed by X_{it}^{ρ} and X_{it} which are also functions of ϕ *and* ρ. Also, $\beta^{\phi}(X_{it}^{\rho})$ and $\beta^{\phi\prime}(X_{it}^{\rho})$ can be re-written as;$\beta_{10}(\phi,\rho)$, and $\beta_{11}(\phi,\rho)$, respectively. Because of this, equation 5.5 can be re-written as;

$$\beta_i^{\phi} X_{it} \approx \beta_{i0}(\phi,\rho) + \beta_{i1}(\phi,\rho) + (X_{it} - X_{it}^{\rho}) \qquad [5.6]$$

We substitute equation 5.6 into equation 5.4 as;

$$LogDD_t = \underbrace{\beta_{i0}(\phi,\rho) + \beta_{i1}(\phi,\rho)(X_{it} - X_{it}^{\rho}) + U_t}_{(*)} \qquad [5.7]$$

(*) represents the value of the ϕ^{th} conditional quantile of domestic debt. According to Shabbaz et al. (2018), equation 5.7 gives the true relationship between the ϕ^{th} quantile of the regressors. The

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parameters β_{i0} and β_{i1} indexed $\phi, and\ \rho$ establishes the true relationship between the quantile under study. A linear relationship between the quantiles of the dependent and independent variables is all it establishes. Therefore, the parameters of the localised linear regression b_{i0} and b_{i1} are, therefore, the estimates of β_{i0} and β_{i1}. The estimates are obtained by minimising the problem;

$$\min_{b_{i0}\, b_{i1}} \sum_{i=1}^{n} \tau\phi[LogDD_t - b_0 - b_1\left(\widehat{logDD}_t - LogDD_t^{\rho}\right)]k\left(\frac{F_n\left(\widehat{logDD}_t\right)^{\rho}}{h}\right) \quad [5.8]$$

Where $\tau\phi(\mu)$ represents the quantile loss function given by;

$$\tau\phi(\mu) = U(\phi - I(\mu < 0)) \quad [5.9]$$

Where I is the indicator function, $K(.)$ is the Kernel function to weigh all observations around X_i^{ρ}. The Gaussian Kernel assigns less weight to observations that are further away from among the distribution function of $\widehat{X_{it}}$ given by $F_n\left(\widehat{X_{it}}\right) = \frac{1}{n}\sum_{k=1}^{n} I\left(\widehat{X_{itk}} < \widehat{X_{it}}\right)$. It also gives the value of the distribution function that connects the quantile X_{it}^{ρ}, given by ϱ. Following Sim and Zhou (2015), we employ a bandwidth of h=0.05

We specify three models with different financial development variables, as indicated above, to measure the mediation effect of the different financial development on debt mobilisation. Because we are dealing with macro-level data, we focus our inquisition on four (4) different quantiles (0.25, 0.50, 0.75, and 1.00 of the distribution). For clarity in the conversation, we denote quantiles of interest in discussion with "*tau*". The basic statistics of the quantiles understudy in the three focus models are displayed in table 5.3 below.

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Table 5.3: Basic statistics of the QQR models understudy

Financial development index model			
tau= 0.25	**tau= 0.50**	**tau= 0.75**	**tau= 1.00**
Min. : -0.483	Min. :-0.926	Min. : -2.821	Min. :-8.037
1st Qu.: -0.224	1st Qu. :-0.455	1st Qu. :-0.421	1st Qu. :-0.951
Median :-0.073	Median :-0.118	Median :-0.258	Median : 0.012
Mean : 0.083	Mean : 0.000	Mean :-0.417	Mean :-1.199
3rd Qu.: 0.009	3rd Qu. : 0.031	3rd Qu. : 0.068	3rd Qu .: 1.268
Max. : 1.052	Max. : 1.352	Max. : 1.327	Max. : 2.507
Financial *Market* Development Model			
tau= 0.25	**tau= 0.50**	**tau= 0.75**	**tau= 1.00**
Min. : -0.275	Min. : -0.458	Min. :-0.912	Min. : -6.221
1st Qu.: 0.009	1st Qu.: 0.007	1st Qu.:-0.274	1st Qu.: -3.505
Median : 0.022	Median : 0.028	Median :-0.003	Median :-0.240
Mean : 0.291	Mean : 0.261	Mean : 0.083	Mean : 0.352
3rd Qu.: 0.317	3rd Qu.: 0.225	3rd Qu.: 0.036	3rd Qu.: 0.462
Max. : 1.454	Max. : 1.389	Max. : 1.346	Max. : 16.643
Financial *Institutions* Development model			
tau= 0.25	**tau= 0.50**	**tau= 0.75**	**tau= 1.00**
Min. : -0.498	Min. : -0.957	Min. : -3.258	Min. : -7.310
1st Qu.: -0.126	1st Qu.: -0.513	1st Qu.: -0.594	1st Qu.: -1.193
Median :-0.037	Median :-0.083	Median :-0.063	Median : 0.052
Mean : 0.071	Mean : -0.011	Mean : -0.597	Mean : -0.432
3rd Qu.: 0.013	3rd Qu.: 0.032	3rd Qu.: 0.022	3rd Qu.: 0.199
Max. : 1.031	Max. : 1.125	Max. : 1.254	Max. : 9.703

Notes: The reported statistics include the; mean, median, minimum, maximum, 0.25, and 0.75 quantiles.

5.7 Empirical Results

5.7.1 Quantile-on-Quantile Estimates

The method adopted for this section is non-parametric, which means that the assumption of the linear regression is relaxed. We, therefore, move to explain the results from the three models estimated using the QQR approach. Finally, we present the result of the overall financial development index and

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present the mediation effect of the financial market index mode, and we complete the analysis with the financial institutions' index model.

5.7.1.1 Financial Development and domestic debt

Table 5.4 below illustrate the result of the overall effect of the model. We also compute the OLS estimation as a comparator to the results of the various quantiles. As indicated in Table 5.4 below, when total financial development mediates the relationship, in the OLS model, two variables are essential in the relationship; the budget balance, which is positively related to the level of domestic debt, and the level of financial development, which negatively referees the relationship. These results are not consistent with the quantile-on-quantile regression. The variable of interest financial development assumes significance at tau = 0.5, 0.75, and 1.00. In all the tau= 0.5 and 0.75, a negative relationship ensues with the level of domestic debt. The sign at tau = 0.5 and 0.75 somehow support the lazy bank theory, which postulates a negative relationship between financial development and sovereign debt. The underlying explanation is that there is a trade-off relationship between the level of debt resources the domestic financial sector can advance for development and the development of the financial sector. A policy that advocates for a developed financial sector will not support high sovereign debt at these quantiles.

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Table 5.4: Mediation results of total financial development on domestic debt

Quantile-On-Quantile Regression Model 1					
Variables	**tau=0.25**	**tau=0.50**	**tau=0.75**	**tau=1.00**	**OLS**
(Intercept)	-0.483	-0.926	-2.557***	-6.553***	-1.119**
	(0.535)	(0.581)	(0.882)	(0.000)	(0.426)
Lag of Log domestic debt	1.053***	1.089***	1.253***	1.700***	0.108
	(0.055)	(0.060)	(0.099)	(0.000)	(0.207)
Budget balance	-0.224	-0.797	-2.821***	-8.374***	0.851**
	(0.611)	(0.724)	(0.956)	(0.000)	(0.368)
Primary balance	-0.277	-0.455	-0.258	1.268***	-1.571
	(0.287)	(0.381)	(0.551)	(0.000)	(2.062)
Log Financial Development	-0.105	-0.176**	-0.421***	0.951***	-0.411**
	(0.077)	(0.085)	(0.151)	(0.000)	(0.180)
GDP growth	0.854	1.352	1.327	2.507***	1.578
	(0.735)	(0.861)	(1.218)	(0.000)	(1.375)
Log of real exchange rate	-0.003	0.003	-0.002	0.124***	-0.068
	(0.012)	(0.016)	(0.025)	(0.000)	(0.043)
Log Interest rate	0.009	0.031	0.068**	0.197***	0.169
	(0.016)	(0.021)	(0.027)	(0.000)	(0.138)
Log CPI	-0.073	-0.118	-0.343**	0.934***	-0.039*
	(0.076)	(0.082)	(0.144)	(0.000)	(0.022)
*Where *,**, and *** denotes significance at the 10%,5%, and 1% level*					

We also find that a positive relationship between domestic debt and financial development ensues at the tail end of the distributions. The explanation is that the comprehensive index on financial development comprises three main sub-indices (private sector access to credit, efficiency, and financial depth). Concerning access, a developed financial sector means private sector access to credit must be higher. Higher efficiency also means that there is, to an extent, a fine balance between advancing loans to the private sector and government. The two sub-indices of access and efficiency could be responsible for the negative sign discovered. Thus, these two indices do not support mobilizing sovereign debt from the domestic financial sector. Moreover, high domestic debt connotes the crowding out of the private sector from accessing credit, which manifests into a low financial development, and an expansion of loans to the public sector dampens the level of efficiency, and hence financial development. In the spirit of this, the negative relationship is established at tau= 0.5

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and 0.75, quantiles. The last sub-index (financial depth) is responsible for the positive relationship established at tau= 1.00. This connotes high capitalization of both financial markets and institutions from which sizeable sovereign debt resources could be raised. Financial depth could strike a balance between patronage in domestic sovereign debt instruments and private sector credit. The result, therefore, means that high financial development is needed for very high domestic sovereign debt mobilization.

Although positive in the OLS model, it is not significant; the QQR model indicates that, at all quantiles, the past levels of debt are both positive and essential in moderating the relationship. Concerning the budget balance, we have contrasting relationships in the two models. According to the OLS model, the effect of budget balance on domestic debt is positive. This is expected as budget deficits have for long been the order of the day in Ghana. Governments in Ghana has traditionally resorted to four primary sources to finance the deficit; central bank financing, which adds to the domestic debt; selling of bonds to the general public, which adds to the level of domestic debt; selling instruments which also adds to the level of domestic debt, and lastly external borrowing. The first three remedies espouse how vital and fundamental the relationship is in Ghana. However, the budget balance becomes significant in the QQR models at the higher quantiles (0.75 and 1.00). However, at these levels, the relationships are negative, which means that surpluses permeate higher quantiles of the models. Budget surpluses are necessary in sovereign debt reduction in that the surplus could be used to defray part of the previous year's debt. In such scenarios, the relationship is no longer positive but negative. However, a positive relationship is obtained for the level of primary balance, which is significant in the QQR model but not the OLS. It is significant at the extreme end of the distribution, i.e. tau= 1.00 quantile. The effect of growth is synonymous with that of the primary balance. We establish a significant positive relationship at the extreme end of the distribution (tau=1.00) at the 1% significance level. The same relationship is established for the real exchange rate variable.

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The QQR estimate of interest rate, however, has a different narrative. Although not significant in the OLS model, we find a positive relationship between interest rate and domestic debt in tau= 0.75, and tau=1.00) quantiles of both interest rate and domestic debt. This is in line with prior expectations because higher levels of interest rate tend to swell domestic debts, and it is only realistic that a positive relation ensues. All the control variables in the QQR model exhibited consistent signs in all the quantiles as far as significance is concerned. Inflation exhibited a different sign-in tau = 0.75, and tau=1.00). At tau = 0.75, inflation is negatively related to domestic debt. At the extreme higher end of both inflation and domestic debt, the relationship is positive.

5.7.1.2 Financial Market Development and domestic debt

We scale down to the two main components of financial development; financial markets and financial institutions. Specifically, we look at the mediation effect of financial markets development on domestic debt in this section. Table 5.5 below details the results of the QQR models and the OLS model, which is a comparator.

We find that none of the variables in the OLS model was significant. We begin with a stern focus on the variable of interest (financial market development). We find no significant relationship between domestic debt and financial market development at all the lower quantiles. A positive relationship is, however, struck at tau = 1.00. At that quantile, a 1% increase in financial development will raise domestic debt by 0.25%. The financial market in this section denotes stock market development.

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Table 5.4: Financial market development model results

Quantile-On-Quantile Regression Model 2					
Variables	**tau=0.25**	**tau=0.50**	**tau=0.75**	**tau=1.00**	***OLS***
(Intercept)	0.086	0.148	-0.274	-3.505***	-0.102
	(0.159)	(0.269	(0.270)	(0.000)	(0.213)
Lag of Log domestic debt	0.994***	0.984***	1.024***	1.291***	0.226
	(0.023)	(0.028)	(0.033)	(0.000)	(0.211)
Budget balance	0.317	0.225	-0.912	-5.231***	-0.116
	(0.266)	(0.510)	(0.560)	(0.000)	(0.449)
Primary balance	-0.275	-0.458	-0.477	-6.221***	-1.643
	(0.294)	(0.363)	(0.481)	(0.000)	(2.398)
Log Financial Market	-0.005	0.001	-0.003	0.249***	-0.035
Development	(0.018)	(0.020)	(0.029)	(0.000)	(0.063)
GDP growth	1.454*	1.389	1.346	16.643***	0.121
	(0.780)	(0.841)	(1.000)	(0.000)	(0.145)
Log of real exchange rate	0.009	0.007	0.019	0.214***	0.015
	(0.012)	(0.016)	(0.018)	(0.000)	(0.023)
Log Interest rate	0.022	0.021	0.036	0.462***	0.197
	(0.017)	(0.021)	(0.022)	(0.000)	(1.501)
Log CPI	0.014	0.029	-0.010	0.240***	-0.022
	(0.034)	(0.035)	(0.046)	(0.000)	(0.029)

*Where, *, **, and *** denotes significance at the 10%, 5%, and the 1% level.*

According to Scott and Ovuefeyen (2014), financial markets such as the stock market provides the platform for debt instruments issued by a government to be traded. The market is also the nucleus of the capital market; given the preceding, development in the markets should suffice to provide the fiscal authorities with the needed debt resources for development. This relationship can only be realized at the extreme end of domestic debt and financial market development distributions. These findings align with the previous model, where a positive relationship ensues at the tail end of the two distributions. This means that, for government to realize maximum resources from the domestic financial market to develop, a policy to develop the market should be embarked on since the positive relationship is at the extreme high end.

We also observe that all the control variables employed in the model are only significant at the extreme upper end of their distributions, with the budget balance and the primary balance exhibiting a negative

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relationship. However, the growth rate, interest rate, and the real exchange rate exhibiting a positive relationship with domestic debt. Thus, persistence could be identified in the model as the lag of domestic debt left a positive trail in all the quantiles under study.

5.7.1.3 Financial Institutions Development and domestic debt

This section of the analysis focuses on the mediation effect of financial institutions development on domestic debt. We maintain the control variables, but the current financial sector development index focuses on financial institutions development. Table 5.6 below gives the estimation results of the QQR models in the section and the OLS estimation results.

Table 5.517: Mediation results of financial institutions development on domestic debt

Quantile-On-Quantile Regression Model 3					
	tau=0.25	**tau=0.50**	**tau=0.75**	**tau=1.00**	***OLS***
(Intercept)	-0.498	-0.957	-3.258***	-7.310***	-1.849**
	(0.511)	(0.613)	(1.133	(0.00)	(0.876)
Lag of Log domestic debt	1.031***	1.068***	1.254***	1.538***	0.077
	(0.041)	(0.050)	(0.102	(0.00)	(0.212)
Budget balance	-0.037	-0.580	-2.648***	-6.387***	0.719**
	(0.479)	(0.675)	(0.972	(0.00)	(0.335)
Primary balance	-0.437	-0.513	-0.064	0.191***	-1.146
	(0.282)	(0.331)	(0.525	(0.00)	(2.263)
Log Financial Institutions Development	-0.126	-0.192**	-0.594***	-1.193***	-0.556*
	(0.083)	(0.092)	(0.210	(0.00)	(0.282)
GDP growth	0.739	1.125	0.303	9.703***	1.653
	(0.730)	(0.842)	(1.419	(0.00)	(1.399
Log of real exchange rate	-0.004	0.001	-0.047	0.521***	-0.072
	(0.011)	(0.015)	(0.045	(0.00)	(0.047)
Log Interest rate	0.013	0.032*	0.022	0.199***	0.175
	(0.015)	(0.018)	(0.030)	(0.00)	(0.145)
Log CPI	-0.040	-0.083	-0.340**	0.682***	-0.019
	(0.054)	(0.064)	(0.147	(0.00)	(0.016)

*Where, *, **, and *** denotes the significance level at 10%, 5%, and 1% respectively*

The results generally depict coefficients that are similar to the overall index's model in the previous section. We observe that the constant, and the budget balance, were the significant variables in the

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OLS model. In addition, the financial institutions' development variable is marginally significant at 10%.

Concerning the QQR, from table 5.6, we find that financial institutions development enters the domestic debt model negatively in all quantiles. However, its importance in the model is seen at the tau= 0.5, tau=0.75, and tau= 1 quantiles, and the magnitude of the coefficient keeps rising as the quantile increases. The negative relationship suggests that a policy that seeks to raise resources from domestic financial institutions must have in mind that there is a trade-off between domestic debt and financial institutions development, more debt resources weaken financial institutions development, and hence the level of financial development in Ghana does not support maximum debt resource generation. Additionally, financial institutions in Ghana lack depth; they are undercapitalized to syndicate and finance huge sovereign debt instruments. Because of that, the government of Ghana has resorted to Eurobond issuance to finance the budget.

Akin to the first model, the lag of domestic debt enters the QQR models positively, even though it is not significant in the OLS model. We find a significant negative relationship between the two variables at the higher end of the quantiles (tau=0.75, and tau=1.00) of both previous domestic debt and budget balance. The relationship, however, as indicated earlier in the OLS model, is positive. This means that budget deficits dominate the mean of the relationship, but budget surpluses permeate tau= 0.75 and tau= 1.00 quantiles. It is worthy of note that the negative relationship is higher in the tail end of the distributions.

The primary balance, GDP growth and the real exchange rate enter the model positively at the extreme tail of the distribution (1.00^{th}) quantile. However, as in the first model, the level of inflation is negatively related to the level of domestic debt at the 75^{th} quantile of both distributions. The relationship at the upper tail quantile (1.00^{th}) is positive, which is in line with the prior expectation.

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Higher inflation courts higher interest rate to make up for the erosion of the value of the debt owed. In some debt arrangements, the debt is indexed against the level of inflation, which means that the higher the level of inflation, the higher the level of the debt. In such circumstances, the relationship could only be positive.

5.8 Checking the Validity of the QQR Strategy

In this section, we verify if the QQR strategy adopted follows the QR estimates behaviour. The quantile-on-quantile regression model allows both the dependent and independent variables to be decomposed into different surrogates. This decomposition gives different coefficients for each quantile. Thus, the ϕ^{th} quantile of the dependent variable is regressed on the ρ^{th} quantile of the independent variable. The parameter in the QQR model is indexed by both ϕ and ϱ, which makes the QQR approach more detailed, and localized. The localization property of the QQR approach makes it possible to employ the QQR coefficient to recover the coefficients from the standard quantile regression. Worthy of note that, ϕ which indexes the quantile regression parameter along ϱ. We, therefore, check the validity by comparing the parameters of the quantile regression with the ϱ averaged parameters by plotting the QR and QQR parameters to demonstrate if the two moves in the same direction or otherwise. We outline the plots in accordance with the models estimated. We first plot the parameters mediated by the overall financial sector development model, the financial market model, and the financial institutions model in figure 5.3, 5.4, and 5.5, respectively.

