

UNIVERSITY OF CAPE COAST

EXCHANGE RATE VOLATILITY AND TAX REVENUE: EVIDENCE
FROM GHANA

BY

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Degree in Economics

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature..... Date.....

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Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

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ABSTRACT

The need for the Ghanaian government to generate enough revenue for development is becoming increasingly crucial in the era of slow economic growth, growing unemployment and high debt. However, tax revenue performance over the years reveals an unstable pattern. One key factor that has been overlooked in the literature in terms of the determinants of tax revenue is exchange rate volatility. Coming from the background of volatility in Ghana's exchange rate, could it be the reason for the instability in the trend of tax revenue? This question is the subject matter of this study. To estimate the effect of exchange rate volatility on tax revenue, the study employed the Auto Regressive Distributed Lag (ARDL) technique after the yearly exchange rate volatilities had been generated using the GARCH(1,1) method. The results of the study suggest that exchange rate volatility has a deleterious effect on tax revenue both in the short-run and long-run but the effect is more pronounced in the long-run than the short-run. The study recommends that the Bank of Ghana step-up its exchange rate stabilization efforts to reduce exchange rate risk imposed on international trade players.

KEY WORDS

Auto-Regressive Distributed Lag (ARDL)

Exchange rate volatility

Ghana

Generalized Autoregressive Conditional Heteroskedastic (GARCH)

Tax Revenue

Trade Openness

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DEDICATION

To my guardians, Miss Beatrice Ama Anakwah and Doris Baidoo

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LIST OF ACCRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
AID	Foreign Aid
ARCH	Auto Regressive Conditional Heteroskedasticity
ARDL	Autoregressive Distributed Lag
BoG	Bank of Ghana
BOP	Balance of Payment
BW	Bandwidth
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Square Recursive Residuals
DF	Dickey-Fuller
ECM	Error Correction Model
ECT	Error Correction Term
ERP	Economic Recovery Programme
EXV	Exchange Rate Volatility
DW	Durbin-Watson
EXVOPN	Exchange Rate Volatility and Trade Openness
FDI	Foreign Direct Investment
GARCH	Generalised Auto Regressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
GMM	Generalized Methods of Moments

GPC	Gross Domestic Product Per Capita
HQ	Hannan-Quinn Information criterion
IND	Industry Sector contribution to GDP
IMF	International Monetary Fund
INF	Inflation
LAID	Log of Foreign Aid
LDCs	Less Developed Countries
LINF	Log of Inflation
LGPC	Log of Gross Domestic Product Per Capita
LOPN	Log of Trade Openness
LTR	Log of Tax Revenue
MNCs	Multinational Corporations
OECD	Organization of Economic Co-operation and Development
OLS	Ordinary Least Square
PP	Phillips-Perron
R&D	Research and Development
RER	Real Effective Exchange Rate
SAP	Structural Adjustment Programme
SBC	Schwartz-Bayesian Criterion
SIC	Schwarz Information Criterion
TR	Tax Revenue
US	United States
VAR	Vector Auto Regressive

VAT	Value Added Tax
VECM	Vector Error Correction Mechanism
WAMZ	West Africa Monetary Zone
WDI	World Development Indicators

CHAPTER ONE

INTRODUCTION

Background to the Study

The development of a nation depends to a large extent on revenue. The World Bank (1988) defines tax as a compulsory, unrequited payments made to the government by individuals, businesses or institutions. Taxes play essential role in economic planning and development as it forms the main source of revenue for both developed and developing economies.

Globally, taxes play important role in the economy at both micro and macro levels. Firstly, tax remains the main source of central government revenue, since tax collection is mandatory and regular, which can guarantee the stability of income needed for developmental purposes. Secondly, taxation aims to meet the social and public needs by providing public goods and services. Thirdly, government need tax revenue to establish armed forces and judicial systems to ensure security and justice for the society.

Taxes can be a powerful means in order to achieve the goals of social progress and the objectives of economic development. It serves as a device to encourage the growth of certain activities by way of giving exemptions; discourage use of certain products by way of imposing heavier charges like those taxes imposed on tobacco products; or strengthen anaemic enterprises through exemptions. Moreover, local industries may be protected through taxation by imposing high custom duties on foreign goods. Taxation can also be used to reduce

inequities or inequalities in wealth and income as in the case of estate and income tax.

Several studies have been conducted to empirically explore the determinants of tax revenue around the world. Studies by authors including but not limited to Teera and Hudson (2004), Sen Gupta (2007), Brafu-Insaidoo, and Obeng (2008), Aggrey (2013) have enumerated macroeconomic variables determining tax revenue performance. These variables include GDP Per Capita, Foreign Aid, Foreign Direct Investment, Inflation, Real Exchange rate, Trade openness, Agricultural sector contribution to GDP, Industrial sector contribution to GDP, Debt to GDP among others as main determinants of tax performance. For instance, Brafu-Insaidoo, and Obeng (2008), found that per capita income and tariff rate affect tax revenue. Pivovarsky, Clements, Gupta, and Tiongson (2003) have also shown that foreign aid has a negative impact on tax revenue.

One key factor or variable that possibly affect tax revenue but all these studies failed to explore is the exchange rate volatility. The real exchange rate by far determines international competitiveness of countries and therefore any instability in it have implications on trade, employment, investment, economic activity, and trade tax revenue realised in a particular period. As Ghana continues to open up to trade, tax revenue would be affected more if volatility in the real exchange rate continues or persist. As evident of developing countries, heavy reliance on imports poses various challenges to the economy including exchange rate volatility. Since the breakdown of the Bretton Woods Accord in 1973 and the advent of floating exchange rate, there has been renewed interest on the effect of

depreciation/appreciation of a country's currency on the trade balance and trade taxes of both developed and developing countries. Obstfeld and Rogoff (1995), Obstfeld and Rogoff (1998), Hau (2002), Calderón (2004) among others have shown that exchange rate volatility is more pronounced in more open economies by asserting that the more volatile the exchange rate becomes, the more risky trade becomes impacting tax revenue adversely.

According to Côté (1994), exchange rate volatility can affect trade directly, through uncertainty and adjustment costs, and indirectly, through its effect on the structure of output and investment and on government policy. Recent studies by Alagidede and Ibrahim, (2016), Alagidede and Ibrahim (2017) and Tarawalie, Sissoho, Conte, and Ahortor (2013) as cited in Obeng (2017) provide evidence of high exchange rate volatility in Ghana.

Particularly, Alagidede and Ibrahim (2016) as cited in Obeng (2017) further provide evidence to support the claim that deviations resulting from shocks to the exchange rate market take about 15 years to be corrected in Ghana. Even though flexible exchange rate is supposed to be self-correcting, at least theoretically, the long and slow adjustment period, in reality, could generate higher risk with deleterious effects on exports volumes and by extension trade tax revenue (Williamson, 1983 and De Grauwe, 1988 as cited in De Vita & Abbot, 2004). The fact that growth is affected in the long run due to exchange rate volatility, tax revenue generation would also be affected. From these empirical findings, exchange rate volatility is seen as a risk factor to trade and therefore it is prudent to extend the analysis further from just looking at the effect of exchange rate volatility

on trade. The study therefore explores this possibility by estimating the effect of exchange rate volatility on tax revenue using Ghana as a case study.

The need to mobilise domestic revenues for development has become even more vital in the wake of the global economic crisis, and greater difficulty in attracting private capital flows and dwindling foreign aid. Since Ghana became a lower middle-income country, total grant receipts especially from European countries like the United Kingdom has been falling annually. The Ministry of Finance in 2015, reported that grants to total revenue has reduced steadily from 6.19 percent in 2004 to 0.5 percent in 2014. Sovereign debt has also been a very serious concern to the government basically due to the problem of debt sustainability and economic growth. Ghana's Debt Stock to GDP was 67.6 percent in 2015 and it close to 70 percent currently according to the IMF.

For Ghana, these lingering problems have brought into sharp focus the importance of urgently addressing the structural factors that hamper tax performance. Being able to depend on reliable sources of funding in the form of taxes will allow Ghana to reduce its dependency on official development assistance. It will also give Ghana power to determine its own development priorities and fund them accordingly without having to mollify donors, who attach conditions to development aid that often reflect the interests of the donor rather than the recipient

Comparatively, Ghana has been losing revenue from trade related taxes. Since 2004, grants to GDP has been on the decline with the effect being higher tax burden on citizens as seen in figure 1. Ghana is confronted with several challenges in raising domestic revenue in the form of taxes to finance public projects. Low per

capita income, reliance on primary exports, developing tax systems, and weak customs administrations all contribute to difficulties in raising tax revenues. In spite of efforts made in revamping the industrial sector, improving GDP growth rate, crackdown on smuggling among others there exist some lapses in tax administration. Tax revenue to GDP remains low at an average of 14 percent compared to Sub-Saharan African average of 18 percent even though trade continues to be liberalised. Generally, tax performance in the past decade has not been so encouraging as the country has barely improved on its total tax revenue to Gross Domestic Product (GDP) of 17.5 percent realised in 2011. Below is a comparative analytical trend of overall tax revenue to the government from both domestic and international sources.