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Figure 5.2: QQR model with overall financial development mediating the relationship

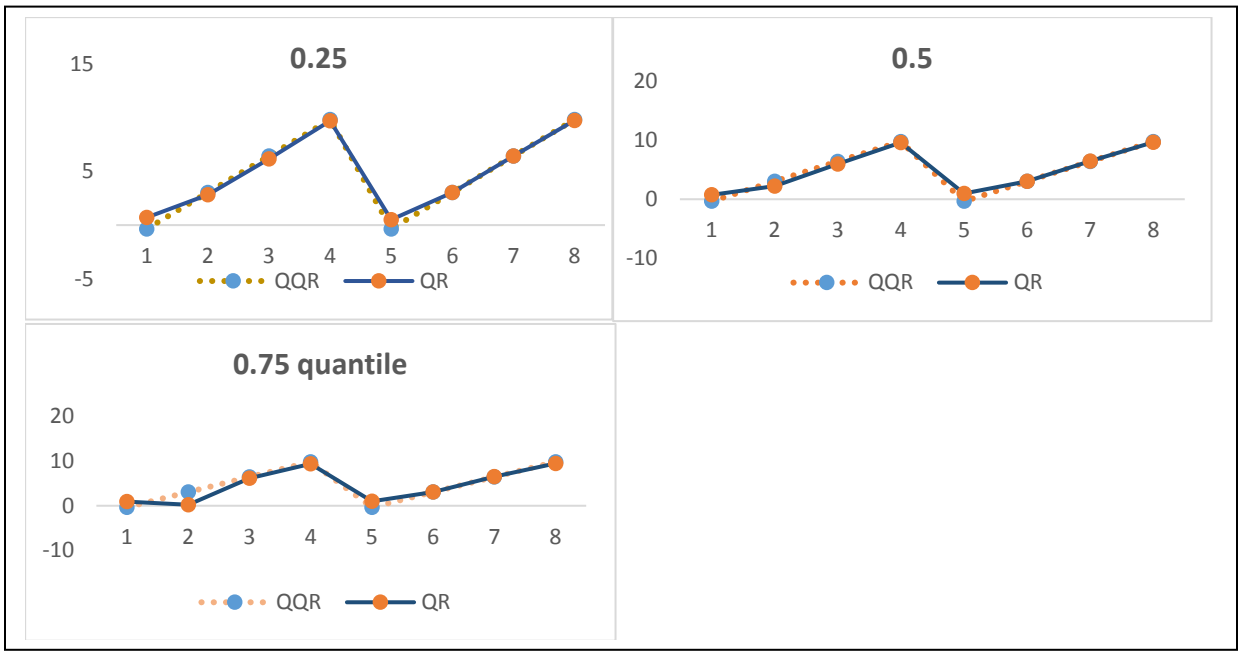
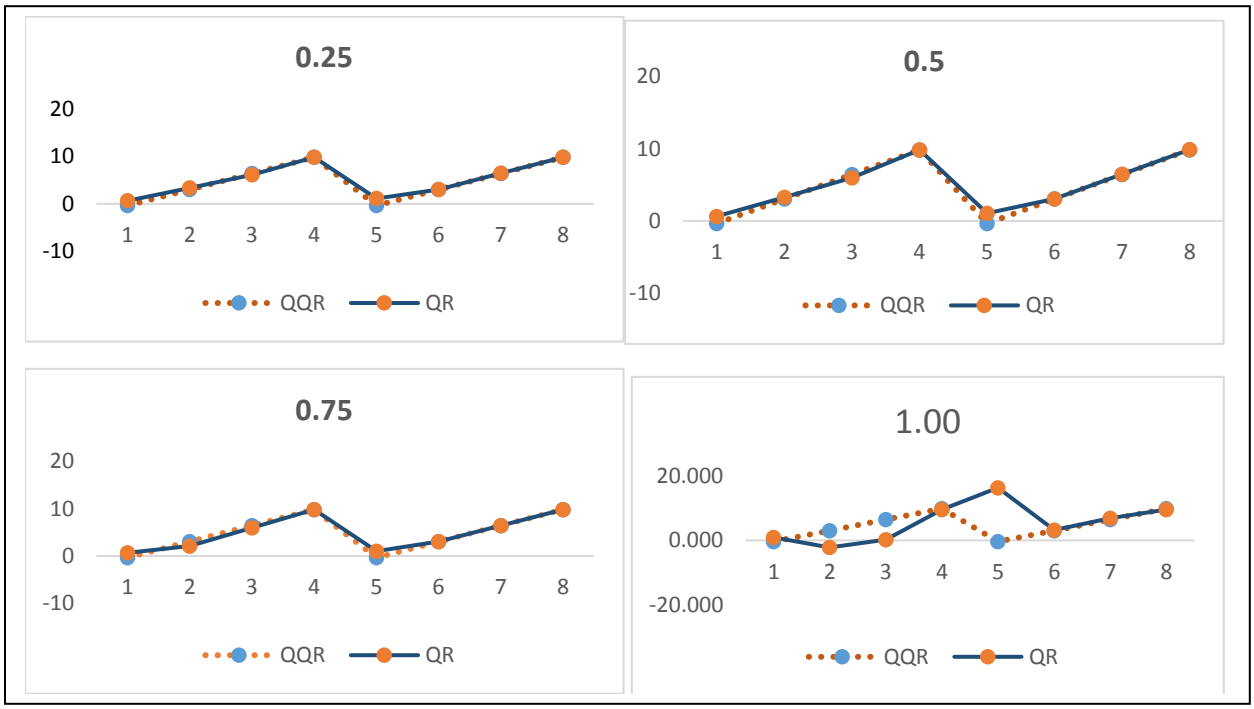
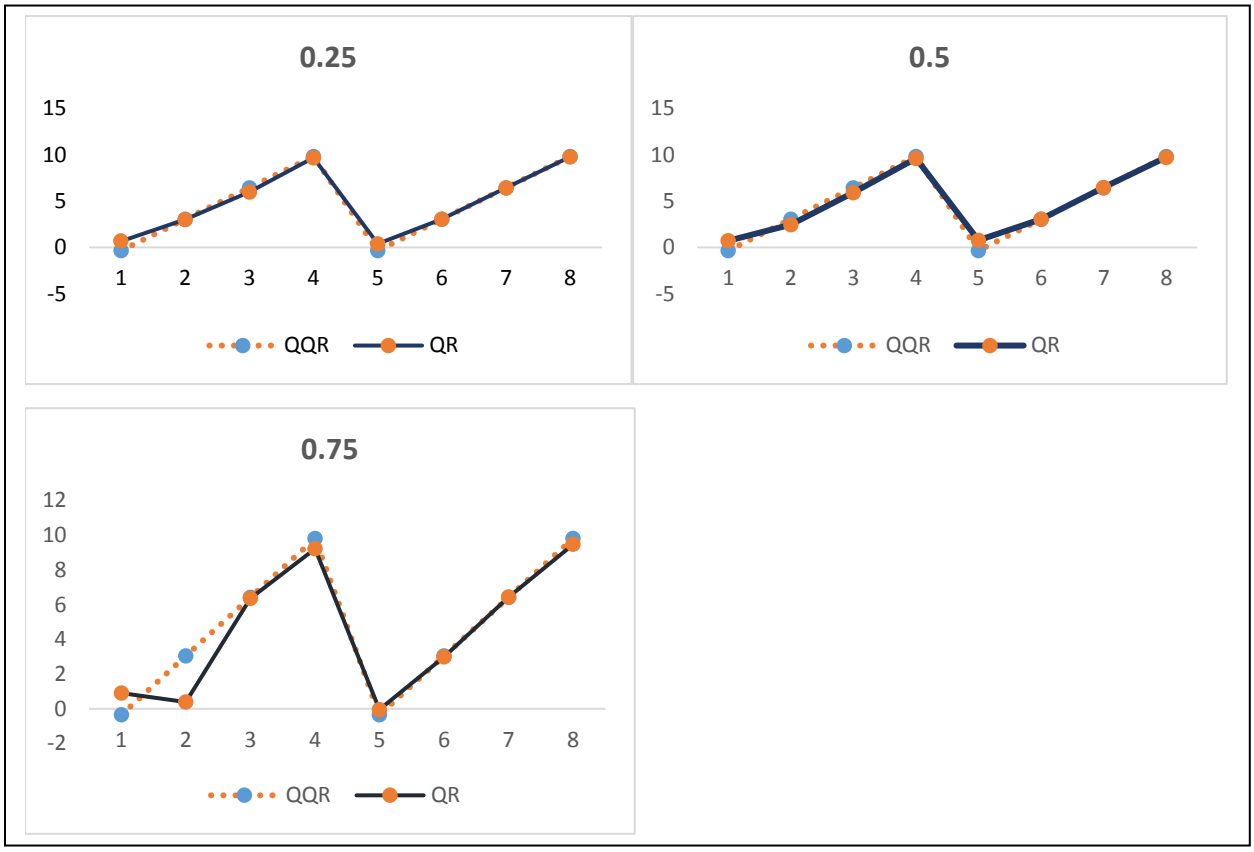


Figure 5.3: QQR model with financial market development mediating the relationship



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Figure 5.4: QQR model with financial institutions development mediating the relationship



From figure 5.2, 5.3, and 5.4, we find that the coefficients of the QQR and the QR regressions are almost the same in all the models, and quantiles, except for tau=1.00. The graphical representation in all the figures above demonstrates that the mean QQR estimates of the slope coefficients are synonymous with the standard quantile regression estimates for all models, with the notable exception of tau= 1.00. Although the slope coefficients for tau= 1.00 quantile for the QQR and standard quantile regression are not the same, they exhibit similar movement, and hence trends, which means that the main elements of the quantile regression can be obtained by summarizing the condensed information in the QQR estimate. The figures above thus, demonstrate that the earlier QQR results explained are valid.

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5.9. What is the level of domestic debt that optimizes financial sector development in Ghana?

The previous section analyzed the effect of financial development on domestic debt mobilization. Therefore, we turn the analysis around to unravel the second objective of the study, i.e. first, to find the effect of domestic debt on financial development and estimate the threshold of domestic debt that can be mobilized for development without compromising the financial sector. This section has become necessary following the varied signs on the effect of financial development on domestic debt at different quantiles and in the different models. The argument is that a threshold exists beyond which any strategy to fall on the domestic financial sector for resources to develop the economy will be inimical to financial sector development and economic development in general.

5.9.1 Identifying domestic debt thresholds.

While the use of quadratic terms has in the past dominated threshold estimations, we argue that the exact relationship and form at the point of inflexion may not be known, and as such, the results of such models are generally unreliable. We overcome this deficiency by relying on the Hansen (1996, 2000) technique because the nature of the nonlinear relationship is not imposed on the model. Additionally, the statistical significance of the thresholds identified can be verified empirically. According to Papageorgiou (2002), the main advantage of the Hansen splitting threshold technique is that it is based on asymptotic distribution theory.

To find the threshold of domestic debt that optimizes financial development, we specify a financial development model following Mckinnon (1973) and Shaw (1973), which are studied in the endogenous growth literature. According to Falhaty and Hook (2013), Mckinnon (1973) contemplate a positive relationship between financial development and economic growth because of the complementarity relationship between capital and money. Financial development effect on growth is

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through the instrumentality of financial markets in debt intermediation which promotes investment, and hence, the level of output. Following the work of Falahaty and Hook (2013), we specify a basic financial development model as;

$$FD = f(GDP, IR,) \quad [5.10]$$

FD financial development, index, and IR are the interest rate, and GDP is the GDP per capita. We augment this functional relationship to include; inflation, real exchange rate, and domestic debt and by log transformation, equation 5.10 becomes,

$$LogFD = logGDP, Inf, logIR, logER, LogDD \quad [5.11]$$

We crystallize equation 5.11 as;

$$LogFD = \theta logDD_t + \alpha V_i + \mu_t \quad [5.12]$$

Where V_i is a vector of the other control variables as indicated in equation 5.11 (including a constant term), θ, and α are the parameters to be estimated, and μ_t is the idiosyncratic error term. $'\theta'$ measures the effect of the domestic debt on financial development, we augment equation 5.12 so that the initial values of domestic debt referee the effect of domestic debt on financial development. Therefore, the initial values of domestic debt form our threshold variable given as $'\pi'$, which is a continuous distribution. The parameters in the equation are therefore split into two (2) regimes conditional on $'\pi'$. We specify this as;

$$LogFD_t = (\theta_1 logDD_t + \alpha_1 V_{it} + \mu_t)\, I_t\{\pi < \Upsilon\} + (\theta_2 logDD_t + \alpha_2 V_{it})\, I_t\{\pi > \Upsilon\} + \varepsilon_t \quad [5.13]$$

Where $I(.)$ represents the indicator function of the dummy variable that assumes the value of 1 when the argument of the indicator function is fulfilled and 0 when the argument is not fulfilled. π is taken

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as the threshold variable, and 'ϱ' is the value of the threshold. Equation 5.13 allows for the effect of domestic debt on financial development to be decomposed into two (2). The first effect looks at the effect when the level of domestic debt is below the threshold, and the second looks at the effect when the domestic debt is beyond the threshold. Θ1 and θ2 measure the effect of domestic debt on financial development i n low regime and high regime periods, respectively. Where $\pi \leq Y$ and $\pi \geq Y$ represent the low, and high regime period.

Similar to the procedure employed by Alagidede et al. (2018), Ibrahim and Alagidede (2018), Iddrisu and Alagidede (2020), Aluko and Ibrahim (2020). We begin by testing the existence of a threshold against linearity. That is, if $\theta_{i1} = \theta_{i2}$ and $\theta_{i1} \neq \theta_{i2}$, we re-write equation 5.13 as

$$y_t = \grave{\theta} X_i + \grave{\delta_n} X_i(Y) + \varepsilon_i \qquad [5.14]$$

Where $\delta_n = \theta_{i2} = \theta_{i1}$ is the threshold effect. We solve it as $Y_n \to 0$ when $n \to \infty$ $\theta_{i1} \to \theta_{i2}$ we further specify equation 5.13 in a matrix form as an $n \times 1$ vector of Y and ε by stacking them and then in an $n \times m$ matrices X and Y respectively. We re-estimate equation 5.14 as;

$$Y = X\theta + X_Y\delta_n + \varepsilon \qquad [5.15]$$

$\theta, \delta,$ and Y is solved with the help of the least-squares estimator $(\theta, \delta, \hat{Y})$. It minimizes the sum of squares errors in equation 5.16 as;

$$SSE_n(\theta, \delta, Y) = (Y = X\theta + X_Y\delta_n)' \, (Y = X\theta + X_Y\delta_n) \qquad [5.16]$$

The threshold test is restricted to a bounded set $\left[\underline{Y}, \overline{Y}\right] = \psi$ in the minimization process. We rely on the concentration approach applied to evaluate the least square estimate $(\theta, \delta, \hat{Y})$ where $\hat{Y}$ minimizes $SSE_n(Y)$ which is uniquely determined as;

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$$\hat{\Upsilon} = \frac{argmin\ SSE_n(\Upsilon)}{\Upsilon \in \psi} \qquad 5.17$$

Where $\bar{\psi} = \bar{\psi}\ n\{\delta_1, \delta_2, , , , , , , \delta_n\}$ the slopes are estimated as $\hat{\theta} = \hat{\theta}(\hat{\Upsilon})$ and $\hat{\delta} = \hat{\delta}(\hat{\Upsilon})$ we employ the likelihood ratio test, we then test the hypothesis;

$H_o: \Upsilon = \Upsilon_o$ using the likelihood ratio test;

$$LR_n(\Upsilon) = \frac{SSE_n(\Upsilon) - SSE_n(\hat{\Upsilon})}{SSE_n(\hat{\Upsilon})} \qquad [5.18]$$

We reject the null hypothesis for large values of $LR_n(\Upsilon_0)$the confidence interval determines to a large extent the reliability of the threshold. It is determined by using the inversion of the Wald or 't' test statistics. Hansen (2000) and Dufour (1997) argues that the asymptotic sampling distribution relies on unknown estimators. The Wald statistics may not suffice. This is especially true because it has finite sample performance, which is exacerbated if the parameter has a region with failed identification. We, therefore, rely on Hansen (2000) newly developed threshold technique to address the problem. An asymptotic confidence level (c) for Υ employing the $LR_n(\Upsilon)$ set at $\hat{\psi}$=$\{\Upsilon: LR_n(\Upsilon) \leq C\}$

According to Hansen (2000), the assumptions of this technique include stationarity of the variables in the model. We, therefore, test for the stationarity or otherwise of the variables in the model with the help of the Augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979) and the Phillip-Perron test by Phillips and Perron (1988). In addition, we test for the threshold in three financial development models, i.e. the overall index and its components (financial market development and financial institutions development) as indicated in the data section.

5.10 Results and discussions

5.10.1 Stationarity results

Table 5.6 below spells out the stationarity test results for all the variables employed.

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Table 5.6: Stationarity test results

Philips-Perron	**Levels**		**First Difference**	
Variable	**Constant**	**Trend**	**Constant**	**Trend**
Log Financial markets Dev't.	-2.74	-2.52	-5.14***	-5.19***
Log Financial Institutions Dev't.	-2.74*	-2.92	-5.43***	-5.39***
Log Financial sector Dev't.	-1.63	-1.58	-5.62***	-5.51***
Log GDP per capita	1.24	-0.64	-4.86***	-5.00***
Inflation	-2.64*	-2.99	-11.33***	-11.43***
Log Domestic debt	0.416	-2.43	-6.12***	-6.15***
Log Interest Rate	-2.08	-2.54	-5.42***	-5.42***
Log real exchange rate	-6.39***	-9.03***	-12.58***	-12.90***
ADF	**Levels**		**First Difference**	
Variable	**Constant**	**Trend**	**Constant**	**Trend**
Log Financial markets Dev't.	-2.23	-1.97	-4.21***	-4.45***
Log Financial Institutions Dev't.	-0.52	-0.94	-4.26***	-4.52***
Log Financial sector Dev't.	-1.50	-1.18	-3.42**	-3.69**
Log GDP per capita	1.35	-1.48	-3.14**	-3.60**
Inflation	-4.01***	-9.61***	-11.23***	-11.15***
Log Domestic debt	-1.18	-2.89	-9.07***	-9.10***
Log Interest Rate	-2.82*	-3.00	-7.51***	-7.59***
Log real exchange rate	-5.05***	-7.91***	-6.28***	-6.35***

*Where; *, **, *** denotes the level of significance at the 10%, 5%, and 1% level.*

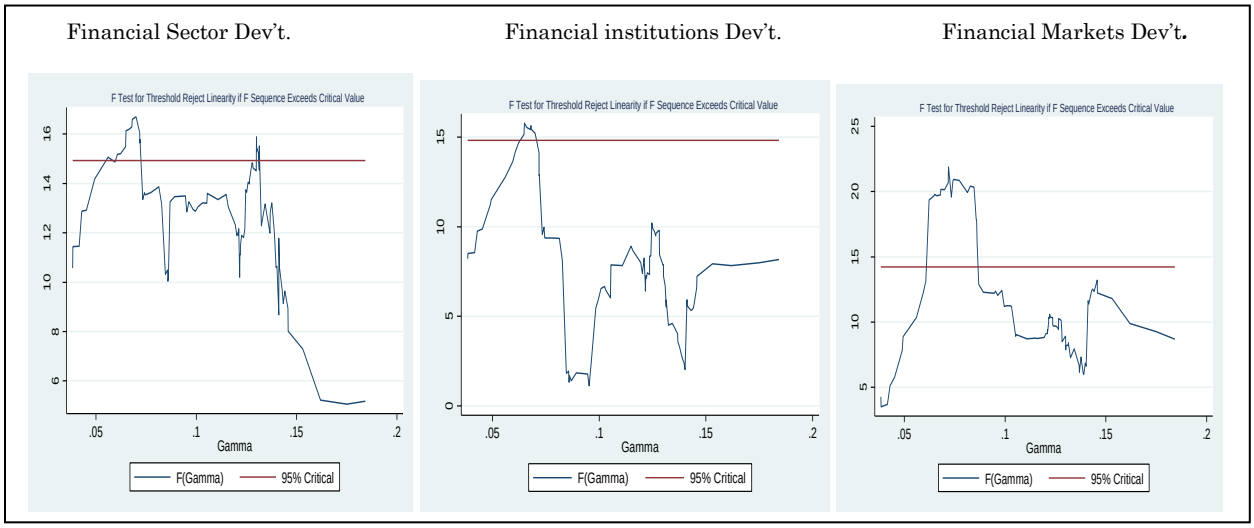
The results reveal that, except for real exchange rate and inflation, none of the variables is stationary in the levels. The rest of the variables are, however, stationary at the first difference. We, therefore, employ the first differences of these variables as the respective regressors.

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5.11 Effect of domestic debt on financial development

The results from the three threshold models are displayed in table 5.8 below. We find thresholds in all the models estimated. This means that the global OLS estimator, even though used as a comparator in table 5.8, cannot be relied on because of the existence of asymmetries. Figure 5.5 gives a graphical

Figure 5.5: F Test for the existence of a threshold



Source: Figures generated from Stata 11

representation of F- test for the existence of a threshold in all models. In the figure, the F-statistics cross the critical lines in all the models, which indicate the existence of a threshold in all the models. This is contrary to Wuyts (1996) discovery that there are no discontinuities in the relationship since domestic borrowing in the long and short runs does not affect private-sector financial sector development (private sector borrowing). We discuss the first threshold model, which has the overall level of financial sector development as a dependent variable, in this section. Beginning with the variable of interest, as demonstrated in figure 5.5 and reported in Table 5.3 below, we find a threshold at the 1% significant level for the domestic debt at 2.5% of GDP per quarter (10% annually). Thus, the dictate of this model indicates that any domestic debt resources mobilized from the overall financial sector beyond this threshold will be injurious to financial stability in Ghana. The small threshold emanates from the underdeveloped nature of the financial sector in Ghana. Concerning the

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effect of domestic debt on financial sector development, we find a robust positive relationship at the 5% significant level in regime 1 (below the threshold, 2.5%). This proves that any borrowing within or equal to the 2.5% threshold level does not destabilize the financial sector. The relationship loses significance beyond the threshold.

Within the threshold, a 1% increase in domestic debt will improve the overall level of financial development by 0.0362%. This is contrary to the findings of Altaylıgil and Akkay (2013), who found a positive overall between domestic debt and financial sector development. Concerning the GDP per capita, we find a positively strong statistically significant relationship at 1% below the threshold. The relationship, however, is not significant beyond the threshold. A 1% increase in the GDP per capita will increase financial development by 4.2% below the threshold from the results. The relationship between economic growth and financial development was laid down in the theoretical foundation of the financial development model by McKinnon (1973) and Shaw (1973); financial development enhances growth, this account for the strong positive relationship. Inflation was found to be statistically significant at 1%, both below and beyond the threshold. We found a positive relationship between inflation and financial development when the domestic debt is below the threshold. The result shows that a 1% increase in inflation will raise the level of financial development by 0.0016 until the threshold of domestic debt is reached. However, in line with the findings of Zermeño et al. (2018) beyond the threshold, the effect of inflation on financial development is negative. Thus, in high regimes, a 1% increase in inflation reduces financial development by 0.0007. The negative relationship stems from the inflammatory positive effect inflation has on interest rates, which may curtail private sector credit. Thus, when inflation is high, banks increase the interest rate to secure their real interest. This raises the cost of borrowing, thereby reducing financial deepening and hence the efficiency of the sector. With respect to interest rate, below the threshold level, we find a 10% positive relationship between interest rate and financial development. The relationship is, however, not significant beyond

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the threshold of debt. The reason for the relationship is that when domestic sovereign debt is low, it signifies a reduction in demand for loanable funds, and hence the cost of borrowing. Also, in such regimes, private sector access to credit is not curtailed and hence financial development increases.

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Table 5.7: Results of the threshold regression

Variables	Financial Development Model			Financial Institutions Model			Financial markets Model		
	< 0.0245	**> 0.0245**	**OLS**	**< 0.0622**	**> 0.0622**	**OLS**	**< 0.098**	**> 0.098**	**OLS**
Intercept	-0.3668* (0.2175)	-0.0498** (0.0189)	-0.0239 (0.0173)	-0.6896** (0.2757)	-0.0267 (0.0171)	-0.0240 (0.0207)	-0.1604 (0.1316)	-0.0182 (0.1449)	-0.0796 (0.0624)
Log GDPPC	4.1998*** (0.8725)	0.0940 (0.4202)	0.9152** (0.4274)	5.7461** (2.8114)	0.2967 (0.6550)	0.9327 (0.6163)	-8.8753 (7.9748)	3.5604** (1.7041)	-0.0070 (2.0800)
Inflation	0.0016*** (0.0003)	-0.0007*** (0.0002)	-0.0003 (0.0002)	0.0004 (0.0003)	0.0000 (0.0002)	-0.0002 (0.0002)	-0.0005 (0.0007)	0.0014 (0.0011)	-0.0002 (0.0005)
Log interest rate	0.0576* (0.0304)	-0.0028 (0.0190)	0.0205 (0.0215)	0.0334 (0.0434)	-0.0044 (0.0279)	0.0090 (0.0266)	-0.3110* (0.1606)	0.0507 (0.0804)	-0.0123 (0.1042)
Log real exchange rate	0.0746 (0.0602)	0.0209*** (0.0059)	0.0077 (0.0059)	0.1706** (0.0738)	0.0103** (0.0045)	0.0073 (0.0062)	0.0665** (0.0315)	-0.0043 (0.0438)	0.0283 (0.0166)
Log domestic debt	0.0362*** (0.0098)	0.1139* (0.0580)	0.0370 (0.0412)	0.0543* (0.0288)	-0.0016 (0.1247)	0.0315 (0.0412)	0.1366** (0.0673)	-2.1831*** (0.3526)	0.0124 (0.0722)
R-squared	0.93	0.18	0.36	0.44	0.02	0.25	0.12	0.47	0.31
Threshold estimate for domestic debt		0.025 (2.5%)		0.062 (6.2%)			0.098 (9.8%)		
Bootstrap P-Value		0.015		0.027			0.000		
95% Confidence interval for threshold		[0.025, 0.026]		[0.006, 0.26]			[0.062, 0.162]		

*Where *, **, *** denotes the attainment of significance at 10%, 5%, and 1%, heteroscedasticity is corrected by the model. We employ the real effective exchange rate, inflation, and GDP per capita from WDI. The interest rate and domestic debt from the Bank of Ghana.*

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Dwelling on the model that employed financial institutions' development index to measure financial development, we find a threshold for the domestic debt at the 5% significant level, at 0.062 or about 6.2% of GDP. This is the optimal level of domestic debt resources that financial institutions in Ghana are supposed to advance to the government that optimizes their growth and development. The threshold is validated by the regression results in the first regime and the second regime. Below the threshold, we identified a positive relationship between domestic debt and financial development; the relationship changes to a negative relationship beyond the threshold. Clearly, 6.2% represents the inflexion point for the financial development function.

Concerning the other control variables, we find a positive relationship between per capita income and financial institutions' development below the threshold, but no relationship exists beyond the threshold. The results bring to fore the knowledge that, below the threshold, financial institutions' development can perform its function of stimulating investment and hence growth. When domestic debt moves beyond its threshold, financial institution's development is weakened, and its function as a catalyst for growth wanes. We find no relationship between inflation and interest rate on Ghana's financial institutions' development in both regimes. Real exchange rate has a positive relationship with financial development in all regimes. However, the effect of exchange rate on financial institution's development reduces beyond the threshold of domestic debt. Below the threshold, a 1% increase in the real exchange rate (appreciation) will increase financial institutions development by 0.1706%. The effect on financial institutions development by a similar magnitude of appreciation beyond the threshold is 0.0103%. The result demonstrates that domestic debt has little or no role in the exchange rate/financial development nexus. The relationship is more direct with Lin and Ye (2011), indicating that the level of financial development indicates a government contract's type and form of exchange

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rate regime. A country with weak financial development may opt for a fixed exchange rate, whereas the opposite is valid for a fully developed financial sector.

Concerning the financial market development model, we find a higher threshold for the domestic debt of 9.8% at the 1% significance level. According to Mogaka and Ochieng (2018), the higher threshold is because financial markets are developed when government debt instruments traded are in steady supply. The capital market thrives on government participation in the debt market. The regression results validate the threshold with the different signs at the point of inflexion. Below the threshold, the results revealed a positive relationship between domestic debt and financial market development. A 1% increase in domestic debt below the threshold will raise financial development by 0.1366%. Beyond the threshold, a 1% increase in domestic debt advanced to fiscal authorities reduces financial development by -2.1831%.

GDP per capita is positively related to domestic debt; this relationship holds beyond the threshold. Beyond the thresholds, a 1% increase in growth leads to a 3.5604% increase in financial development. This means that the impact of growth on financial market development is more efficacious when domestic debts that will finance the growth are higher. This is because inflation and interest rate are not essential variables in the financial market model. However, the effect of real exchange rate on financial development is positive below the identified threshold but not significant beyond the threshold.

5.12 Policy imperatives and Conclusion

This study set out to unravel two objectives, first to find the mediating effect of financial development on domestic debt mobilization in Ghana, and secondly, to find the effect of domestic debt on financial development, with a keen eye on the possibility of discontinuities in the relationship.

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Concerning the first objective, the QQR models demonstrate mixed results between the lower quantiles (tau=0.25 and tau=0.5), and the tau=1.00, and between models. Although the role of financial sector development in domestic debt mobilization is established from tau = 0.5 upwards, a positive relationship ensues only at the extreme end (tau=1.00) of the overall financial sector model and the financial markets model's distributions. A negative relationship is found at tau= 0.5 and the tau=0.75 quantiles in all models, and tau= 1.00 of the financial institutions model. Thus, the results generally indicate a negative relationship. This finding is instructive; the Ghanaian financial sector is not developed enough to support an expansive domestic public debt drive. It is characterized by lowly capitalized financial institutions that are unable to support massive public debt drive. In recent years, Ghana has resorted to the international financial market for Eurobonds to support its development because of the capital inadequacies in the sector. The underlining observation is that any policy to leverage the financial resources of the domestic market to finance development massively will be at the expense of another sector (the private sector). The positive result in the highest quantile (tau=1.00) is indicative that there are prospects for a highly developed financial sector to support domestic debt mobilization. However, that will become a reality only if the financial sector is highly developed. Massive capitalization of the sector could provide robust institutions that will support the government development agenda. Thus, a policy to highly develop the financial sector will rake in the necessary debt resources needed to develop at the overall level.

Focusing on the second objective, we find that significant discontinuities in the domestic debt financial development nexus exist. Indeed, we find that in all three measures of financial development adopted; there is a threshold of domestic debt that optimizes financial development. In the overall index, the threshold is 2.5% of GDP, 6.25% in the financial institutions' development index, and lastly, 9.8% of GDP in the financial market model. In all the models, we find that, below the threshold, there is enough support for the safe asset theory. Thus, below the threshold, domestic public debt provides

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relatively 'safe assets' for the financial sector from which sizeable profit could be made. According to Soto (2000), public debt provides a safe asset that makes it possible to overcome "the institutional imperfections that often prevent the use of real estate or movable property as collateral". Beyond the threshold, the 'lazy bank' theory kicks in as the relationship proves negative. Beyond the threshold, domestic debt accumulation by financial institutions may slow down their progress. According to Hauner (2009), complacency could set in these institutions' activities especially to develop their sector under challenging times. The thrust of the theory is that too much public lending may deprive the private sector of critical resources it needs to invest. Also, excessive lending may expose financial institutions' operations to high risks that may not augur well for the sector.

The main policy imperative is that the Ghanaian financial sector cannot accommodate too much domestic debt. Though current domestic borrowing is in the region of 25% of GDP, it is above the optimal level and should be reduced. Furthermore, the high public sector borrowing in Ghana has shown signs of a constrained private sector, and the constraints have manifested in the form of interest rate. Thus, although domestic debt is good in many respects and could provide a good source of resources for development, a delicate balance ought to be stricken. In the spirit of finding a balance, the narrative does not support excessive leveraging on the Ghanaian domestic market. This is because the sector is not fully developed. Minimum debt resources could be scrapped from the sector, but in its current state, the policy should shift to international sources for debt and tax revenue mobilization to develop the country.

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Appendices

Appendix 5. 1 Granger Causality Test

Pairwise Granger Causality Tests
Sample: 1983Q1 2017Q4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DDG does not Granger Cause FMDI	136	1.34219	0.2579
FMDI does not Granger Cause DDG		2.62040	0.0380
DDG does not Granger Cause FID	136	0.66069	0.6204
FID does not Granger Cause DDG		2.59915	0.0393
DDG does not Granger Cause FMD	136	0.98486	0.4183
FMD does not Granger Cause DDG		1.65402	0.1648
DDG does not Granger Cause BDG	136	6.07878	0.0002
BDG does not Granger Cause DDG		5.29158	0.0006

Appendix 5.2: Granger Causality test

Pairwise Granger Causality Tests
Sample: 1983Q1 2017Q4
Lags: **5**

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
DDG does not Granger Cause FMDI	135	3.05789	0.0123
FMDI does not Granger Cause DDG		6.86286	1.E-05
DDG does not Granger Cause FID	135	2.57513	0.0297
FID does not Granger Cause DDG		5.75840	8.E-05
DDG does not Granger Cause FMD	135	1.04604	0.3938
FMD does not Granger Cause DDG		3.76019	0.0033
DDG does not Granger Cause BDG	135	5.16711	0.0002
BDG does not Granger Cause DDG		2.82877	0.0187

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CHAPTER SIX

TIME VARYING CAUSAL RELATIONSHIP BETWEEN DOMESTIC RESOURCE MOBILISATION AND GOOD GOVERNANCE IN GHANA; A CHICKEN-AND-EGG PROBLEM?

"I like to pay taxes. With them, I buy civilisation." Oliver Wendell Holmes Jr.

6.1 Introduction

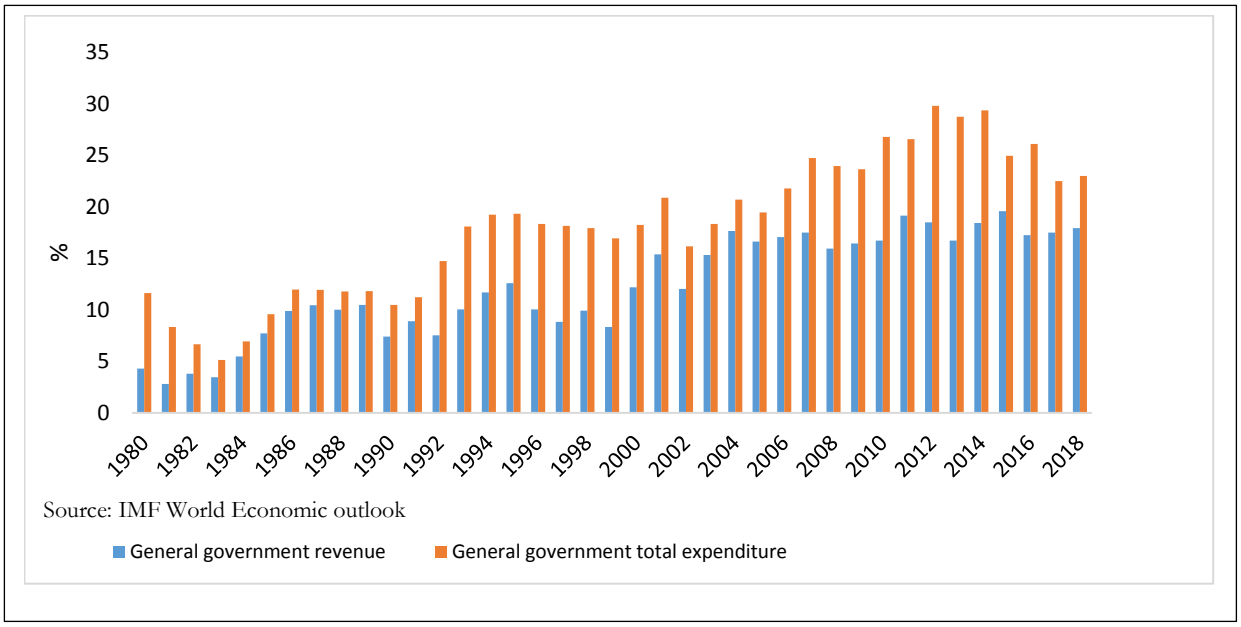
There has been renewed interest in the relationship between domestic resource mobilisation and good governance. However, investigations are at the margins of development policy discussions. The relationship was first brought to light by the work of Levi (1989), that revenue mobilisation effort by states is the history of the evolution of states. According to Moore (2008) and Eubank (2012), governance/tax revenue conversation began when ancient rulers needed revenues to finance their wars negotiated with citizens willing to finance these conflicts in exchange for some sort of government accountability. Thus, the government's reliance on domestic resources for development provided citizens with economic power, significant leverage to demand improvement in political institutions' accountability in a process called 'revenue bargaining'. Moore (2008) defines the revenue bargaining process as 'the exchange of tax revenues (for the state) for institutionalised influence over public policy (for citizens)'. Through this participatory process, governance systems are strengthened, and good governance evolves. In the preceding spirit, it is reasonable to suggest that better governance could boost tax morale and compliance and potentially explain domestic revenue flows. Because of that, some studies; Morton (1994), Mahon (2004), Timmons (2005), and Prichard (2009), have all found evidence in that regard that some aspect of governance could help explain the behaviour of tax revenue generation. However, observably, the link between good governance and taxation could be a double-edged sword. High taxes or domestic resource mobilisation could shape governance because revenues can help governments procure better resources to govern well. In the words of

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Zainulabideen and Iqbal (2009), "taxation may play the central role in building and sustaining the power of states and shaping their ties to society". Thus, there is a rising conversation on the potential for the prevailing governance structure to alter revenue levels, albeit embryonic. Irrespective of the literature, the relationship remains sceptical and weakly documented, especially in Ghana. Curiosity exists in the causal direction. Does good governance explain domestic revenue mobilisation, or it is domestic revenue mobilisation that predicts good governance? If the former exists, then a good policy on governance could be the panacea to bridge the perennial fiscal imbalance in Ghana. The relationship may, therefore, not be straightforward as advanced in the empirical and theoretical literature.