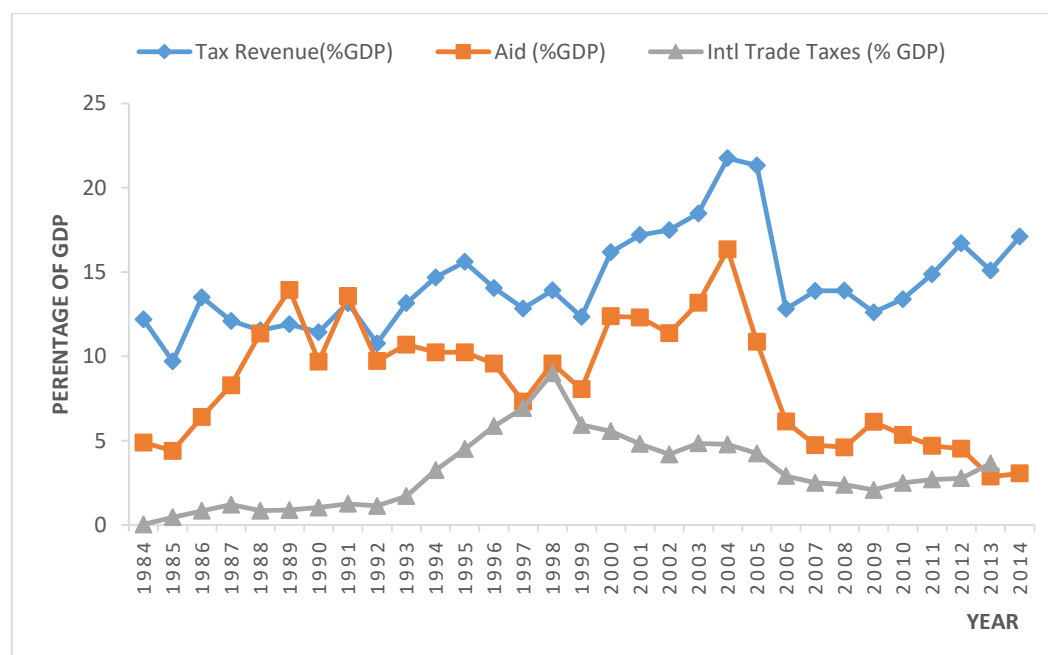


Figure 1: Plot of Major Components of Tax Revenue (1984 – 2014)

Source: By Author with data from WDI

A careful look at figure 1 reveals that the trends of overall tax-to-GDP, trade taxes, and aid performance have been largely unstable. For instance, trade taxes rose steadily from a little over zero percent to 9 percent from 1984 to 1998. On Aid, receipt was also encouraging as it increased from 5 percent in 1984 to 16 percent in 2004 though there were significant fluctuations 1990, 1992, and 1997. Lastly, on tax-to-GDP, the trend was also encouraging as the trend basically increased from 9.7 percent in 1997 to 21.8 percent in 2004.

However, the gains dipped in 2004 and from then, all but tax-to-GDP have continued that way. So, what might be the reason(s) for this unstable or fluctuating trend in the tax-to-GDP for Ghana? With the windfalls falling, Ghana cannot be satisfied with the blessings from gains from international trade in the form of production and exchange only as was posited by Heckscher and Ohlin, (1991) and Rybczynski (1955). If trade related taxes had been averaging half as domestic receipts, Ghana will be able to generate reliable revenues for developmental purposes. The study juxtaposes this unstable trend in Ghana's tax revenue with exchange rate volatility. The figure below is a graph of exchange rate volatility for Ghana over the study period.

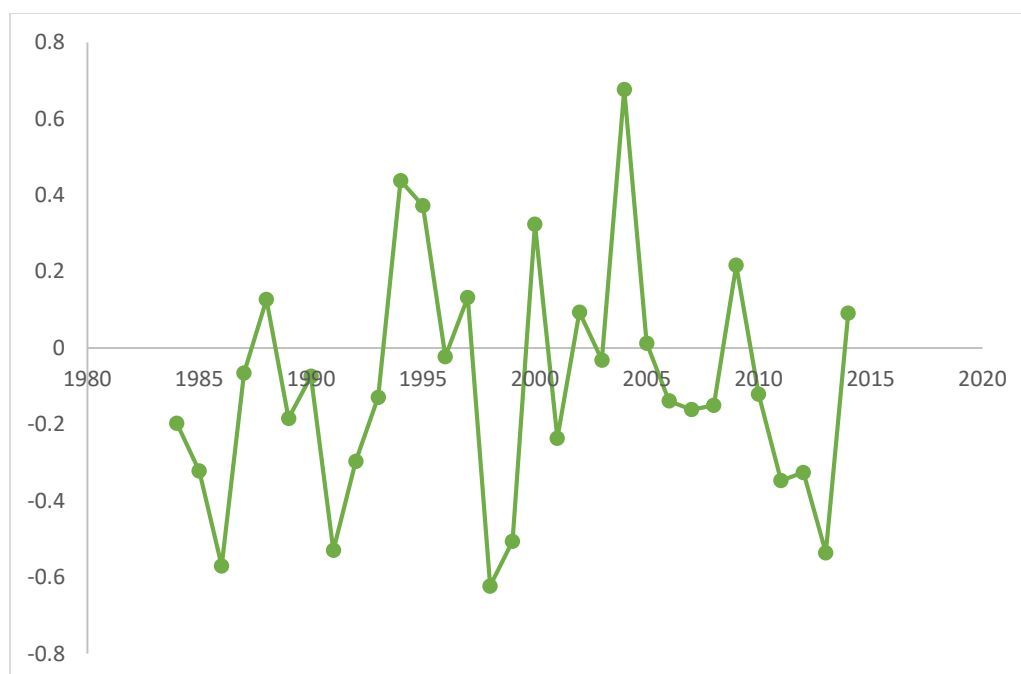


Figure 2: Graph of Exchange Rate Volatility

Source: By Author using Data from WDI, 2017

Since the adoption of the flexible exchange rate regime in Ghana, the Ghana Cedi has depreciated against major currencies especially the US Dollar (US\$), albeit, not monotonically, as the Ghana Cedi recorded a modicum of stability between 2002 and 2007. Ghana redenominated her currency on 1st July 2007 where US\$1 was exchanged for 93 pesewas. This move saw a depreciation of the Cedi overtime and by the end of July 2009, the US\$ was exchanged for GH¢1.49. However, between August 2009 to March 2010, the Cedi marginally appreciated by 3% and was consequently exchanged for US\$= GH¢1.49 in April 2010. Most recently, the Cedi has been very volatile. For instance, at the beginning of January 2014, a dollar was exchanged for GH¢2.21 and by the end of September

2014, the Cedi–Dollar exchange rate stood at GH¢3.20 – denoting about 44.65% depreciation.

Arguably, this level of depreciation contributed to a rise in consumer price inflation which stood at 17% in December 2014 from 13.8% in January 2014. Increased exchange rate instability especially in the last two decades (1995 – 2015) has affected Ghana’s openness to trade by making trade riskier and by extension its implication on tax revenue. A more pronounced, downward volatility in the two decades as seen in the figure 2 are volatilities in 1998, 1999, 2001, and 2006 to 2014 with the exception of 2010. However, stabilisation of the Ghanaian economy in 2010 (improved fiscal balance, low inflation, and stable exchange rate) led to the increase in tax-to-GDP from 12.6 percent in 2009 to 13.4 percent in 2010. This clear association between exchange rate volatility and tax revenue is interesting and worth investigating.

Statement of the Problem

Economists have long been interested in factors that cause different countries to grow at different rates in terms of tax revenue. The need to improve and sustain tax revenue is not only a major concern of the economic policy makers, tax specialists and administrators but has long been of interest to academics. Over the years, the trend of tax revenue of Ghana has been unstable. For instance, tax revenue increased from 10.7 percent in 1992 to 15.6 percent in 1995 and reduced thereof to 12.8 percent in 1997. More significant over the years was the sharp dip in the percentage of tax to GDP in 2004 from 21.8 percent to 12.8 percent in 2006.

Theoretically and empirically, efforts have been made to establish the main determinants of tax revenue. These include; the general level of development (reflected in per capita income and levels of literacy, urbanization, communication, etc.), the administrative and political constraints on the fiscal system, social-political values, indigenous institutional arrangements, popular desires for government spending, plus other factors which condition overall willingness to pay taxes (Weiss 1969). However, the effect of GDP per capita, inflation, trade openness, foreign aid, debt, corruption, and exchange rate are mostly explored. For instance, Tanzi (1989) observed that there is often an inverse relationship between a country's tax revenue and the real level of its official exchange rate. Moreover, studies such as De Grauwe (1988) and Hooper and Kohlhagen (1978) which considered exchange rate volatility, a risk factor to trade, did not estimate the effect on tax revenue.

However, critical to the unstable tax revenue in Ghana could be due to the instability that characterise the real effective exchange rate which has become more prevalent in recent years (For example, at the commencement of January 2014, 1 United States dollar was exchanged for GH¢2.21 and by the end of September 2014, the Cedi–Dollar exchange rate stood at GH¢3.20 – signifying about 44.65% depreciation. This stem from the fact that once trade become riskier due to exchange rate volatility, the effect is felt on tax revenue too.

This study is motivated by the need to empirically determine the effect of exchange rate volatility on tax revenue in Ghana more importantly because no study has been carried out with regards to the subject matter.

Objectives of the Study

1. To present a trend analysis of tax revenue and exchange rate volatility over the study period (1984 – 2014)
2. To estimate the effect of exchange rate volatility on tax revenue.
3. To estimate the causal relationship between exchange rate volatility and tax revenue.

Hypotheses

1. H_0 : Exchange rate volatility has no effect on tax revenue.
 H_A : Exchange rate volatility has effect on tax revenue.
2. H_0 : There is no causal relationship between exchange rate volatility and tax revenue
 H_A : There is a causal relationship between exchange rate volatility and tax revenue

Significance of the study

The study will be beneficial to the Bank of Ghana and Ministry of Trade as it looks at how exchange rate volatility affects trade tax revenue generation and the way forward in maximizing tax revenue for the fulfilment of Government objectives and goals. The result will point to these institutions the magnitude of revenue losses given exchange rate volatility.

This will go a long way to inform the Ministry of Finance and Economic Planning on their quest to help the government transform the economy which is

only possible given enough revenue. The findings will further fuel the concern on the need for stability in the exchange rate.

This study seeks to add to existing literature by bridging gaps in it. The study explicitly fills the gap by determining the effect of exchange rate volatility tax revenue. This will serve as a platform for further research into issues related to effectiveness and efficiency in tax revenue generation.

Scope of the Study

Generally, this research seeks to estimate the effect of exchange rate volatility on tax revenue in Ghana. It includes theoretical and empirical discussions of taxation, exchange rate volatility and tax revenue. The study considered a thirty-year period spanning from 1984 to 2014. This period saw Ghana adopt a flexible exchange rate regime while trade was as well largely liberalised.

Based on economic theory, data on several time series variables: tax revenue, trade openness, foreign aid, inflation, share of industry to GDP were selected for this study to test the hypotheses. Exchange rate volatility was however calculated. Moreover, the Auto Regressive Distributed Lagged (ARDL) technique was used to estimate the short run and long run relationship between tax revenue and exchange rate volatility.

Organization of the Study

The study is organized into five main chapters with each chapter further divided into sections and sub-sections. The first chapter which is the introductory

chapter presents a background to the study, problem statement, objectives of the study, hypotheses, scope of the study as well as organization of the study. Chapter two focuses basically on the overview of the Ghanaian economy with regards to taxation, theoretical as well as empirical literature on tax revenue and exchange rate volatility. Chapter three focuses on the specification of the empirical model and estimation technique employed in conducting the study. The results from the estimation were analyzed and discussed in chapter four. Chapter five presents the summary of findings, conclusion, policy implications and recommendations of the study.