The problem on which the study is founded is that according to Annan et al. (2014), revenue levels are low in Ghana, and fiscal authorities are continually in search of solutions to boost it[48]. The rapid growth in population and urbanisation in Ghana have come with an increased burden on public

Figure 6.1: Fiscal developments in Ghana



Source 21: IMF

[48] For instance, in 2011 and 2015, revenue shortfalls were 15.6% and 15.7% of GDP.

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finances. The World Bank estimates that[49] Ghana needs to make a sustained investment in infrastructure of about US$2 billion a year for the next ten years to bridge its infrastructure gap[50]. Figure 6.1 shows Ghana's revenue performance and expenditure pattern since 1980. Figure 6.2 in the methodology section gives a pictorial representation of the tax and non-tax revenue. Fiscal imbalances run through the series, with fiscal deficits heightening in election years. Debt instruments have been used to finance the debt; the result has been undesirable debt levels, with untoward implications on Ghana's macroeconomic space. It has therefore become imperative to explore fiscal relationships to steer policy interventions. If good governance can explain domestic resource mobilisation, an opportunity exists in leveraging that relationship to boost the revenue potentials of Ghana.

While we recognise the relationship between domestic resource mobilisation and governance as documented in the above literature, we reckon that the relationship may not be the same across countries and that the individual idiosyncrasies of states counts. This is because conditions exist where governments take taxation without compromise in certain states. This is usually evident in countries that are endowed with natural resources, such as Ghana. Such countries present situations where the government can grab natural resource rent as revenues without offering political concessions in return. In such circumstance, domestic resource mobilisation efforts may not predict or explain good governance, and hence the relationship may not exist. Empirical evidence of the Ghanaian case is instructive because of the dire need to explore whether good governance is a panacea to the revenue challenges in Ghana. This chapter seeks to answer the broad question: what is the nature of the causal relationship between tax revenue mobilisation and good governance in Ghana? What is the level of connectedness among domestic resource mobilisation and the level of governance in Ghana? Do such inter-linkages vary with time intervals and investment scales?

[49] See < http://siteresources.worldbank.org/INTGHANA/Resources/gh_note_scaling_up.pdf>
[50] See < https://siteresources.worldbank.org/INTAFRICA/Resources/aicd_overview_english_no-embargo.pdf>

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Studies that attempt to uncover the relationship between governance and tax revenue have suffered methodological and data challenges and measurement errors. First, the relationship may not be linear as claimed (Ajaz and Ahmad, E. (2010); Awotomilusi et al. (, 2019); distinctively, this chapter overcomes this knowledge gap by employing linear and non-linear causality models. Moreover, the addition of a non-linear estimate aligns with real-world economic relationship (Zainulabideen and Iqbal, 2009). Secondly, we contribute to the embryonic literature on the interconnectedness of DRM and governance by estimating the space-time-scale dynamics of the relationship. This idea is based on the notion that the relationship may be time-varying. Thus, employing linear and non-linear causality alone may not reveal in detail the extent of the space-time-scale continuum so crucial in policy targeting. Lastly, current literature on the relationship has focused on the accountability and corruption dimensions of governance with essential dimensions such as government effectiveness, regulatory quality, the rule of law, and political stability relegated to the background. We improve the literature by relying on the standard Granger causality test, the Diks and Panchenko (2005, 2006) non-linear Granger Causality test, in both levels and scales (using the maximal Overlap Discrete wavelet transform MODWT), and the wavelet coherency and phase difference maps.

A snapshot from our findings is revealed. We report weak causality among the constituents of revenue and governance; however, causality is found between overall revenue and governance on the one hand and non-tax revenue and governance on the other hand. We also find mixed results for the different scales for both linear and non-linear causality and the wavelet estimates.

The chapter is organised as follows; Section 1 introduces the study, section 2 deals with literature on the subject matter of the study, whiles Section 3 describes the methodology employed.

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6.2 Related literature

Boly et al. (2017) chronicle the literature on the causal relationship into three; the strand that looks at the quality of institutions on domestic revenue compliance processes (tax compliance) with perspectives from both individual and firms, the second strand studies direct political participation and domestic revenue compliance measures such as tax compliance, the third looks at the reverse relationship from tax compliance to quality of governance or institution.

Concerning the first, the empirical works have circled on a hypothesis that individuals are willing to pay more tax provided the governance system is; fair, responsible, accountable, and able to meet their needs. The cross-country analysis began with the work of Torgler (2004). His study of tax morale in Asian countries reveals that trust in the government and the legal system confers positive impacts on tax morale and hence DRM. Torgler (2005), basing his analysis in South America, found out that the main reason for tax evasion is lack of honesty and corruption. He also observed low tax morale in South America/ Mexico than in the Central American/Caribbean area. Additionally, trust in public officials, especially the president, the rule of law and a pro-democratic attitude positively impact tax morale. Other studies that conducted empirical studies along this hypothesis include, Torgler (2006); Picur and Riahi-Belkaui, (2006); Alm and Torgler (2006), Frey and Torgler (2007); Richardson (2008); Lago-Penas and Lego-Penas, (2010); Williams and Martinez, (2014) and Anderson (2017). Studies have also been conducted on specific country levels. Beginning with developed countries, Bird et al. (2008) assert that responsiveness of states and legitimacy are essential factors for increased tax efforts. According to them, improving governance institutions is possible for developed countries. Hammar et al. (2009) demonstrated that trust is an essential element in the tax compliance study in Sweden. Torgler (2003a), in his "To evade taxes or not to evade: that is the question," found strong evidence to support the claim that trust in government, pride, and religiosity have a significant impact on tax morale in Canada, and Torgler and Schneider, (2005) found similar results in Australia however, they

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discovered that lower perceived compliance diminishes tax morale. This presupposes that social comparisons are relevant. In developing countries, Timmons and Garfias (2015) found a similar result in Brazil; Adeyeye and Otusanya (2015) found out that state accountability, transparency and corruption have more significant effects on voluntary tax compliance in Nigeria. Although there have been studies on various tax compliance in Ghana, only Ibrahim et al. (2015) drew the relationship between tax compliance and trust. To them, tax compliance increases with trust in the government in Ghana.

On firm-level analysis, Nur-tegin (2008), using data from 4,538 firms in 23 transition economies, found out that reducing corruption is a more meaningful measure in deterring tax evasion. Joulfaian (2009) found out that tax evasion increases with bribery to tax officials. Uslaner (2010), Alon and Hageman (2013) discovered the vital role of institutional factors in tax compliance. They reveal that corruption and high particularised trust results in lower tax compliance, Alm et al. (2016), Mawejje and Okumu (2016), Kaplanoglou et al. (2016), Mickiewicz et al. (2017) are the latest literature as far as firm-level analysis is concerned with Abdixhiku et al., (2017) discovering that tax evasion is highly spurred on by low trust in the state and the juridical system, increased corruption perceptions and compliance cost in transition economies.

The second strand of the empirical literature posits that direct participation by citizens in the governance process increases their sense of civic responsibility and hence raises voluntary revenue compliance (Feld and Frey, 2002). Vihanto (2003), in support of this position, suggest that when the taxpayer directly participates in the governance process, it enables him/her to voice out any discontentment on the tax burden or tax authorities. Pommerehne and Frey (1992) kick-started the single country empirical reviews by focusing on Switzerland. They revealed that Swiss cantons with referendum democracy have higher tax morale than cantons with representative democracy.

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Pommerehne and Weck-Hannemann (1996) also demonstrated that income tax non-compliance is low when taxpayers exercise direct control over the government's budget; the opposite is true when they have minimal control. Feld and Frey (2002) also found out that tax morale is higher when the tax authorities treat citizens with respect instead of relying on deterrent procedure. The latter raises tax evasion. Torgler (2003) also found out that direct democratic rights, local autonomy, and trust in government, the court and the legal system increases tax morale. Torgler (2005) found out that direct democratic rights significantly affect tax morale in Switzerland. Torgler and Schneider (2005) also demonstrate that social variables such as trust or pride affect tax morale in Austria. The evidence on cross-country studies includes; Frey and Torgler (2007) have seen a high positive association between the quality of institutions and tax morale in 30 European countries. Other studies that tested this position are; Daude and Melguizo (2012), Lago-Penas and Lego-Penas, (2010), Leonardo and Martinez-Vazquez, (2016).

Finally, as indicated above, the last strand of the literature investigates the reverse of the first and second strands. The position here is that payment of domestic revenue handles such as taxation strengthens institutions. Timmons and Garfias (2005) discovered that in the short run, clean audit raises property taxes in Brazil whiles, corruption find short-run effects consistent with this theory. Alonso and Garcimartin (2010) also found a strong positive relationship between a sound tax system and institutional quality. According to them, DRM handles such as Taxes create a strict relationship between the government and citizens. Altunba and Thorton (2011), in a cross-country study, found that taxes raise governance quality. Indeed, direct taxes have more robust governance improving qualities than indirect taxes. Asongu (2015), in a, follow up to the Eubank (2012) hypothesis on Somaliland found that, when foreign aid is absent government's dependence on tax raises the leverage at the disposal of citizens for improved governance. The same conclusion was reached using sub-

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national data from studies conducted by Gadenne (2001), Hoffman and Gibson (2005), Berger (2011), and Prichard (2010).

We contribute to the literature by exploring previously unexplored areas. For example, the above literature did not explore whether the relationship is time-varying or not, neither did any of them look at the time-scale dimensions of the relationship. We improve the literature by exploring these dynamics.

6.3 Good Governance in Ghana

After independence in 1957, governance in Ghana has witnessed various systems from a dejure one-party state under a republican constitution to military coups and multi-party democracy. The period preceding the inception of democracy witnessed a struggle for the emergence of good governance structures. The period constrained human right, freedom of speech, and other pillars of accountability and good governance. Democracy was, however, restored in 1992 when international and domestic pressure was brought on the incumbent government. The 1992 constitution of Ghana provides the basic charter for governance in Ghana. It was framed around the concept of checks and balances and power-sharing among the executive headed by the president; the legislature organised around a unicameral parliamentary system with the Speaker of parliament as the head; and the judiciary led by the Chief Justice, with the council of state offering advisory services, and recommendations to the president.

Fobih (2008) indicates that the democratic credentials of Ghana have been consolidated with improvements in democratic systems. According to Gyimah-Boadi (2009), key among them is the improvements in the independence and administrative capacity of the electoral commission since 1992. In the view of Arthur (2010), Ghana's vital democratic institutions such as the judiciary, the Commission on Human Right and Administrative Justice (CHRAJ)and parliament have experienced

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sustained development and solidification. In addition, media freedom has markedly improved under all elections. These improvements have culminated in the attraction of development aid and other development assistance such as the Millennium Challenge Account from the United States of America.

Given the preceding, important metrics on governance captures Ghana ahead of its peers in many governance dimensions. For instance, the Mo Ibrahim index of governance in 2017 scored Ghana 68.1 ahead of South Africa 68, Nigeria 47.9, and Rwanda 64.3. Its, however, lower than the performance of Mauritius 79.2, Cape Verde 71.1, and Seychelles 73.2. Ghana has remarkably done well in the participation and human right section of the index (74.1), with essential sections such as safety and the rule of law (70.7) following, respectively. Observably, sustainable economic opportunity (58.6) lags behind the other metrics such as Human development (69.9). Corruption is higher up in government; Ghana ranks 78 out of 180 countries on the transparency internationals' corruption perception index. Irrespective of these observations, Arthur (2010) reveals that Ghana can be described as a thriving democracy in Africa.

6.4 Data and methodology

6.4.1 Data

We employ causality tests (linear and non-linear) and the Wavelet technique to assess the relationship between domestic resource mobilisation and good governance in Ghana. While the linear Granger causality test has received wide application in fiscal dynamics, the Wavelet technique has recently been applied in macro-economic studies. Almasri and G. Shukur (2003), Benhmad (2012), Karlsson (2020), Gurdal, Aydin, and Inal (2020) all applied the wavelet technique to study macroeconomic relationships. We employ total tax as a ratio of GDP, non-tax revenue, and total revenue data from the Bank of Ghana to measure domestic resource mobilisation (DRM). We agree with Gisselquist (2014) that governance is a highly contested concept with a myriad of contending definitions; given

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that, we rely on the definition given by Weiss (2000), stated in Gisselquist (2014) as "the act of governance is understood here as the exercise of political power to manage a community's affairs". We rely on the World Governance Indicators (WGI) by the World Bank to measure governance. According to the governance and social development resource centre[51] even though the WGI has sample and transparency challenges, it is the most widely used global governance measure. Although it measures different governance dimensions, it is essential to note that it does not cover all aspects of governance as there are elements of governance that are not amenable to empirical measurement. We conduct the test on the disaggregated level and the aggregate level. Thus, we test for the causal relationship between tax and non-tax revenue and all the six components of governance (government effectiveness, regulatory quality, the rule of law, political stability, control of corruption, and government accountability) for detailed analysis of the relationship; the overall relationship is vital because of that, we construct an index that measures governance holistically. We employ quarterly data for all the variables. We decompose the variables under study from annual data to quarterly data using Eviews 10. Since there is no aggregate data for governance, we construct one with Principal component analysis to test the aggregate level relationship.

6.4.2 Overall index of good governance

We rely on the average of two indices to construct the overall governance data. Principal component analysis (PCA) is employed to lead the construction of the overall index. We also rely on the equal-weighted average. We then average the two indices to prevent underestimation and overestimation of the overall governance index.

[51] http://www.gsdrc.org/docs/open/hd699.pdf

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6.4.2.1 Principal Component Analysis (PCA)

We compute the overall governance index following the work of Arzamasov and Penikas (2014). The principal component analysis employs the following constraints on the weight of the variables

$$\overrightarrow{W_J^k}\ \overrightarrow{W_J} = 1 \qquad [6.1]$$

where $\overrightarrow{W_J}$ is the weight of the initial factors jth principal component. We ensure positive weight from the principal component by taking an arithmetic mean of all principal factors as;

$$W_{ij} = \frac{\sum_{i=1}^{n} C_{ij}}{n} \qquad [6.2]$$

where n is the number of principal factors, j is the variable under the microscope, and i is a factor index number.

$$\widetilde{W_{ij}} = \frac{W_{ij}}{\sum_{j=1}^{v} W_{ij}} \qquad [6.3]$$

where v is the number of variables in the principal component method. We compute a combined index for the six sub-indices employing equation 6.4 as;

$$I_{tj} = \sum_{j=1}^{n} \pi_j * W_{ij} \qquad [6.4]$$

where $\pi_j = \frac{\frac{1}{n}+\widetilde{Z_{ij}}}{2}$ is the average weight estimate from both the normal uniform index and the index from the principal component method. We conclude the process by aggregating the six (6) indices into a single broad index (GOVI) as;

$$GOVI_t = \theta GE \sum_{j=1}^{n} I_t GE + \theta RQ \sum_{j=1}^{n} I_t RQ + \theta RL \sum_{j=1}^{n} I_t RL + \theta PS \sum_{j=1}^{n} I_t PS +$$

$$\theta CC \sum_{j=1}^{n} I_t CC + \theta VA \sum_{j=1}^{n} I_t VA \qquad [6.5]$$

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where GOVI is the overall level of governance, GE is government effectiveness, RQ is regulatory quality, RL is the rule of law, PS is political stability, CC is the control of corruption, and VA is voice and accountability. The overall governance index has the same characteristic as the sub-indices; when it is positive, governance levels are improving and deteriorating when it is negative. The basic characteristics of the data employed in this chapter are given in table 6.1 below. We also plot the graphical behaviour of the various variables employed in the in figure 6.2 below. The trend of the tax handles is not different from what was observed in the previous chapters from the figure. It has been trending upwards. However, it is the governance indicators that have interesting movements. While we observe that the overall level of governance has improved over the years, it is control corruption and the level of government effectiveness that depicts worrisome trends. Indeed, the graph shows that Ghana is losing the fight against corruption; as such, they trend downward. Ghana has fared dismally in its fight against corruption in many dimensions. Consistently Ghana has performed badly in many rankings by anti-corruption and transparency bodies. This includes the famous Afrobaremeter report by Transparency International and the Ibrahim Index of African Governance. The level of perceived corruption in Ghana seems to have been in the ascendency.