Chapter Summary

This chapter basically provided an introduction of the study. The background, problem statement, hypothesis, significance of the study as well as how the study was conducted was also provided.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The main aim of this chapter was to present the review of relevant literature on the relationship between tax revenue and exchange rate volatility. The first section looks at the concept of taxation and the historical perspective of taxation in Ghana. This was followed by the theoretical literature review which encompassed theory and models. The second section reviews literature on exchange rate volatility, and other determinants of tax revenue. The last section deals with empirical literature review with particular emphasis on tax revenue in general.

The Concept of Taxation

Since antiquity, taxation has attracted widespread attention from the schooled and unschooled due to its impact of real income. To the layman, a ‘tax’ may be defined as an amount of money levied by a government on its citizens and proceeds used to run the economy, a municipality, a state, or the country. More intuitively, a tax is a compulsory and obligatory contribution to state revenue, from personal income and business profits or transactions. The Latin word ‘*taxo*’ which literally translates in English as ‘tax’ is to impose a financial charge or other levy upon a taxpayer (an individual or legal entity) by a State such that failure to pay is punishable by law.

Taxation is based strictly on an arbitrary system of laws passed by Parliament and interpreted by the Judiciary, giving effect to what one must assume

to be the democratic will of the citizens (Akoto, 2001). A tax is not a voluntary payment or donation, but an enforced contribution, exacted pursuant to legislative authority and is any contribution imposed by central government or any of its subsidiaries whether under the name of toll, tribute, tillage, impost, duty, custom, excise, subsidy, aid, supply, or other name with a fundamental aim of mobilizing sufficient revenue to meet the growing public sector infrastructural requirements. Raising tax revenues is one of the most crucial or central activity of any country. Most fundamentally, revenue from taxation is what literally sustains the existence of the state, providing funding for several activities ranging from social programs to infrastructure investment.

Trend in Taxation Based on Income Classification

One important factor determining tax revenue of countries is their income levels. When countries are classified based on the share of tax revenues in percentage of GDP across income groups, it can be seen that differences across groups are sharp (see Figure 3). The low-income group has the lowest tax-to-GDP ratio, but it has been improving since 1998. The improvement is clearer especially in recent years. For this group of countries, the average share of taxes in GDP increased to 13.6 percent of GDP in 2009 from 10.5 percent in 2003 and 10 percent in 1998. Throughout the years, each group managed to increase its average tax-to-GDP ratio, but this increase is much higher in the low-income group. Even there is still a large room for further improvement, recent developments are very promising,

given the fact that this group of countries always finds it difficult to raise enough public funds to finance development needs.

The share of taxes as a percentage of GDP is almost 6 percentage points higher for the middle-income group when compared to the average share in the low-income group. This share in the middle-income group has been consistently rising since 1998; it was 17.1 percent in 1998, and 19.3 percent in 2009.

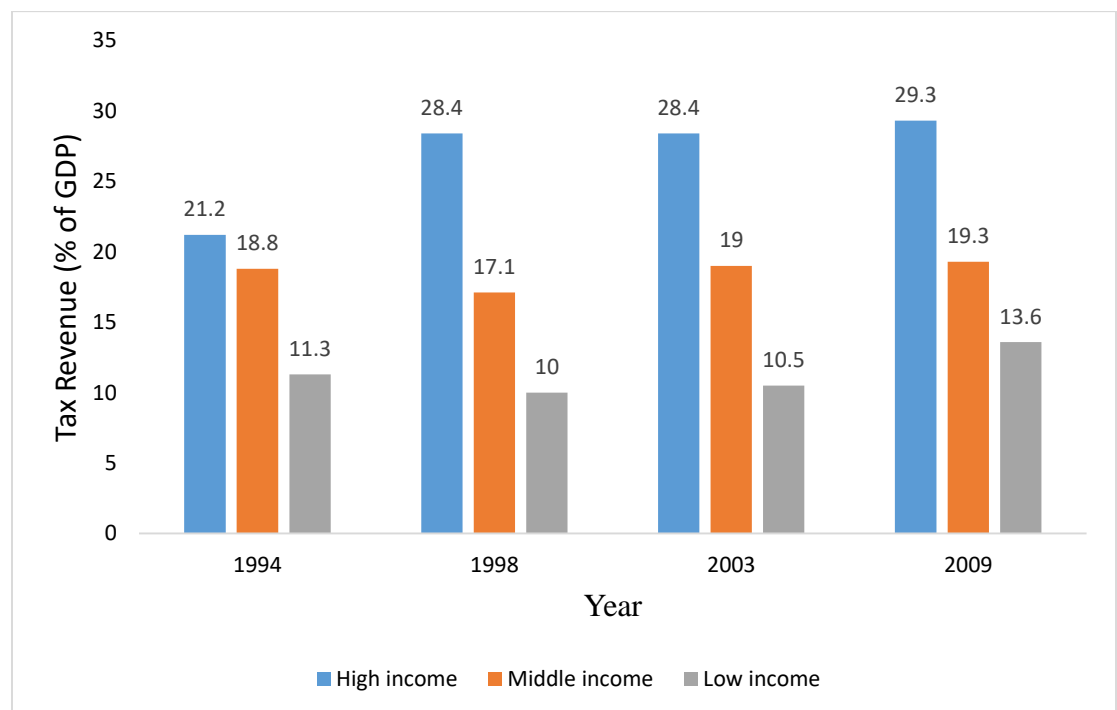


Figure 3: Tax Revenue (% of GDP) by Income Groups, 1994-2009

Source: The World Bank classification and WDI.

The highest tax share belongs to the high-income group. The group collects almost 2-3 times higher taxes in percentage of GDP when compared to the low-income group and almost 10 percentage points higher taxes when compared to the middle-income group. Tax collection in this group further increased by 1

percentage point between 2003 and 2009, a rise from 28.4 percent to 29.3 percent. After initial drops in tax collection rates mainly due to the global financial and economic crisis of 2008, the increasing trend in tax collection is expected to continue given that public spending and budget deficit increased enormously in recent years.

Trend in Taxation Based on Region

Another factor determining tax rates is the geographic region of countries. Figure 4 presents the share of tax revenues in percentage of GDP across regions. The lowest tax rate belongs to the South Asia region (SAR); they collect 10.2 to 10.5 percent taxes as a share of GDP. The East Asia and Pacific (EAP) region has the second lowest tax collection rate in the world. Taxes in EAP are around 4 percentage points higher than the one observed for SAR. The tax share in the Latin America and Caribbean (LAC) region, the Sub-Saharan Africa (AFR) region, and the Middle East and North Africa region (MENA) present similar tax collection, which is around 18 percent of GDP. But the shares have been consistently rising in the LAC and MENA regions in recent years.

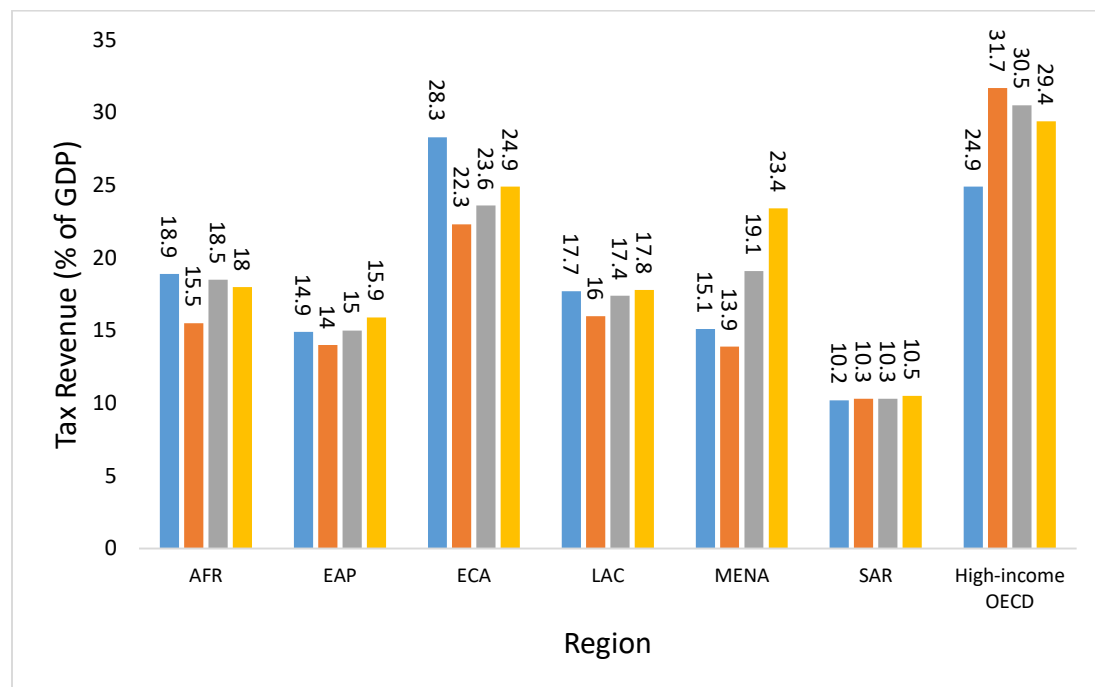


Figure 4: Tax Revenue (%GDP) by Regions, 1994 - 2009

Source: The World Bank classification and WDI.

Note: AFR is Sub-Saharan Africa, EAP is East Asia and Pacific, ECA is Eastern European and Central Asia, LAC is Latin America and Caribbean, MENA is Middle East and North Africa, SAR is South Asia.

After a sharp drop in taxes in percentage of GDP in the Eastern European and Central Asia (ECA) region in 1994, the rate has been rising consistently from 22.3 percent in 1998 to 23.6 percent and 24.9 percent in 2003 and 2009, respectively. OECD high-income countries have the highest tax collection as percentage of GDP, but they are the only group of countries which have dropping tax on average throughout the period. It declined from 31.7 percent of GDP in 1998 to 30.5 percent in 2003 and to 29.4 percent in 2009.

Historical Perspective of Taxation in Ghana

Paying taxes, and avoiding paying taxes, is an act older than the pyramids. The earliest cuneiform samples of Mesopotamia circa 2500 BC document the relevant poll tax and the types of tolls and fees that merchants had to pay when transporting goods from one region to another.

The law codes of Hammurabi, made famous in the Old Testament, deal with penalties for smuggling to avoid paying tax as well as the punishments of citizens trying to avoid the obligatory government service. This form of tax could take the form of hard labour on civil projects such as digging a canal or, at worst, military service. Although technically illegal, sending a hired surrogate to fulfil this obligation was a thriving trade in this ancient society, perhaps making getting out of paying your tax the world's third oldest profession.