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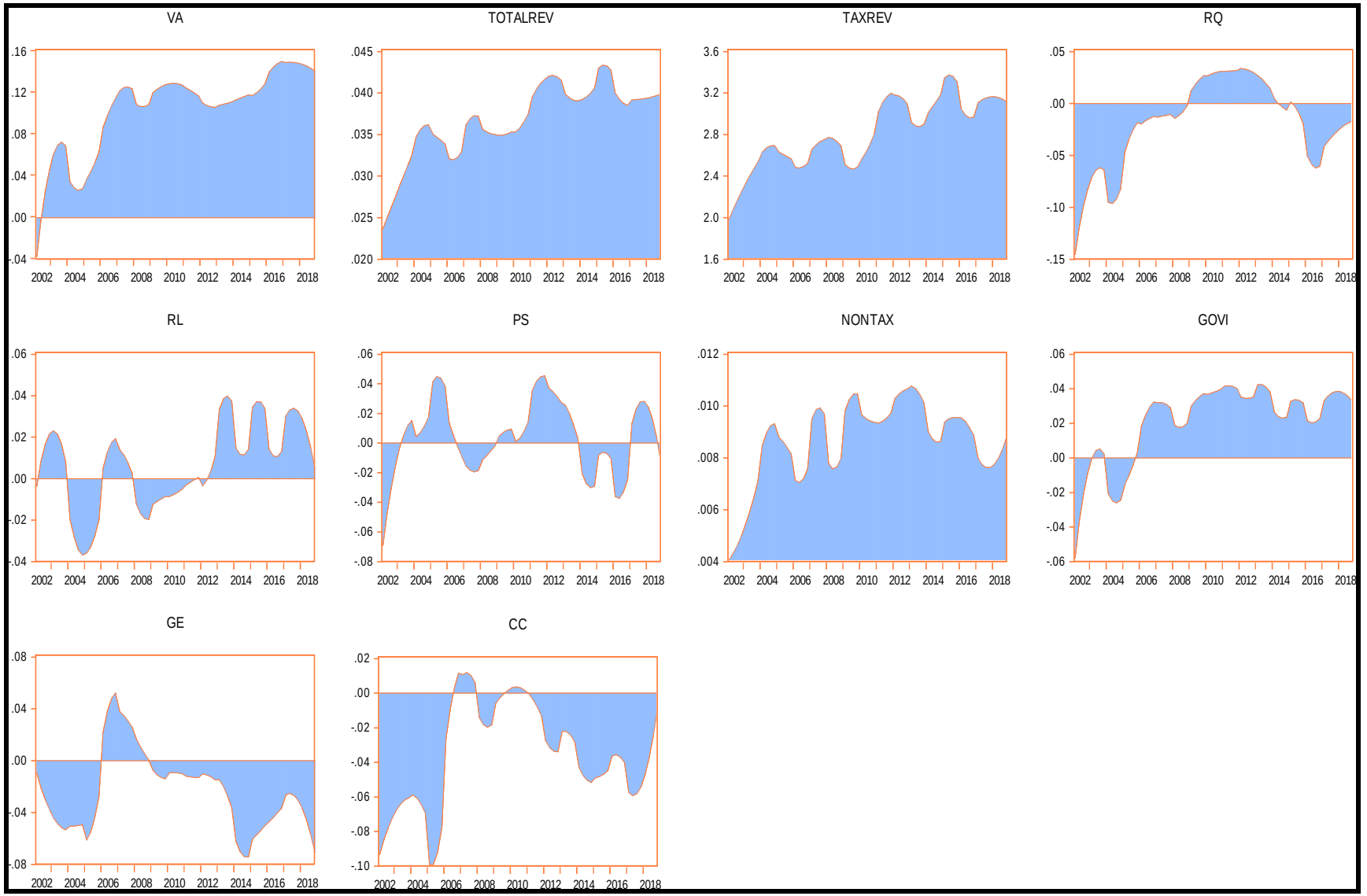
Table 6.1: Basic statistical properties of revenue and governance indicators

	VA	Total Rev.	Tax Rev.	RQ	RL	PS	GOVI	Non-tax	GE	CC
Mean	0.103	0.037	2.812	-0.019	0.006	0.004	0.021	0.009	-0.024	-0.035
Median	0.116	0.037	2.770	-0.013	0.009	0.005	0.031	0.009	-0.027	-0.035
Maximum	0.150	0.043	3.372	0.034	0.040	0.045	0.042	0.011	0.052	0.012
Minimum	-0.037	0.024	1.985	-0.145	-0.037	-0.069	-0.058	0.004	-0.074	-0.099
Std. Dev.	0.041	0.004	0.327	0.042	0.020	0.025	0.023	0.002	0.031	0.030
Skewness	-1.312	-0.928	-0.294	-0.787	-0.272	-0.317	-1.487	-1.102	0.574	-0.249
Kurtosis	4.224	3.740	2.380	3.088	2.343	2.873	4.517	3.925	2.776	2.163
Jarque-Bera	23.746	11.323	2.071	7.038	2.062	1.182	31.584	16.193	3.875	2.687
Probability	0.000	0.003	0.355	0.030	0.357	0.554	0.000	0.000	0.144	0.261
Sum	7.032	2.500	191.217	-1.304	0.428	0.248	1.424	0.587	-1.632	-2.375
Sum Sq. Dev.	0.113	0.001	7.186	0.120	0.028	0.041	0.034	0.000	0.063	0.061
Observations	68	68	68	68	68	68	68	68	68	68

Where VA is voice and accountability, RQ is regulatory quality, RL is the rule of law, PS is political stability, GE is government effectiveness, and CC is the control of corruption. All the observations are annual data that has been quarterly decomposed by Eviews 10.

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Figure 6.2: Line plots of revenue and governance indicators



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6.4.3 Estimation procedure

We rely on parametric and non-parametric method (linear and non-linear) causality tests to unravel the objective of this section. We also rely on the wavelet coherence method to study the time-frequency/dimension of the relationship between revenue mobilisation and governance.

6.4.3.1 Linear Granger Causality test

Granger (1969) developed a causality test based on the VAR system to study the linkages between variables. We adopt this method for this section. The concept of causality revolves around the realisation that given any two (2) stationary variables, governance indicator W_t, and domestic resource mobilisation indicator V_t, W_t is said to Granger cause V_t in a linear way if the lag of W_t provides critical information to explain the current value of V_t. This is the bivariate causality; we specify the relationship as;

$$W_t = \rho_1 + \sum_{i=1}^{k} \beta_{1i} W_{t-i} + \sum_{j=1}^{k} \theta_{1j} V_{t-j} + \mu_{1t} \quad [6.6]$$

$$V_t = \rho_2 + \sum_{i=1}^{k} \beta_{2i} W_{t-i} + \sum_{j=1}^{k} \theta_{2j} V_t + \mu_{2t} \quad [6.7]$$

Where ρ_1 and ρ_2 are the drift terms and θ denotes the coefficients, k is the optimal lag length, and μ_{1t} and μ_{2t} are the residuals from the VAR models.

6.4.3.2 Non- Parametric (Non-Linear) Granger Causality test

Increasingly non-linear models are preferred in studying non-linear informational linkages (Omane-Adjepong, and Alagidede, 2019). Because of that, we rely on the non-parametric non-linear Granger causality test by Diks and Panchenko (2005, 2006) (DP). The DP test is employed because of its flexibility and robustness over the causality approaches of Baek and Brock (1992) and Hiemstra and Jones (1994) (HJ). The main advantage of the DP approach is the ability to repel the high over-rejection that has become accustomed to the HJ test by employing the null hypothesis of Granger

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non-causality among the variables. The bivariate DP test has the following specifications. Let W_t and V_t be any stationery pair of dependent variables. We also specify the information set of lags for the variables under the microscope as; $D_{W,t}$ and $D_{V,t}$ before period $t-1$; we also symbolise its equivalent distribution by (~) given that, W_t is viewed to have Granger caused V_t if;

$$\left(V_{t+1,}\ldots\ldots V_{t+m}\middle|D_{W,t}\,D_{V,,t}\right)\tilde{}\left(V_{t+1,}\ldots\ldots V_{t+m}\right)\middle|D_{W,t}\,) \qquad [6.8]$$

Where; m is a positive integer$(m \geq 1)$, an indicator of the forecasting horizon. Under the null hypothesis of $H_0: V_{t+1}|(W_t^{l_r}; V_t^{l_s})\tilde{}\,V_{t+1}|V_t^{l_s}$ and given $(l_r, l_s \geq 1)$, we examine the conditional independence by employing l_r and l_s (determinate number of lags). This is for the lag vectors

$$W_t^{l_r} = (W_{t-l_r+1,\ldots\ldots\ldots,}W_t) \text{ and } V_t^{l_s} = (V_{t-l_s+1,\ldots\ldots\ldots,}V_t) \qquad [6.9]$$

It is worthy of note that the null hypothesis bothers on the invariant distribution of the time index $(l_r + l_s + 1) -$ dimensional vector $Q_t = (W_t^{l_r}, V_t^{l_s}, Z_t)$, we develop we drop the time index for the lead vector $Z_t = V_{t+1}$, we re-write it as follows Q_t= (W, V, Z). Assuming that the three variables in Q_t follow a continuous random variable, and setting$l_r + l_s = 1$, and $m = 1$, we argue that the null hypothesis specified earlier can be reframed via a joint probability density function $f_{W,V,Z}\,(W,V,Z)$

With marginal probability density fulfilling the condition.

$$\frac{f_{W,V,Z}\,(W,V,Z)}{f_{V(v)}} = \frac{f_{W,V(w,v)}}{f_{V(v)}} * \frac{f_{V,Z}\,(V,Z)}{f_{V(v)}} \qquad [6.10]$$

According to Omane-Adjapong and Alagidede (2019), W and z which are the continuous random variables are independent conditionally on $V = v$ for every value assumed by v Diks and Panchenko (2006) demonstrate under the varied null hypothesis that;

$$q = E\left[f_{W,V,Z}\,(W,V,Z)f_{v(V)} - f_{W,V}\,(W,V)f_vZ(V,Z)\right] = 0 \qquad [6.11]$$

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Diks and Panchenko (2006) arrived at a method for estimating q, using a weight function $g(w,v,z) = f_v^2(v)$. The estimator is given by;

$$T_n(\varepsilon_n) = \frac{(2\varepsilon_n)^{-dw-2dv-dz}}{n(n-1)(n-2)} * \sum_i [\sum_{k,k\neq i} \sum_{jj\neq i} (I_{ik}^{WVZ} I_{ij}^{v} - I_{ik}^{wv} I_{ij}^{vz})] \quad [6.12]$$

The bandwidth parameters are given by ε_n but $I_{ij}^{Q}(\|Q_i - Q_i\| < \varepsilon_n)$

We represent the local density formula for estimating a dQvariate random vector Q and Q_i as;

$$\hat{f}_Q(Q_i) = \frac{2\varepsilon_n{}^{-dQ}}{(n-1)} * \sum I_{ij}^{Q} \quad [6.13]$$

The $T_n(\varepsilon_n)$ statistic of the DP test shrinks to;

$$T_n(\varepsilon_n) = \frac{(n-1)}{n(n-2)} * \sum_i (\hat{f}_{W,V,Z}(W_i, V_i, Z_i)\hat{f}_V(V)\hat{f}_{W,V}(W_i, V_{i,})\hat{f}_{V,Z}(V_i, Z_i)) \quad [6.14]$$

Because $dw = dv = dz = 1$ when $\varepsilon_n = Cn^{-\beta}$, for $\big(C > 0, \beta \in (0.25.\, 0.67)\big), T_n(\varepsilon_n)$ congregates in distribution to the standard normal:

$$\sqrt{n} * \frac{(T_n(\varepsilon_n) - q)}{S_n} \underline{d} N(0.1) \quad [6.15]$$

Where S_n is the asymptotic variance of $T_n(.)$ this is why the Diks and Panchenko (2006) method is more powerful than the H.J method we perform the DP test on filtered residuals from VAR models.

6.4.3.3 Multiscale wavelet method and Parametric Granger causality

To study the time-varying dimension of the causality relationship, we decompose the variables into scales representing the short term (D1), the medium-term (D2), and the long term (D3). We follow the work of Fernandez-Macho (2012) and Omane-Adjepong and Alagidede (2019). We thus rely on the multivariate time-scale method. We also employ the Maximal Overlap Discrete Wavelet transform (MODWT) over the Discrete Wavelet Transform (DWT) because it is superior to the latter, especially

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on two fronts. First, the MODWT can handle every data series in the sample, and secondly, it remains largely unchanged when circularly moving the variables. As such, its coefficients and multiresolution characteristics are connected with zero phase filters. The multivariate time scale method is given by specifying a random variable from a multivariate stochastic process as;

let $Y_t = \{Y_{1t}, Y_{2t} \dots \dots \dots Y_{nt}\}$ and [6.16]

Let $V_t = \{V_{1t}, V_{2t} \dots \dots \dots V_{nt}\}$ [6.17]

be the corresponding scale. π_i the wavelet coefficient for the process is obtained by applying the MODWT to eachY_{it}. Traditionally, the number of scales is determined by $j = log_2(n)$ where j is the number of scales, and n is the total number of observations. We do this by employing the Danbechies least-square asymmetric filter of length 8 in the multiscale framework. We employ quarterly data from 2002 to 2018 (68 observations). Thus, the formula is $j = log_2(68)$, which means the highest decomposition is 6 i.e. $(j = 6)$. Thus, the respective period to be observed within the desired wavelet coefficients of scale (1…..6) are (D1: 1- 6months to 1 year) $4\sim8$ quarters, (D2: 1-2 year scale) $8\sim16$ quarters, (D3; 2-4 year) 16∼32 quarters (d4: 4-8 year scale) 32∼64 quarters, (D5: 8-16 years scale), 64∼128 quarters, and (D6; 32-64) 128∼ 256 quarters. However, we decompose using three-time scales because we focus on the short term, medium-term and long term, respectively (D1, D2 and D3).

6.4.3.4 The Continuous Morlet Wavelet Transform (CMWT)

We move the inquisition forward by examining the relationship using wavelet coherence and phase difference. Two approaches exist in wavelet transforms; the discrete Wavelet Transform (DWT) and the Continuous Wavelet Transform (CWT). Madalenon and Pinho (2012) reveal that the DWT is primarily used in noise reduction and data compression. According to Aguiarr-Conraria (2014), significance is felt in features extraction (A). We fall on the Continuous Morlet Wavelet Transform

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(CMWT) and the package (waveletComp) as designed by Roech and Schmidbaur (2014). The strength of the Morlet wavelet proposed by Morlet, Arens, Fourgean, and Glard (1982) makes it suitable for bivariate co-movement analysis. According to Grinsted et al. (2004), the CMWT permits the isolation and identification of periodic signals by finding a fine balance between time localisation and frequency. It is also better at identifying oscillations and peaks. This study makes use of wavelet coherence and its decomposition to deepen the DRM/ governance discussion. We will study the co-movement between domestic resource mobilisation and governance across both time and scale within the entire dataset. According to Loh (2013), wavelet coherence examines the local correlation between two-time series variables in time and frequency.

In and Kim (2013) defines the continuous wavelet transform as the integral of the signal over all the period under investigation multiplied by the scaled shifted versions of the wavelet function $\psi(scale(c), position\ (p), time\ (t))$

$$V(scale, position) = \int_{-\infty}^{\infty} X_t(c, p, t) d_t \qquad [6.18]$$

Equation 6.18 indicates that the continuous wavelet transform could have wavelet coefficients given by V_1, a function of the position (p), and scales(s). It assumes coefficients that are compatible with the time series' (X_t) region of interest. A signal that relates a continuous variable cv and a transform that also relates the $cv's$ is desired, Burns et al. (1998) defines the CWT as;

$$F(m, n) = \int X_t \psi \left(\frac{t-m}{n}\right) dt \qquad [6.19]$$

The inverse is given by;

$$X_t = \iint F(m, n)\ \psi \left(\frac{t-m}{n}\right) dm\ dn \qquad [6.20]$$

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Conveying time and frequency information in a signal dates to the work of Gabor (1946); his study employed a generalised Fourier integral operator using Gaussian window. Grossman and Morlet (1984) later developed an affine coherent state integral operator referred to as the Morlet transform. The Morlet wavelet, which is a plane wave when modulated by Gaussian, is expressed in its simplest form;

$$\rho(\tau) = \pi^{-\frac{1}{4}} e^{i\tau} e^{i\tau\psi} e^{\frac{-\tau^2}{2}} \qquad [6.21]$$

Where τ is a non-dimensional 'time' parameter. In order to generate the admissibility of the Morlet function, we set the 'angular frequency' to 6. One revolution is 2π (radius), as such, the inverse frequency equals $\frac{2\pi}{2}$, $\rho(\tau)$ is therefore defined as a complex, non-orthogonal, and normalised to give it unit energy. We are searching for a better time-varying relationship for bivariate series; hence we employ the cross-wavelet coherence concept, which is similar to the coefficient of determination. Boako et al. (2016) reveal that a more precise definition of wavelet coherence could be grasped from the cross-wavelet transform, wavelet power spectrum (WPS) and phase difference. The bivariate cross wavelet transform of X_t and Y_t, according to Torrence and Compo (1998), is given as;

$$W^{xy} = W^x W^y \qquad [6.22]$$

Where W^x and W^y denotes the respective wavelet transforms decomposing the Fourier co- and Quadrature-spectra (Roesch & Schmidbauer, 2014). The waveletcomp program modifies equation 6.22 as;

$$W^{xy}(s, \phi) = \frac{1}{\phi} W^x(s, \phi) W^{y*}(s, \phi) \qquad [6.23]$$

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Where s is the frequency and ϕ is the time domain, respectively, and * denotes the complex conjugate. Thus, the absolute value of equation 6.23 may be viewed as a cross-wavelet power (7). Although limitations exist, equation 6.22 makes it possible to assess the wavelet power of the two series via.

$$\rho^{xy}(s,\phi) = |W^{xy}(s,\phi)| \qquad [6.24]$$

Equation 6.22 is synonymous with the conveyance in a geometric sense and as was the case with equation 6.23. Although, however, it depends on the unit of measurement of the various series, a more direct relationship in terms of the degree of association between the two variables may not suffice; according to Roesch and Scmidbaur (2014), a wavelet coherency may resolve this.

Although analogous to the Fourier coherency, wavelet coherency requires smoothing the cross-wavelet spectrum and normalising individual wavelet power spectra. Torrence and Webster (1999) specifies the bivariate wavelet coherence between two-time series X and Y as;

$$R_t^2 = \frac{|S(W_t^{xy}(s)|^2}{S(s^{-1}|W_t^x(s)|^2)S(s^{-1}|W_t^y(s)|^2)} \qquad [6.25]$$

S is the smoothening operator in time and scale. Smoothening is important as without it, in both time and scales, coherency will be unity. Coherency measures the spate of co-movement between the bivariate series. The coherency index will lie between 0 and 1, with near values signalling strong coherency and vice versa. Finally, under the continuous wavelet transform, phase difference analysis applied to determine the lead-lag relationship between the bivariate variable under study. Following Madaleno and Phino (2012) and Torrence and Compo (1998), the phase difference is given by;

$$\beta_{xy} = tan^{-1}\frac{I\{W_t^{xy}\}}{R\{(W_t^{xy}}, \beta_{xy} \in [-\theta, \theta] \qquad [6.26]$$

An absolute value of β_{xy} which is less than $\frac{\theta}{2}$ means that the bivariate variables move in phase or anti-

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phase (in the case of larger $\frac{\theta}{2}$, where the instantaneous time referred to as the time origin and at the frequency under consideration. The sign of the phase demonstrates the variables in the pair leading the relationship. Graphically, phase vectors are represented by arrows.

6.5.1 Results and discussions

We employed the Augmented Dickey-Fuller test (ADF) by Dickey and Fuller (1981), which uses the Mackinnon (1994, 1996) critical values, and the Philips and Perron (1998) test, which improves the autocorrelation flaws of the ADF to test for the stationarity of the variables.