Tax shelters have been documented as early as the fourth dynasty in the Old Kingdom of Egypt (2625-2500 B.C.E). The staff and the property of sacred temples, which were often funded through tax revenues, appeared to have been successful in gaining an exemption from paying taxes or compulsory labour. The tax collector truly became a villain in the Roman Empire, when the function was given over to ruthless profiteers who employed gangs of thugs to ensure the colonials had rendered Caesar his due. By the time of the New Testament being written, tax collectors were considered to be amongst the lower professions.

However, Paul does put a divine induction on tax season saying in Romans 13:5 “his is also why you pay taxes, for the authorities are God’s servants,

who give their full time to governing.” Implying the governor needs tax revenue to take care of itself and to meet the social welfare of his citizenry.

In more modern times, as governments became more adept at collecting taxes, the revenue accrued increased dramatically. As wars became more common and more expensive, the tax burden increased. For instance, the tax burden of the eighteenth and early nineteenth centuries increased by 85% in England. No surprise then that this period gave rise to the first calls for what we know as Progressive Taxation. Adam Smith, in *Wealth of Nations*, wrote “It is not very unreasonable that the rich should contribute to the public expense, not only in proportion to their revenue, but something more than in that proportion.” The cry “No Taxation without Representation” was the shout heard around the world, the spark that ignited the American Revolution. The Declaration of the Rights of Man has this to say about taxation: “A common contribution is essential for the maintenance of the public forces and for the cost of administration. This should be equitably distributed among all the citizens in proportion to their means.”

Introduction of Taxation in Ghana

Taxation was first introduced in Ghana, then the Gold Coast, in 1943 by the British Colonial Government at a time when World War II was raging. It should be noted, however, that before the introduction of Income Tax in 1943, several attempts had been made to modify it. For example, as far back as April, 1852, the Poll Tax Ordinance was passed to raise money to finance the increased cost of British Administration (Ali-Nakyea, 2008). Under the Ordinance, every man or

woman residing in a district under British Protection was to pay one shilling per year. These early experiments of the introduction of direct taxation was not successful due to weaknesses inherent in the system of collection. Moreover, fact remains that the first proceeds were mainly used to pay the increased salaries of British officials and not for developmental projects. The first Income Tax Law was thus the Income Tax Ordinance (No.27), 1943. This Ordinance was modeled to a large extent on the general principles underlying the Income Tax Act then in force in the United Kingdom (Ali-Nakyea, 2008)

After becoming a sovereign state, Ghana needed funds to run the state machinery, to consolidate the newly won independence and also to meet the developmental expectations of the citizens. For these reasons, there was the need for drastic changes in the Tax system inherited from the colonial masters. For example, in 1961, drastic amendments were made to the consolidated edition under Act 68, followed by Act 178 in 1963 and sealed off by Act 132 in 1965. A second consolidated edition (The Income Tax Decree, 1966-No. 78) was published in September, 1966. (Ali-Nakyea, (2008). Further steps aimed at consolidating the Income Tax System led to a series of amendments to the ordinances until the Income Tax Decree 1975, S.M.C. Decree 5 was enacted. The current Income Tax Law is the Internal Revenue Act, 2000 (Act 592).

Overview of Taxation in Ghana from the ERP era

At the beginning of the 1980s, the Ghanaian tax system was deeply in crisis. Central government taxation amounted to less than 5% of GDP, while the

government relied on heavy exactions from the agricultural sector, and cocoa producers in particular, through pricing policy in order to raise enough revenue to maintain the most basic functions of government (Aggrey, 2013) . The years since then have witnessed a dramatic reversal as Ghana has become one of the encouraging tax collectors measured by tax per GDP ratios in sub-Saharan Africa, trailing only South Africa and Kenya. During the years 2004-2007, tax revenue averaged greater than 20% of GDP, and reached 3.2 billion cedis (Aggrey, 2013).

Growth in tax revenue has been driven by large increases in both direct (income and corporate) taxes, and taxes on goods and services, including a large expansion following the introduction of the VAT in 1998. Trade taxes, the third major component of tax revenue, have remained relatively stable since the late 1980s, though this masks a significant shift, as export taxes have been virtually eliminated, while tariff revenue has grown, largely owing to expanded trade and improved customs administration. As with most tax systems in the region, there has been a growing reliance on goods and services taxes as a share of revenue, and a declining reliance on trade taxes due to trade instability.

Types and Forms of Taxes

Generally, taxes comprise direct tax and indirect tax. The meaning of direct tax and indirect tax can vary in different contexts, which can sometimes lead to confusion. This distinction is from an administrative point of view, although it may not always be correct. (Ali-Nakyea, (2008)

A direct is intended to be paid by the person or organization on whom/which it is actually levied, the impact and incidence being on the same person or organization, for example, Income Tax, Capital Gains Tax, Gift Tax and Corporate Tax. The Administrative body in Ghana is the Internal Revenue Service.

An indirect tax on the other hand, is levied on one person or entity with the expectation that the tax will be shifted or passed on to another. Here, the impact and incidence are on different persons, for example, Excise Duty, Custom Duty and Valued Added Tax. They are called Indirect Taxes because the administering authorities, the Customs, Excise and Preventive Service (C.E.P.S) and the Value-Added Tax Service (V.A.T. Service), which levy the taxes on goods and services, do not collect the taxes from the consumer but do so indirectly through importers, manufacturers or other intermediaries. The shifting or passing on of liabilities is affected by loading the tax element on the selling price of the commodity/services sold to the next person in the commercial chain until it is finally borne by the consumer.