Table 6.2: Test for stationarity of the variables

Philips-Perron	**Levels**		**First Difference**	
Variable	**Constant**	**Trend**	**Constant**	**Trend**
Rule of law	-2.34	-2.28	-4.37***	-4.30***
Government Effectiveness	-1.78	-1.95	-3.93***	-3.93**
Regulatory Quality	-3.14**	-2.48	-4.81***	-4.92***
Voice and Accountability	-3.57***	-3.77**	-4.57***	-4.46***
Political Stability	-3.40**	-3.31*	-4.34***	-4.42***
Control of corruption	-2.34	-2.28	-4.37***	-4.30***
Overall governance	-3.67***	-3.45*	-4.84***	-4.85***
Tax revenue	-1.11	-1.62	-3.30**	-3.32*
Non-tax revenue	-1.97	-1.51	-3.27**	-3.39*
Total revenue	-1.51	-1.08	-3.60***	-3.69**
ADF	**Levels**		**First Difference**	
Variable	**Constant**	**Trend**	**Constant**	**Trend**
Rule of law	-2.17	-3.85**	-3.77***	-3.74**
Government Effectiveness	-2.04	-2.70	-2.74*	-2.87
Regulatory Quality	-2.39	-2.23	-1.60	-1.70
Voice and Accountability	-2.90*	-2.96	-2.09	-2.47
Political Stability	-2.68*	-2.77	-3.32**	-3.32*
Control of corruption	-1.80	-1.76	-2.33	-2.20
Overall governance	-1.80	-1.54	-5.87***	-6.04***
Tax revenue	-2.44	-3.04	-4.41***	-4.45***
Non-tax revenue	-3.09**	-2.76	-5.11***	-5.18***
Total revenue	-3.10**	-2.97	-4.28***	-4.41***

*Where *, **, and *** denote the establishment of causality at 10%, 5%, and 1% significant level.*

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Relying on the Philips Perron test, we observe that regulatory quality, voice and accountability, political stability, and the overall level of governance are stationary in their levels. The rest of the variables are stationary in their first differences. We thus employ the first difference of these variables for the linear and the non-linear causality tests.

6.5.2 Absolute causality between DRM and governance

We begin by studying the causal relation between the DRM handles and governance and its constituents. Table 6.3 below gives details of the absolute causal relationship.

Table 6.3: Causality between absolute DRM and governance

Direction of causality	Linear causality			Non-linear causality		
	F- Statistics			*T-Statistic*		
	Tax rev	Non-tax	Total rev.	Tax rev	Non-tax	Tota l rev.
Rev. does not Granger Cause *RL*	0.92	1.96	2.54**	0.48	0.53	-0.18
RL does not Granger Cause *Rev.*	0.06	0.59	0.20	0.81	-0.13	-0.59
Rev. does not Granger Cause *CC*	0.99	1.22	2.27*	0.48	-1.55	0.37
CC does not Granger Cause *Rev.*	0.08	1.70	1.29	-1.53	0.32	-1.06
Rev. does not Granger Cause *GE*	0.03	0.19	0.21	-1.20	-0.13	-0.14
GE does not Granger Cause *TR*	0.02	0.68	0.11	0.65	0.62	0.58
Rev. does not Granger Cause *VA*	0.99	1.54	2.29*	-1.13	0.38	0.02
VA does not Granger Cause *Rev.*	1.09	1.49	0.82	0.41	-0.32	0.10
Rev. does not Granger Cause *RQ*	0.11	0.23	0.61	-1.07	0.41	0.06
RQ does not Granger Cause Rev.	0.02	0.60	0.16	1.05	0.08	0.04
Rev. does not Granger Cause PS	0.36	0.04	0.27	0.07	-0.76	-0.02
PS does not Granger Cause *Rev*	1.41	0.14	0.90	0.17	-0.78	0.47
Rev. does not Granger Cause *GOVI*	0.21	2.70**	3.16**	-0.16	-0.39	0.14
GOVI does not Granger Cause *Rev.*	0.56	1.16	0.36	-0.80	-0.07	-1.15

*Where *, **, and *** denote the establishment of causality at 10%, 5%, and 1% significant level.*

We observe from table 6.3 above that there is no evidence of linear and non-linear causality between tax revenue and governance in Ghana. This means that high tax revenue does not necessarily lead to good governance, neither does good governance garner high tax revenue. As much as we reckon that

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taxation and good governance are a double-edged sword, both are blunt in these estimations. None of them is leading a charge on the other. On non-tax revenue, we observe that no causality exists in the non-linear dimensions of the relationship. However, there is a uni-directional causality between non-tax revenue mobilisation and governance in Ghana. Reasons suffice for the relationship. Observably, the non-tax revenue includes grants, and fees and fines for public service. The causality stems from governance conditionalities attached to specific grants for African governments that Ghana continues to enjoy. These conditionalities were adopted by both bilateral and multilateral donors such as the World Bank and IMF. For instance, Ghana qualified for the first compact of the Millennium Challenge Corporation's grant of $547 million to pursue development-oriented activities because she met most of the governance requirements ahead of her peers. Huntington (1993), in his "third wave", describes the transition to democracy by Africa as the manipulation of developed countries with the help of aid for democratic reforms. These conditionalities, to some extent, have consolidated some aspect (control of corruption, political stability, and voice and accountability) of the good governance credentials of Ghana. It stands to reason that, all things being equal, the more Ghana seeks these grants, the more the governance credentials may improve.

Concerning the total revenue/governance causality, the result discredits the possibility of non-linear causality. However, we find a linear causality between the rule of law and total revenue, with the causality moving from improved total revenue to the rule of law. Thus, improvement in total revenue, Granger-causes rule of law. It is expensive to promote the rule of law; improved revenues will afford the government of the day the financial muscle to procure the requisite resources to maintain law and order, thereby consolidating governance. The study also established a uni-directional causality moving from total revenue to the overall level of governance. Thus, higher revenues promote good governance in Ghana. This finding aligns with reality, as improved revenues enhance the delivery of public services, strengthening governance. Although the transmission mechanism has not been

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estimated, hypothetically, higher revenues capacitate the government to equip itself with the best resources to govern well. Overall, we find no non-linear causality between the variables, but there is some limited linear causal relationship between DRM and the constituent of governance or total governance. The absolute linear causal result reveals that it is DRM that Granger causes governance and not the other way around.

6.5.3 Time-varying linear and non-linear causality between DRM and governance

We decompose the data from its absolute state into D1, D2, D3, employing the Maximal overlap wavelet transform. With D1, D2, D3 denoting short term, medium term, and long term, respectively.

1.5.3.1 Short-run parametric linear and non-parametric (non-linear) causality

The time frame for the short run as intended in this study is from six (6) months to one (1) year, i.e. from 1 quarter to 4 quarters. The results of the short-run causality (D1) are depicted in Table 6.4 below. Again, the linear causal outcomes are on the left, and the non-linear dimensions of the study are on the right.

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Table 6.4: Short-run linear and non-linear causality between DRM and governance

Direction of causality	Linear causality			Non-linear causality		
	F- Statistics			*T-Statistic*		
	Tax rev.	Non-tax	Total rev.	Tax rev	Non-tax	Total rev.
RL does not Granger Cause *Rev*	0.42	0.25	0.43	0.51	0.31	-0.59
Rev. does not Granger Cause *RL*	1.04	1.08	1.09	-0.36	-0.83	0.03
CC does not Granger Cause Rev	2.45*	6.26***	2.56**	-1.258	-0.04	0.38
Rev. does not Granger Cause *CC*	1.91	0.49	1.67	-1.130	-1.55	-1.70
GE does not Granger Cause *Rev*	0.65	0.78	0.23	-1.12	0.87	0.84
Rev. does not Granger Cause *GE*	3.31**	2.73**	4.21***	-1.70	-1.70	-1.52
VA does not Granger Cause *Rev*	1.64	4.37***	1.38	-1.37	-1.52	-1.16
Rev. does not Granger Cause *VA*	0.39	0.31	0.55	-1.11	-1.11	-0.88
RQ does not Granger Cause *Rev*	0.25	2.85**	0.22	-1.23	-1.58	-0.44
Rev. does not Granger Cause *RQ*	1.20	0.75	1.47	-1.20	-1.72	-1.73
PS does not Granger Cause *Rev*	2.66**	0.41	2.13*	-0.44	-1.80	-0.80
Rev. does not Granger Cause PS	10.55***	4.22***	9.36***	-1.02	-1.17	-0.57
GOVI does not Granger Cause *Rev*	0.49	3.45**	0.48	-1.28	-1.93	-2.16
Rev does not Granger Cause *GOVI*	0.94	0.50	1.08	-0.79	-0.15	-0.09

*Where *, **, *** represents significance at 10%, 5% and 1% level respectively. On-linear causality is by the Diks and Panchenko method*

From table 6.4 above, there is no possible short-run non-linear causality between the handles of DRM and good governance or their constituents. There is, however, some evidence to suggest the possibility of linear causality in the short run. Focusing on tax revenue and government effectiveness, we find a uni-directional causality between tax revenue and government effectiveness, with tax revenue leading the causality. Thus, higher tax revenues enable governments to achieve their targets and thereby improving their effectiveness. This finding conforms with the apriori expectation as tax revenues arm the government with the necessary resources to execute its agenda. Concerning tax revenue and political stability, we find a bi-directional causality. Thus, both variables can lead the relationship. The reason is that a placid political atmosphere attracts investment which also has positive implications on tax revenue mobilisation as productivity rises. On the other hand, if well invested, higher tax revenues

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can secure political stability for a nation. The preceding narrative stems from the political uprising that has been experienced in Ghana and other North African countries. Thus, underdevelopment, spurred by low tax revenue, can polarise the political environment and subsequently destabilise governments. The bi-directional causality is therefore justified. Notably, there is no causality between the overall level of governance and tax revenue mobilisation.

On non-tax revenue, we observe many feedback loops. First, we find a uni-directional causality from the control of corruption to non-tax revenues at the 1% significance level. Thus, the control of corruption improves non-tax revenue generation. The results underpin citizens resolve to ensure accountability in the spending of public revenue. According to Djumashev (2007) and Joulfaian (2009), corruption in public service reduces revenue generation compliance by losing confidence in institutions and severely restricting development. Strong institutions are thus needed for higher revenue mobilisation.

As in the tax revenue case, a similar relationship ensues in the non-tax revenue category; there is a uni-directional causality between non-tax revenue and government effectiveness. Non-tax revenues lead this at the 1% significance level. Higher non-tax revenues guarantee government effectiveness. Higher revenues make it possible for the government to have at its disposal the most reliable resources to pursue its agenda. From table 6.4 above, promotion of voice and accountability in the governance process can garner tax revenue. Thus, when citizens are given the platform to contribute to the governance process, the government also remains accountable to its citizens, and non-tax revenues improve. Accountability, media freedom, freedom of speech has become some of the critical ingredients to revenue mobilisation. According to Ajaz and Ahmad (2010), the absence of voice and accountability negatively impacts the government's revenue. Citizens' sense of belonging to the state

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and ownership are high when their views and voice are heard in the governance process. This also makes them contribute financially to the sustenance and development of the state.

Evidence also exists from table 6.4 that at the 5% significance level, regulatory quality is vital in guaranteeing higher non-tax revenue. Thus, there is causality between regulatory quality and non-tax revenue, with regulatory quality leading the relationship. The finding is in line with what we expected from the empirical estimation. This is because non-tax revenues are mainly fees, fines and grants. The fees and fines are mainly paid to public service regulators. The stronger these institutions are, the more citizens are likely to pay and hence raise revenues. We also find a uni-directional causality between non-tax revenue and political stability at the 1% significance level. Thus, higher non-tax revenues Granger-causes political stability. The results reiterate the significance of financial resources in promoting a balanced political atmosphere for development. Higher non-tax revenues will afford the government the strength to procure these resources. At the overall governance level (taking account of all the constituents of governance), we find strong causality at the 5% significance level to suggest that good governance could offer a path for non-tax revenue growth. Thus, good governance Granger-causes non-tax revenue. This means that a strategy to improve Ghana's governance and institutional structures can propel DRM to appreciable levels for growth and development. This finding contradicts the view of Moyo (2009), who suggests that non-tax revenues, such as aid, breeds weak governance institutions. This is because such revenues do not have accountability mechanisms attached to them.

As far as total revenue is concerned, the establishment of causality represents the interplay of tax and non-tax revenue and governance and its constituent's causality. We find that causality was established where the different sources of revenue reinforce each other. Given that, we find causality between total revenue and three different constituents of governance. They include the control of corruption,

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government effectiveness and political stability. Concerning the control of corruption, similar to the tax and non-tax revenues, the study finds that control of corruption Granger causes total revenue generation. We also find that total revenue Granger causes government effectiveness and political stability at 1% level.

6.5.3.2 Medium-term linear and non-linear causality

We focus on the intermediate-term dynamics of the relationship. The study captures the medium term to be around one (1) to two (2) years or 4 to 8 quarters. We observe no non-linear causality relationships at all levels of DRM and governance in the medium term.

Table 6.5: Medium-term linear and non-linear causality

Direction of causality	Linear causality			Non-linear causality		
	F- Statistic			*T-Statistic*		
	Tax rev.	Non-tax	Total rev.	Tax rev	Non-tax	Total rev.
RL does not Granger Cause *Rev*	0.32	0.65	0.61	1.225	0.936	-0.124
Rev. does not Granger Cause *RL*	1.79	2.82**	2.64**	-0.626	-0.408	0.726
CC does not Granger Cause Rev	3.03***	2.13*	1.80	-0.990	-1.354	-1.269
Rev. does not Granger Cause *CC*	0.98	0.89	0.86	-1.047	0.005	-0.536
GE does not Granger Cause *Rev*	1.45	1.84	1.46	-0.923	0.361	0.382
Rev. does not Granger Cause *GE*	0.80	1.74	1.22	-0.626	-1.121	0.227
VA does not Granger Cause *Rev*	1.52	1.35	0.78	1.034	0.890	-0.208
Rev. does not Granger Cause *VA*	0.73	1.80	1.21	-0.924	-0.298	-1.101
RQ does not Granger Cause *Rev*	0.47	1.06	0.21	-0.517	0.034	0.232
Rev. does not Granger Cause *RQ*	0.73	3.04**	1.82	-0.007	-1.644	-0.867
PS does not Granger Cause *Rev*	1.73	0.55	1.97	-0.712	0.034	0.220,
Rev. does not Granger Cause PS	5.39***	6.26***	6.74***	0.749	-1.644	0.248
GOVI does not Granger Cause *Rev*	0.48	3.64**	0.21	1.097	0.57	-0.756
Rev does not Granger Cause *GOVI*	1.26	1.27	2.72**	-0.870	-0.853	-1.135

*Where *, **, *** denotes the establishment of causality at the 10%, 5%, and 1% significance level.*

Concerning the linear causal relationship, tax revenue and two constituents of governance had a causal relationship. The control of corruption (CC) was found to Granger cause tax revenue at 1% significant

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level. This finding is in line with the realisation of institutional challenges that bedevils revenue administration. Corruption in public administration has long been described as the bane of good governance. Corruption affects the way government function in diverse ways. Financial corruption reduces the resources for development. Nepotism and favouritism places square pegs in round holes in revenue administration, affecting how much tax revenue is collected as tax assessment and declaration may fall short of what is due. This eventually has a negative bearing on the way government functions, its efficiency and effectiveness. It is not out of place that the control of corruption Granger-causes resource mobilisation. Here, it is a constituent of good governance leading the charge, not the other way around. A policy aimed at reducing corruption, therefore, has positive implications on tax revenue. Lastly, we find a justification for a causal relationship between tax revenue generation and political stability, with tax revenue leading the charge at 1% significant level. We find two justifications in a real-world scenario. First, we contend that higher tax revenue means that citizens' contribution towards development is high.[52], and as such, the higher the resources available for growth and development. According to Aisen and Veiga (2013), countries with sustained growth and development have lower political instability. We connect the two preceding statement and conclude that, because high tax revenue connotes high participation in the development process[53], inclusiveness deters the political atmosphere from being highly polarised.

Focusing on non-tax revenues in the medium term, we find strong causality at 5% significance level to suggest that non-tax revenue Granger-causes the rule of law. Thus, improvements in non-tax revenues cause improvement in the rule of law. This finding is unique to the medium term as no such relations exist in the short term. The implications are that strong principles based on the rule of law, i.e. certainty of laws and the length of its applicability, guarantees non-tax revenues. A policy to enact

[52] That is, if taxes are channelled into development
[53] http://www2.ids.ac.uk/gdr/cfs/pdfs/TJF_3-2_Final%20Moore-Simpson.pdf

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laws to govern every sphere of life, to eliminate discretion suffices for strong non-tax revenue growth. The rule of law improves the investment atmosphere as economic agents are given the platform to resolve their difference under a guaranteed fair system.

Secondly, we find a strong causality at 5% between non-tax revenue and regulatory quality. With the movement coming from non-tax revenue to regulatory quality. High non-tax revenue improves the government's ability to regulate its agencies well. This finding is especially factual for Ghana as most public corporations that generate revenue have been mandated by the Ministry of Finance to keep some percentage of the revenues they generate for their upkeep. The revenue flows ensure efficiency by helping them procure the best resources for their activities. We also have evidence to suggest that non-tax revenue Granger causes political stability. We envisage that higher non-tax revenue provides good resources to the government to govern well, and hence the less likely there is the need for rising tensions and uprising, which disturbs the peace and tranquillity of the country.

At the overall governance level, we again find strong evidence at the 5% significant level that, in the medium term, improved governance Granger-causes non-tax revenue growth. This finding negates any thought that revenue improves the overall level of governance in a country. A solid resolve to govern efficiently has substantial positive implications on revenue growth, as shown in Table 6.5 above.

We see a strong causality moving from total revenue growth to the rule of law concerning the total revenue. Higher revenues are thus needed for strengthening governance, especially with the rule of law. There is also a strong causality between total revenue growth and political stability; the charge is coming from total revenue. These findings are in recognition of the vital role revenues play in governance. Without an assured high revenue flow, development stalls, and the political system becomes polarised. It is worthy of note that at the overall governance level, there is a potential

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Granger-causality. As could be seen from table 6.5 above, there is causality from total revenue to improved governance. Thus, in the medium-term high total revenue is significant in improving the quality of governance. This was expected as financial resources are essential in the governance process.

6.5.3.3 Long term linear and non-linear causality

We discuss the long-term causality findings in this section. We envisage the long run to be between two (2) to four (4) years, i.e. 8 to 16 quarters. From table 6.6 below, we establish causality within the linear and the non-linear causality framework.

Table 6.6: Long term linear and non-linear causality

Direction of causality	Linear causality			Non-linear causality		
	F- Statistics			*T-Statistic*		
	Tax rev.	Non-tax	Total rev.	Tax rev	Non-tax	Total rev.
RL does not Granger Cause *Rev*	0.77	0.56	0.35	1.53*	-0.11	0.71
Rev. does not Granger Cause *RL*	3.83***	2.56**	5.10***	0.83	0.32	0.57
CC does not Granger Cause Rev	0.62	1.20	2.02	1.26	1.10	1.35*
Rev. does not Granger Cause *CC*	2.58**	1.91	2.49*	0.47	0.83	1.36*
GE does not Granger Cause *Rev*	0.62	0.41	0.47	1.62*	1.17	1.52*
Rev. does not Granger Cause *GE*	0.43	0.36	0.42	0.81	0.96	0.77
VA does not Granger Cause *Rev*	3.36**	1.09	2.01	1.97**	1.35*	1.04
Rev. does not Granger Cause *VA*	2.28*	1.95	2.41*	1.90**	0.94	1.79**
RQ does not Granger Cause *Rev*	3.17**	0.60	2.24*	1.50*	0.98	1.13
Rev. does not Granger Cause *RQ*	0.54	1.25	1.08	0.80	0.88	0.41
PS does not Granger Cause *Rev*	1.25	1.18	1.35	2.11**	-0.08	1.47*
Rev. does not Granger Cause PS	0.56	1.11	0.58	1.48*	0.25	0.95
GOVI does not Granger Cause *Rev*	2.39*	0.69	1.40	1.10	0.86	1.14
Rev does not Granger Cause *GOVI*	1.68	2.04	2.26*	0.68	-0.14	0.91

*Where *, **, *** signifies the establishment of causality at 10%, 5%, and 1% significant level*

Focusing on tax revenue and governance, we find a uni-directional causal relationship between tax revenue, the rule of law, tax revenue leading the charge on the linear level, and the rule of law marginally leading the charge at the non-linear level at 10%. We also find that higher tax revenues

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Granger-causes the control of corruption at the linear level. There is no possibility of a non-linear relationship. In the long-term, an agenda to control corruption does not necessarily raise tax revenues as occurred in the short and medium terms.

We also observe some causal relationships between voice, and accountability and tax revenue mobilisation in both the linear and non-linear models. The relationship is bi-directional in both models, which supposes that tax revenue and the promotion of accountability mechanisms in the governance process reinforces each other. Thus, when tax revenues are high, citizens concern about what their monies are used for rises, and hence they participate in the governance process by voicing their pleasure and displeasure. Also, the relationship suggests two things; first, the possibility that the relationship is non-linear is high; secondly, allowing citizens to participate in the governance process, by promoting transparency and allowing their voice to be heard, encourages them to pay taxes to support the governance process. This aspect of the inquisition reveals a chicken and egg scenario, but it also suggests that promoting voice and accountability in governance can support a domestic resource mobilisation drive.

Concerning regulatory quality, we find a linear causality at 5% significant level between regulatory quality and tax revenue mobilisation. We also witnessed a weak non-linear causality between regulatory quality and tax revenue which amplifies the possibility of a non-linear relationship. Thus, there is a chance that regulatory quality does not directly lead to improvement in tax revenue but passes through other variables. The last causal relations found was between political stability and tax revenue. There was a bi-directional causality between the two, with political stability Granger-causing tax revenue at 5%, and tax revenue Granger-causing political stability marginally at 10%. Thus, the mechanism by which political stability translates into improved tax revenue and vice versa may not be direct, but intermediaries direct the relationship. Although the reverse of the relationship is marginal, promoting

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a serene political atmosphere can have tax revenue mobilisation implications. There is no causal relationship between tax revenue and the overall governance level in the long run.

6.6.1 Coherency and co-movement between DRM, and governance: results, and inferences

The co-movement and coherency results are depicted in figure 6.3, 6.4, 6.5, and 6.6 below. Figure 6.3 details the wavelet coherency and phase difference between tax revenue and the ingredients of good governance; figure 6.4 gives pictorial evidence of the co-movement between non-tax revenue and the various aspect of good governance; figure 6.5 is dedicated to the co-movement between total revenue and the sub-indices of good governance; the last of the figures on the coherency and co-movement figure 6.6, will examine the interdependence of the two development concepts at the aggregate governance level. These plots examine on the bivariate level, the co-movements in the frequency (the periods are in quarters) and the time domains. Whiles wavelet coherency measures the local correlation amongst the variables; the phase differences depict the lag or lead (causality) relationships among the variables of interest. The white region with arrows in the wavelet coherency plot denotes significance at 5% level[54]. Indeed, co-movements are more robust in the reddish areas within the white contours at all frequencies.

Specifically, in figures 6.3, 6.4, 6.5, and 6.6, the vertical and horizontal axes denote time and time-frequency in quarterly ranges from 1 quarter to 32 quarters. The region of edge effect is shown by the cone of influence which contains the white contour lines signifying the region of 5% significance level as simulated by the Monte Carlo method with two white noise series of the Bartlett window stock. With respect to the local correlations (coherence), the vertical bar to the right of the figure (coherence and phase difference plots) shows the colour codes for coherence stretching from the high coherence region (red) to the low coherence region (blue). This means that solid co-movement at low frequencies

[54] concerning two white noise processes simulated by the Monte Carlo method

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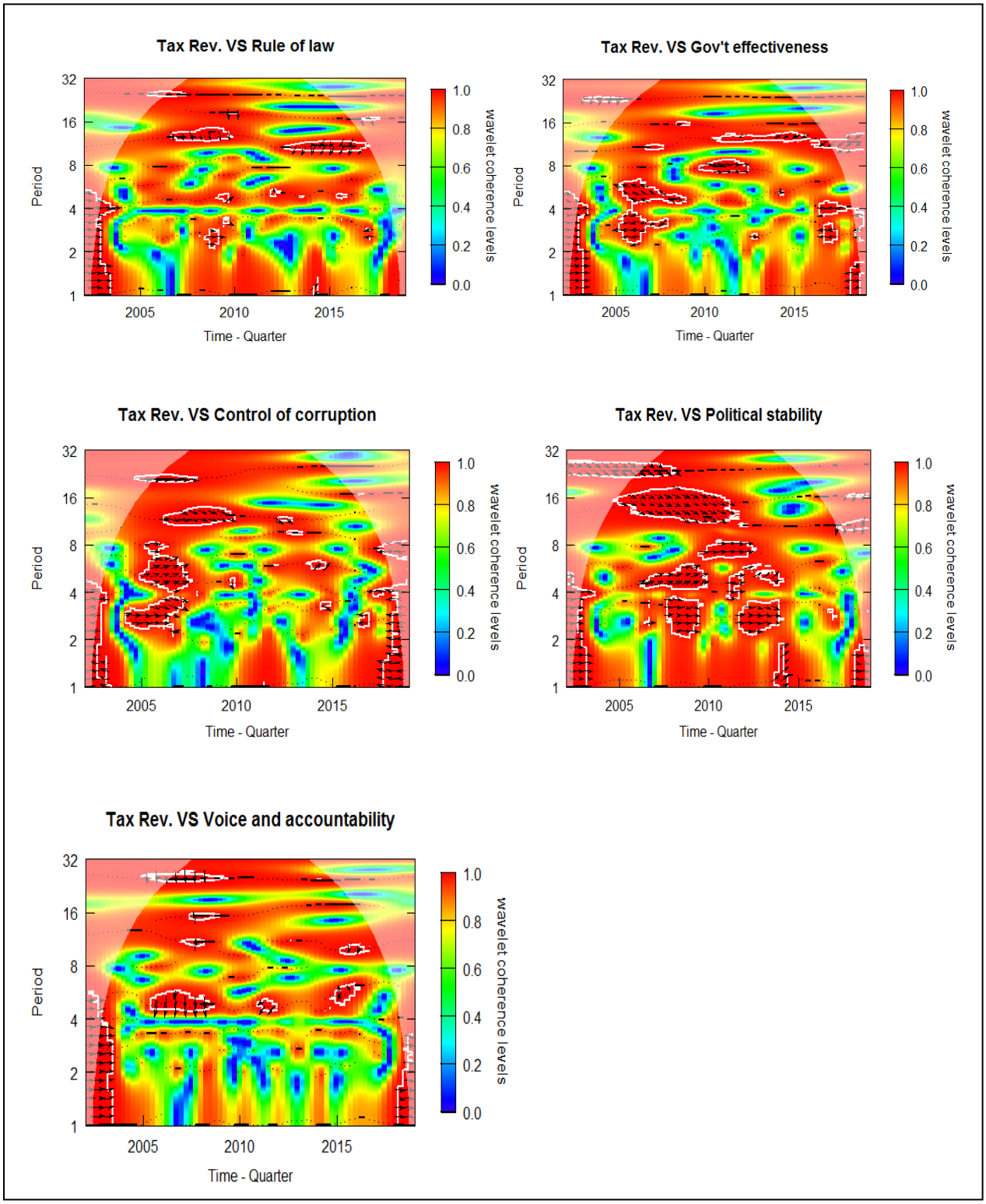
in our framework is represented by the reddish colour in the white contours at the bottom (top), whiles the reddish colour in the white contour areas at the left-hand (right-hand) side signifies a strong co-movement beginning from the sample period. Arrows indicate the phase difference between the series. The series shown first is the first series, and the other variable is the second.[55]. According to (Madaleno and Pinho, 2012), if the arrows point to the right, it signifies that the variables are in phase. If it goes to the right and up, the first variable lags the second variable. If it is going to the right and down means that the first variable is leading. The two variables are out of phase if the arrows point to the left. Specifically, if it points to the left and up, it means the first variable is leading, and if it points down, the first variable lags behind the second.

Thus, in the plots, we interpret the arrows to the right to mean the series is in phase, whiles arrows to the left mean that the two series are out of phase. Arrows to the right and up means the first variable is lagging, or the second variable is leading and vice versa to the arrows to the right that goes down. Arrows to the left that goes up mean that the first variable is leading, and the second variable is lagging, and according to Roesch and Schmidbauer (2014), when the arrow goes to the left and down, the first variable is lagging and the second leads. The order of the variables is as depicted on top of the plots. From figure 6.3 below, we plot the wavelet squared coherency and phase differences between tax revenue and the various aspects of good governance.

[55] In our case, the DRM variables are shown first, and the governance indicators come second.

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Figure 6.3: Tax Revenue and good governance indicators



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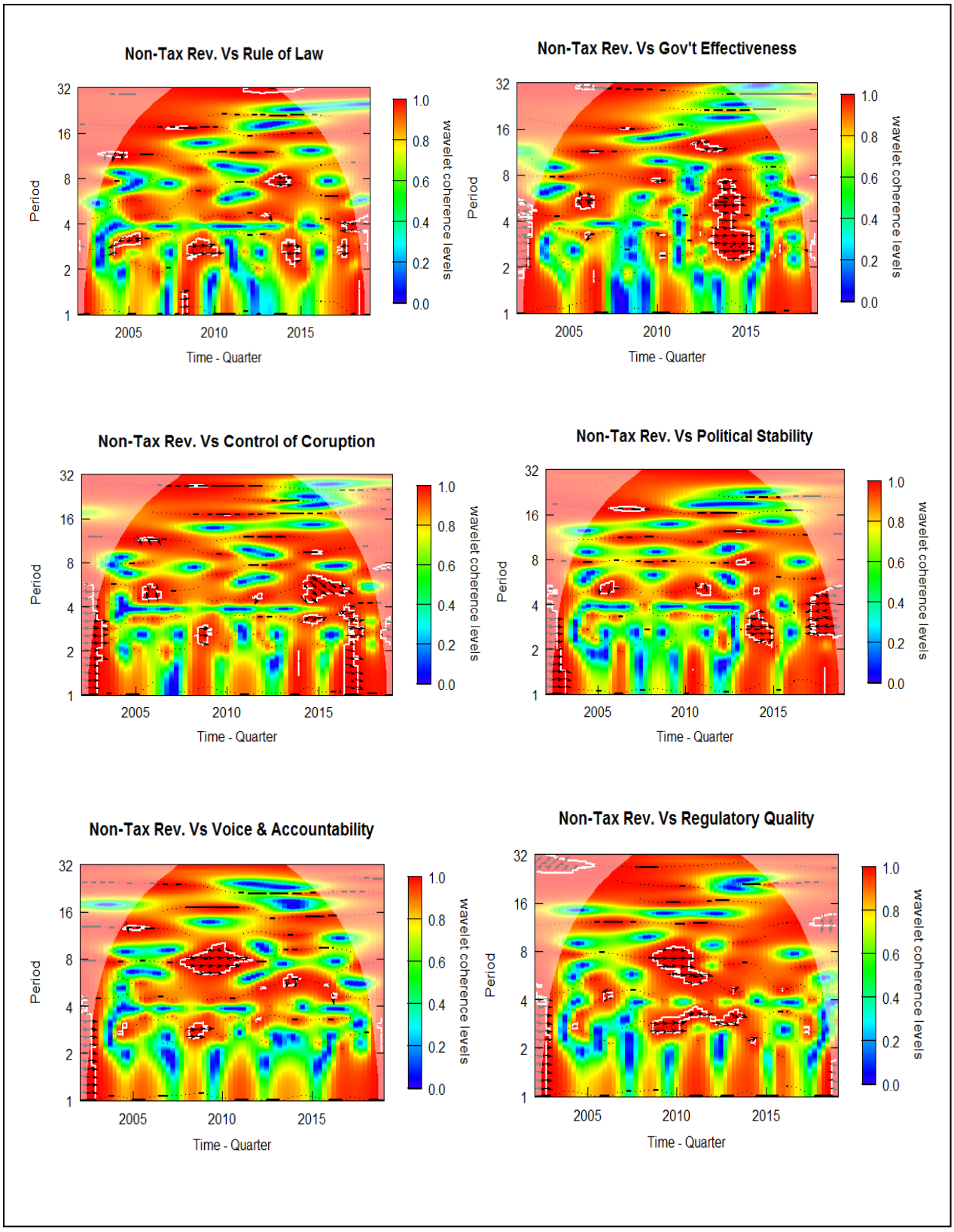
Figure 6.3 demonstrate that all the different pairs exhibit significant co-movement at different cones of influence across time and scale. Generally, we see that the movement of the variables is in phase. I.e. they are positively correlated. What is unique among them is the strong co-movement in the short run between 2002, and 2003, on the one hand, and 2017; the direction of the arrows in these periods indicate that the pairs are all in phase with no clear lead-lag relationship. In between the stated period, we also see strong co-movement between the variables to suggest that some are out of phase, and others are in phase; with government effectiveness and the rule of law leading tax revenue among those out of phase, and voice and accountability, leading the charge among those in phase. This signifies that improvements in voice and accountability have a fair, favourable implication on tax revenue generation in the medium to long term.

Figure 6.4 examines the co-movement between non-tax revenue, and the constituents of governance demonstrate lower co-movement. The short-run positive co-movement seen in the previous figure has fairly reflected in figure 6.4, with the cone of influence suggesting that most of them are in phase. There are not many significant co-movements between non-tax revenue and the constituents of good governance in the long term, but isolated co-movements are identified in the short to medium term, especially where non-tax revenue leads to 'control of corruption.

Figure 6.5 lumps the non-tax and the tax revenues and compares them with the elements of good governance. We find no short-run co-movement except for 2003 and 2017 in a few of the governance elements where the variables are in phase. Pairing total revenue and the rule of law, we find that rule of law leads total revenue in the long term. Also, in the medium to long term, we find total revenue leading government effectiveness especially between 2005 and 2007. Total revenue also leads control of corruption mainly between 2005 and 2016 in the medium term, in an out of phase scenario.

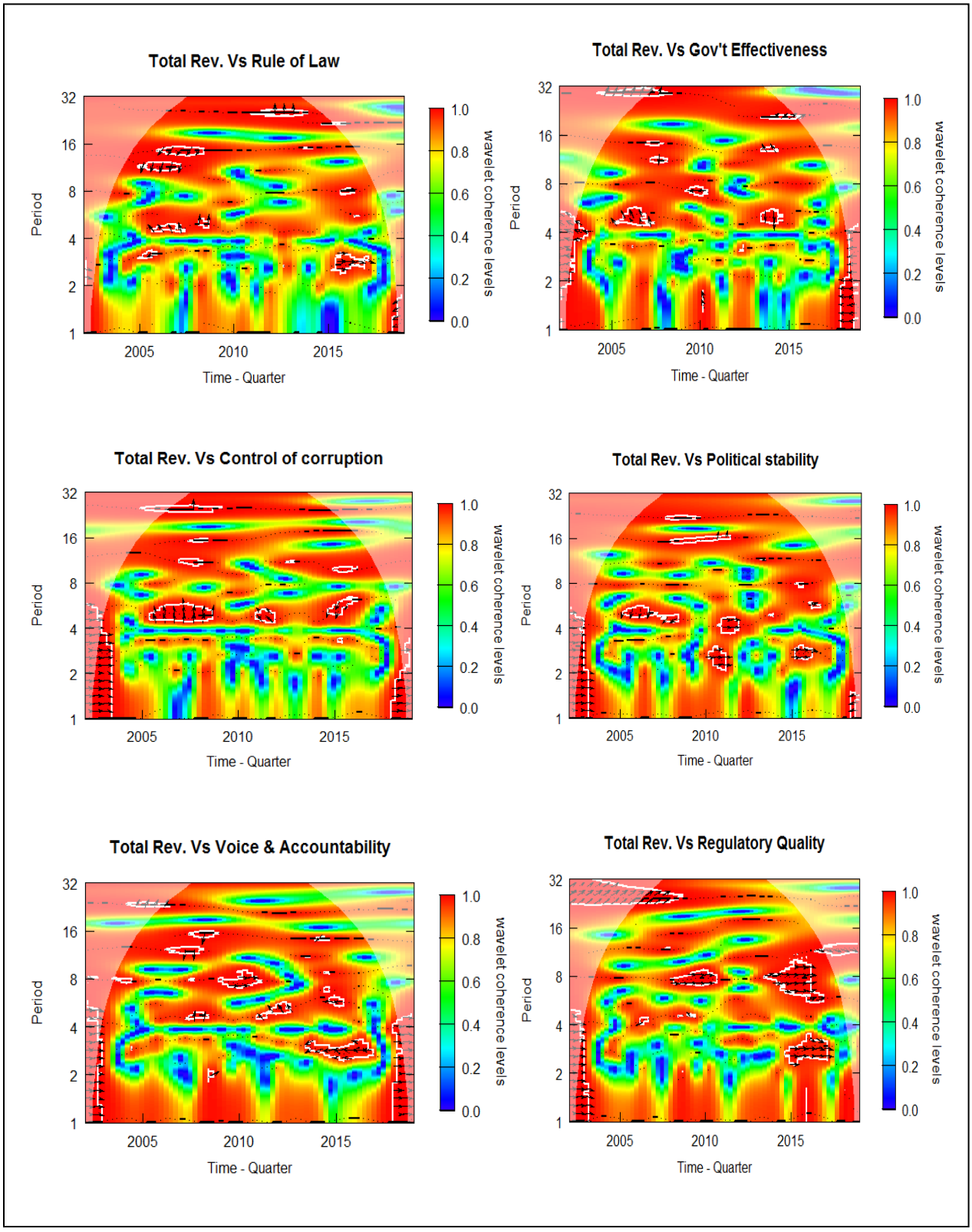
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Figure 6.4: Non-Tax Revenue and good governance indicators



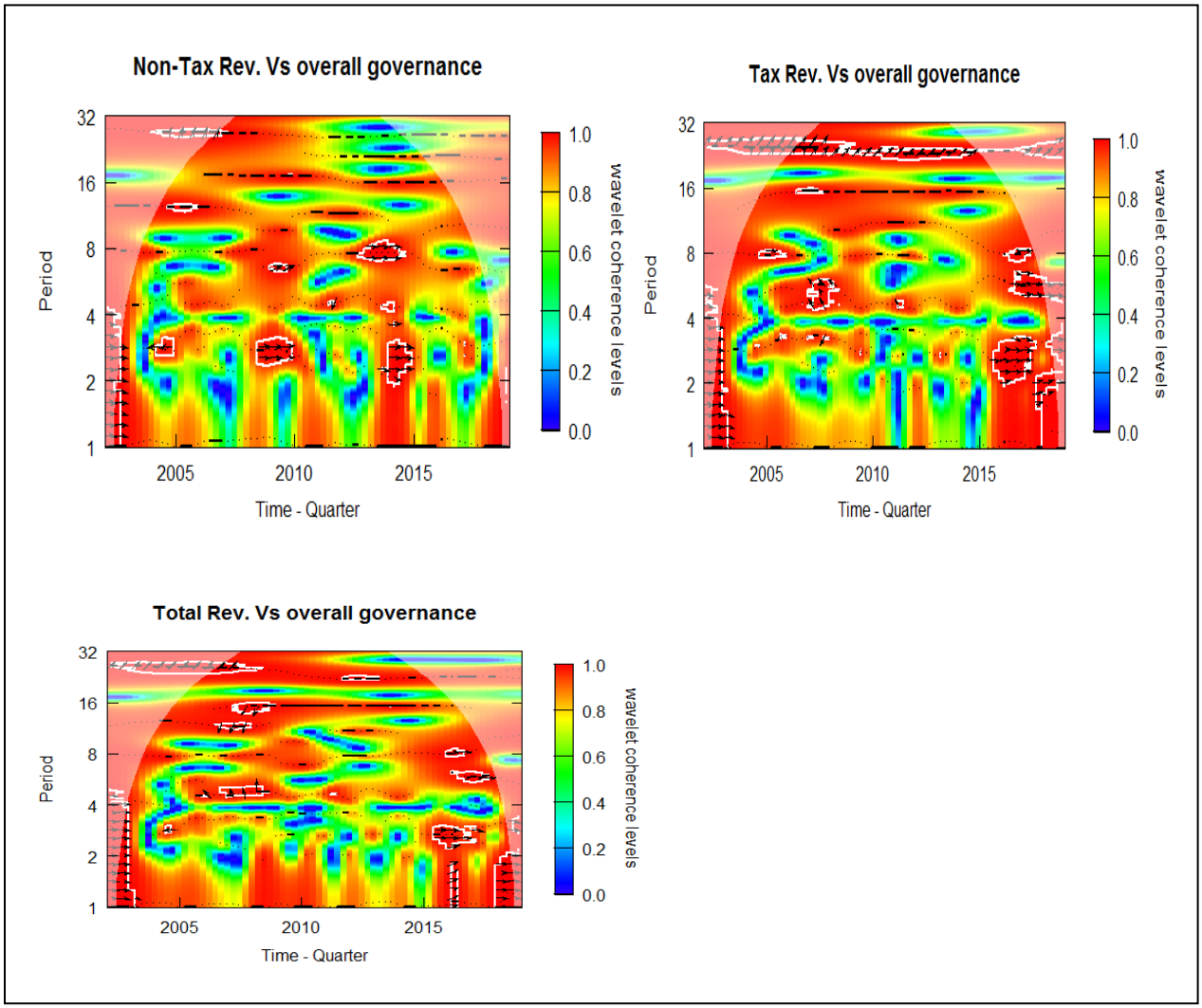
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Figure 6.5: Total revenue and good governance indicators



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Figure 6.6 : All revenue levels, and overall governance level



Political stability also leads total revenue between 2004 and 2008, as does voice and accountability between 2006 and 2007 in an out of phase scenario within the medium term.

Regarding figure 6.6, which assesses the co-movement at the aggregate levels, i.e. pairing total tax, non-tax, and total revenue against the overall level of good governance, we see no clear one-sided pattern to draw conclusions to cover all the pairings. In view of that, we analyse each pair separately. First, little co-movement is seen between non-tax revenue and good governance. It is practically non-existent in the long run. The short to medium term co-movement is found between 2009 and 2010,

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and 2014 and 2015; they are in phase. The lead-lag relationship is not clear, which does not resolve the chicken and egg problem we face. This lends much credence to a possible reverse causality between the two; they reinforce each other. Concerning tax revenue and good governance, we witness significant co-movement from 2016 to 2017, although some movement is seen around the medium term in 2008. We witness the variables being in phase within the short and medium-term. We are unable also categorically to identify the lead-lag variable. The probable reason is mainly feedbacking between the variables; the chicken and egg challenge is also unresolved. Lastly, at the overall DRM and good governance level, the results are split based on scales or time horizons. In the short term[56] total revenue and good governance are in phase. In the medium term[57] total revenue charges good governance. Meaning improvement in revenue mobilisation is required for good governance credential to evolve in the medium term. The lead-lag relationship is, however, reversed in the long term. In the long term[58], good governance essentially translates back to improved revenue collection. This is the feedbacking that has so much been suspected in the earlier relationships.

6.7.1 Conclusions and reflections on policy

In an extensive search for ways to improve domestic resource mobilisation, we set out to find whether improvement in governance could be a panacea for low domestic resources or improved domestic resources that lead to better governance. We investigated the issue by employing causality strategies at the levels, time scales, and wavelet coherency and phase difference techniques because of the frailties of the traditional causality tests. At first glance, we find that the causal relations are mainly linear; there are no intermediaries in the causality process. We find that it is higher revenues that support the emergence of good governance. However, in the short term, we find ample evidence to suggest that

[56] Co-movement mainly around 2015 to 2017
[57] Co-movement mainly between 2006 and 2009
[58] Co-movement mainly between 2006 and 2007

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there are no non-linear causality relations. In its details, some good governance elements promote revenue mobilisation drive while some revenue levels also drive some elements of good governance. There is no clear pattern. The two variables Granger causes themselves at different levels and measures. In the intermediate-term, we find similar outcomes to the short-term scenario. There are no intermediaries in the causal process; as such, there is no non-linear Granger causality; different measures of DRM and governance can have causal relations. The chicken and egg solution is not clearly delineated at the disaggregated and aggregate level. In the long run, however, the possibility of intermediaries in the causality process is heightened as the non-linear dimension of the relationship manifest. However, there is no patterned causality at both the linear and the non-linear causality tests as both sides (DRM and Governance measures) can Granger-cause themselves at the disaggregated level. There is no strong causality at the aggregate level. If we interrogate the relationship further with wavelet coherency and phase difference technique, we find that, in general, most of the pairs are out of phase, with the measures of good governance leading. However, the results for the intermediate terms are mixed, with both variables having the chance to lead. The short term has the variables being in phase, mainly at the extreme ends of the time, with the lead-lag relationship being indeterminate.

Several policy imperatives are ripe for discussion. First, we reckon that the two development concepts cannot exist in isolation. For good governance to emerge, the government need revenues to fund its programs and services. In reverse, good governance encourages citizens to support the development process with their taxes and other statutory payments. Even though we do not find a patterned result that suggests that good governance Granger-causes domestic revenue mobilisation, a policy steered towards improving governance at all levels is only proper. In this regard, the government of Ghana must first employ its meagre resources to set the platform for good governance structures. In the medium-to-long term, the policy will bear fruits in high DRM. Secondly, this strategy should exist

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alongside the traditional policy option of reforming tax bases and revenue administration and roping more people and economic agents into the tax net; revenue levels for development will improve.

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CHAPTER SEVEN

SUMMARIES, CONCLUSIONS, AND POLICY IMPLICATIONS

7.1 Introduction

This chapter, which is the concluding episode of the "studies on domestic resource mobilisation in Ghana, " summarises what was done in the preceding chapters and critical findings, draw conclusions based on the results and offer recommendations for policy uptake. We also suggest some potential areas for future research on the subject of resource mobilisation.

This research piece sought to investigate some critical issues on domestic resource mobilisation in Ghana. The study was informed by the responsibilities imposed on fiscal authorities to look beyond aid to develop. Domestic resource mobilisation and private resource financing have emerged in the milieu of the discussion on development finance policy options due to its resilience and sustainability. The importance of domestic resource mobilisation is projected by international organisations such as the UN and the African Union. Moreover, although the government of Ghana's revenue and spending has increased over the years, it has not met all its developmental needs, with the gap between revenue and expenditure widening in recent years. The reason is that development aid, which hitherto bridged the financing gap, is dwindling, and the cost of borrowing from the international financial market is expensive. Domestic resource mobilisation DRM provides a better chance to financing development. We support the work of the academic community towards settling on the best policy development financing strategy by exploring the cause and effect between domestic resource mobilisation handles and other elements of development. We contribute to knowledge and understanding of subject matter by resolving the following questions;

1. *How has tax policy reforms impacted the buoyancy and elasticity of domestic resource mobilisation systems in Ghana?*

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2. *What is the effect of tax systems on economic welfare in Ghana?*
3. *What is the role of Ghana's financial sector development in domestic debt resource mobilisation?*
4. *What is the relationship between domestic resource mobilisation and good governance in Ghana?*

7.2 Tax buoyancy and elasticity in Ghana (1984-2018)

This essay employed the generalised method of moment GMM, two-stage least squares 2SLS, and the Koyck (1954) long-run cumulative effect to assess the tax buoyancy and elasticity of tax systems in Ghana. Our estimations were based on the Divisia index approach to tax elasticity and buoyancy. We established that tax systems in Ghana are not buoyant but elastic, and as such, revenue growth in Ghana is all an elasticity phenomenon. This finding is irrespective of the time frame under review. Thus in both the short run and the long run, taxes are not buoyant but elastic. This means that growth in tax bases have a higher chance of raising revenue than mechanical adjustments in tax policy. Thus, the discretionary tax reforms proffered during the period under review did not support tax revenue growth behaviour at all levels. We also observe that the long-run cumulative buoyancy and elasticity are higher than the buoyancy and elasticity of the baseline model, suggesting that the long-run tax policy has become more efficacious in the long-run tax policy. Thus, the impact of tax policies informed by both discretionary and automatic responses of tax revenue bases does not wane out rapidly; it takes time to adjust and gravitate towards its long-run level. This also suggests that there are intertemporal outcomes as far as tax policy planning is concerned. Therefore, there is the need to have a short-run and long-run perspective of the outcomes in mind as far as fiscal policy is concerned.

7.3 Tax systems and economic welfare

The basis of the second empirical essay was on the realisation that domestic resource mobilisation such as taxes could affect distributional concepts such as poverty and inequality positively and negatively. Thus, tax systems have negative and positive impacts on distribution. We, therefore,

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undertook an empirical journey to understand whether the relationship is asymmetric or symmetric. We employed the non-linear ARDL technique and tested whether our initial thoughts were confirmed. Concerning the impact of tax systems on poverty in Ghana, we established an asymmetric relationship in all the tax systems and measures of poverty in the long run. However, a symmetric relationship ensues when indirect taxes and total taxes are employed in the poverty line model. We observed that, while positive and negative shocks in direct taxes raise and reduce the level of poverty, respectively, the negative and positive shocks in all the other tax systems produce negative results. We also found out that negative shocks generally produce more significant impacts on poverty than positive shocks. Therefore, a poverty reduction strategy that looks at tax reduction at all levels should produce the desired results in the long run. Similar findings were also discovered in the short-run dynamics. Our study, however, revealed a symmetric relationship between tax systems and inequality, with the relationship being significant only in the long run. This is because indirect taxes are regressive in Ghana, with direct taxes playing a peripheral role.

7.4 Financial sector development and domestic resource mobilisation in Ghana

In this essay, we unravelled two objectives, first to find the nature of the mediation effect of financial development on domestic debt mobilisation in Ghana using a non-parametric approach, and secondly, to find the threshold of domestic debt that the domestic financial system can contain. We estimate the first objective with the help of the Quantile-on-quantile regression technique. The results reveal heterogeneous impact across models and quantiles. Although the role of financial sector development on domestic debt mobilisation is established from the 0.5 quantiles upwards, a positive relationship ensues only at the extreme end (tau=1.00) of the overall financial sector model and the financial markets model's distributions. With a negative relationship found at tau = 0.5 and tau = 0.75 quantiles in all models, and tau = 1.00 of the financial institutions model. Thus, the results generally indicate a heterogenous relationship.

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Concerning the threshold model, we find that a threshold exists for the relationship in all the three different measures of financial development we employed. We find a threshold of 2.5% in the overall index threshold, 6.25% in the financial institutions' development index, and 9.8% of GDP in the financial market model. We also found support for the safe asset theory below the threshold. Thus, below the threshold, domestic public debt provides relatively 'safe assets' for the financial sector from which sizeable profit could be made. The central policy imperative from the two estimations is that the Ghanaian financial sector cannot accommodate too much domestic debt. Though current domestic borrowing is in the region of 25% of GDP, it is above the optimal level and should be reduced.

7.5 The relationship between domestic resource mobilisation and good governance in Ghana

In the last empirical chapter, we examined whether improvements in governance can improve Domestic revenue mobilisation. This was done by employing the standard Granger causality test, the Diks and Panchenko (2005, 2006) non-linear Granger Causality test, in both levels and scales (using the maximal Overlap Discrete wavelet transform MODWT), and the wavelet coherency and phase difference maps. We find the mixed result on the lead-lag relationship in levels, scales, and time. In some cases, various revenue levels are required to have good governance; in many cases, good governance is a panacea for poor revenue mobilisation. Nevertheless, the revenue implications of good governance should not be downplayed; a policy attempt to increase revenues should begin from governing well.

7.6 Conclusion and Policy Implications

The revelation that taxes in Ghana are not buoyant but elastic reiterate the point that, for an efficacious domestic resource mobilisation drive, it is best to invest in strengthening tax bases rather than

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resorting to discretionary ad-hoc measures. Moreover, discretionary tax policies in themselves do not offer scientific solutions to revenue stagnation. It is, therefore, reasonable to put in place policies that grow the bases such as increasing productivity in all the three major sectors Agriculture, Industry, and Services. Laws regulating these redundant sectors must be reviewed to bring the sector under the governance of best practices. The laws must not counter-productivity and derail tax revenue mobilisation.

Secondly, we recommend that policy be enrolled to curtail tax leakages. There must be an aggressive drive to match sectoral growth with sectoral tax revenue mobilisation. This is a strategy to ensure that the tax net captures all growth areas and avoids leakages. We also recommend revising the tax exemption regime in Ghana to curtail abuse and ensure tax revenue realisation matches what is expected.

The second empirical essay reveals that the impact of taxes on distribution may not be symmetric but asymmetric. This finding reiterates the need for the recommendation proffered in the preceding section. Because taxes could negatively impact distribution, tax policies must not be implemented in an ad hoc, arbitrary, or discretionary terms. Tax policy decisions must be occasioned by in-depth research and analysis before they are enrolled. Once, implemented all policies regarding revenue mobilisation must be tied into how to hasten the rate at which tax revenue responds to the tax bases. Policies to improve it must be rooted in taking advantage of the tax high elasticity in Ghana. Also, policies to improve tax bases must be pro-poor to occasion poverty reduction resource mobilisation strategies and equal distribution of the bases.

Shifting attention from taxation to domestic debt, in the fifth chapter, we discovered a heterogeneous relationship between financial sector development and domestic debt but generally leaned towards a negative relationship. We also establish a low debt threshold in Ghana for financial development. The

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domestic financial market is not matured enough to support a massive debt project. Given this, we recommend a continuous focus on tax revenue as a viable source of domestic resource mobilisation in the interim. Tying in the recommendations above, we expect that growing the tax bases, coupled with scientific tax policies and incorporating pro-poor growth policies, will strengthen savings and the financial sector (Quartey, 2008). A developed financial sector can then complement the revenues from tax systems by channelling part of now ample loanable funds to the social planner or governments for development. This recommendation supports the results obtained by the Quantile-on-Quantile approach, which strike a positive relationship between domestic debt and financial sector development only at the highest quantile (tau = 1).

In the last empirical chapter, we realised that taxes, non-tax revenues, and domestic debt are not the only means by which states like Ghana can raise domestic resource mobilisation. The chapter identified reverse causality between good governance indicators and various revenue handles (tax and non-tax). The conclusion is clear; Ghana needs good governance to emerge to raise more domestic revenues. The interesting observation is that the two concepts reinforce each other. When the country is governed well, citizens are more likely to pay taxes; the taxes, in turn, will also strengthen the good governance credentials of Ghana. Because of this, we recommend that effort be made to improve governance by providing quality public service, implementing systems to curb corruption, and improving the democratic credentials of Ghana by giving them a voice. Government should remain accountable to citizens and be effective in public service delivery. The public regulatory authorities must also keep their activities in check to be in line with best international practices.

The four empirical chapters are interlinked; implementation of the regulations will help speed up domestic resource mobilisation in Ghana. Moreover, since African economies are the same in terms of structure, the recommendations are pretty adaptable in other jurisdictions.

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7.7 Areas in need of further research efforts

While this dissertation has touched on critical issues on domestic resource mobilisation in Ghana, we realise that the problem areas are not exhaustive. Other important topical issues require further research. Key among them include creating a semi-autonomous revenue authority (the Ghana Revenue Authority) on revenue mobilisation in Ghana. Dom (2017) asserts that challenges associated with political corruption, and patronage on tax administration in SSA, has forced reforms to focus on ring-fencing tax collections away from political interference by establishing semi-autonomous revenue authorities (SARAs). SARAs operate at arm's length away from ministries of finance. In the words of Fjeldstad and Moore (2009), the hope is that SARAs will improve tax compliance and mobilisation as compared to conventional tax administration models, where compliance and mobilisation are low because citizens' trust in the government is eroded due to the discretionary manner in which government utilises its taxing authority. According to Chand and Moene (1999) and Talierco (2004), by severing tax control to an independent authority, there is a clear signal of a credible commitment to a fair and less discretionary utilisation of taxing authority which boosts compliance.

The year 2009 heralded the merger of revenue institutions in Ghana into a one-stop-shop, semi-autonomous revenue authority (Ghana Revenue Authority). The expectation was that domestic revenue mobilisation would gain momentum due to the onward improvement in compliance. However, after the merger, policymakers and academics are yet to see the relevance and impact of the investment made in the reform. Amid the revenue gap and the massive fiscal deficits experienced in the years after the merger, it is only expedient that an econometric strategy is deployed to investigate the impact of the reform on DRM. There is relevance in this exercise as the impact of the SARAs are still unclear.

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Lastly, the effect of the COVID-19 pandemic on economies is devastating. Indeed it is one of the most significant global health pandemics in history. It has affected almost every sphere of socio-economic functioning. Key among them is the state of public finance and domestic resource mobilisation systems in Africa and Ghana. Whiles responses have been on an ad hoc basis and impacted negatively public finances; there is the need to do a deep-dive study on the long-term impact and the opportunities it offers for constructive change and development. We recommend that future endeavours explore these topical issues to bring clarity to domestic revenue mobilisation strategies.

7. 8 Limitation of the study

This study was primarily based on macroeconomics methodology. However, for a more dependable result and policy reliance, a follow up of the findings with primary data centred research would have added more bite to the results and reliance on the policy prescription. Moreover, the historical time series data available on tax systems were not very recent. Because of that, we could not factor in some important global issues that had an impact on various domestic resource mobilisation, such as the COVID-19 pandemic. Nevertheless, we suggest that future research in the area will take a look at it.

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