The chief components of direct taxes are individual income tax and corporate tax, with other recognized components, including capital gains, property and rent taxes, contributing very little to revenue generation due to extremely weak enforcement. Individual income tax is a progressive tax with a top rate of 25%, while the corporate tax rate has been significantly reduced over the past few years from 32.5% in 2001 to 25% in 2006. These reductions in the corporate tax rate, coupled with improved ease of compliance, were reflected in Ghana's gains in the World Bank Doing Business survey, climbing from 83rd position to 77th position

in a League of 175 countries. Ghana was for that period among the top ten movers in the World Bank Doing Business survey. In revenue terms, corporate taxes and individual income taxes comprise almost identical shares of the total tax take, which is the end result of steady gains in the area of individual income taxation. From individual income taxes, the overwhelming share (88.7% in 2007) comes from withheld taxes on formal sector wages (PAYE), with only tiny share accruing from the self-employed, which encompasses most of the informal sector and many professional occupations, such as consultants. For example, income taxes are collected from the persons who earn periodic income. By contrast, indirect taxes are collected from someone other than the person ostensibly responsible for paying the taxes.

A country's tax system is often a reflection of its communal values or/and the values of the government in power. To create a system of taxation, a nation must make choices regarding the distribution of the tax burden; who will pay taxes and how much they will pay and how the taxes collected will be spent. In democratic nations where the public elects those in charge of establishing the tax system, these choices reflect the type of community that the public and/or government wish to create. In countries where the public does not have a significant amount of influence over the system of taxation, that system may be more of a reflection on the values of those in power.

Attributes of a Good Tax System

Ali-Nakyea (2008), citing Adams Smith, in his book “The Wealth of Nations” in which the attributes of taxation are captioned as “canons of taxation.” states four significant attributes which were relevant in the time of Adams Smith and which are still relevant today. These are:

Equity: - A good tax system should be fair to the people who are required to pay it. The subjects of every state are to contribute their quota by way of taxes to support the government nearly as possible in proportion to their respective abilities. Ability to pay refers to the economic resources under a person’s control. For example, income taxes are based on a person’s inflow of economic resources during the year, whereas VAT and other Indirect Taxes, are based on a person’s consumption of resources represented by the purchase of goods and services. Rent Tax on the other hand, is based on a person’s accumulation of resources in the form of landed property.

Certainty: - People should be able to determine their true tax liability with a fair degree of accuracy. Tax payers should be clear in their minds as to how much tax they are owing and how much is payable at any point in time. There should be no ambiguities and tax administrators must have no discretionary powers as to how much to demand, that is, the tax administrator is not to squeeze out more than necessary. Additionally, the time of payment, the manner of payment, the amount to be paid, the place of payment as well as all rights and obligations under the laws must be known to both the tax administrator and the tax payer. - It can be said that the Internal Revenue Service, the administrator of direct taxes in Ghana issues tax

assessments that categorically states all the aspects of the rights and obligations as already said.

Convenience: - A good tax should be convenient for the government to administer and for the people to pay. Perhaps the most important characteristic of this canon is that tax payers must not overly suffer in order to comply with the tax laws. Every tax must be levied in a manner that makes it convenient for the contributor to pay it. The method of collecting the tax should be such that the majority of the tax payers would understand and routinely comply. The collection method should not overly intrude on tax payers' privacy but should offer minimal opportunity for non-compliance.

Economy: - A good tax should be economical to the government. The administrative cost of collecting and enforcing the tax should be reasonable in comparison with the total revenue generated by the tax. Every tax ought to be so contrived as both to take and keep out of the pockets of the people as little as possible over and above what it brings into the Consolidated Fund.

Simplicity: A system of taxation ought to be simple, plain and intelligible. If a tax system is complicated, it becomes difficult to understand and administer, leading to administrative, interpretation and legal problems.

Elasticity/Flexibility: A system of taxation ought to respond automatically to changes in the community's wealth, population and other important variables. In this sense therefore, it should be possible for the tax structure in terms of both tax rate and coverage, to suit the changing nature and circumstances of the economy.

Productivity: A system of taxation ought to produce a high-net yield of revenue but not so high as to damage the source of that revenue. It should be able to yield enough revenue such that government should have no recourse to deficit financing.

International Trade Taxes

Tax revenue from duties on imports and exports trade transaction constitutes revenues from international trade taxes. Import duty is a tax levied on all imports in exception of those items exempted by the law. It is charge on the Cost, Insurance and Freight (CIF) value of commodities. Also, it is levied at different rates. However, it must be noted that there is a clear distinction between import VAT and import duty. Import VAT is charged at a flat rate and levied on duty inclusive value of the goods.

Export duties are grouped into two major categories; traditional and non-traditional exports. The traditional export commodities involve: beans, cocoa, logs, fresh fish and yam, electricity and mineral ore (for instance, unprocessed gold). However, the non-traditional commodities consist of all commodities excluded from the traditional type. With the exception of cocoa beans and hydrocarbon, the other exports commodities attract zero percent. Parrots, rattan canes, narcotics, bamboo, pornographic materials and Ghanaian currency in excess of GH 5000.00 are prohibited from export under the law in Ghana.

Tax Revenue Performance in Ghana

The figure shows the trend of tax revenue from both domestic and international sources over the study period (1984 – 2014).

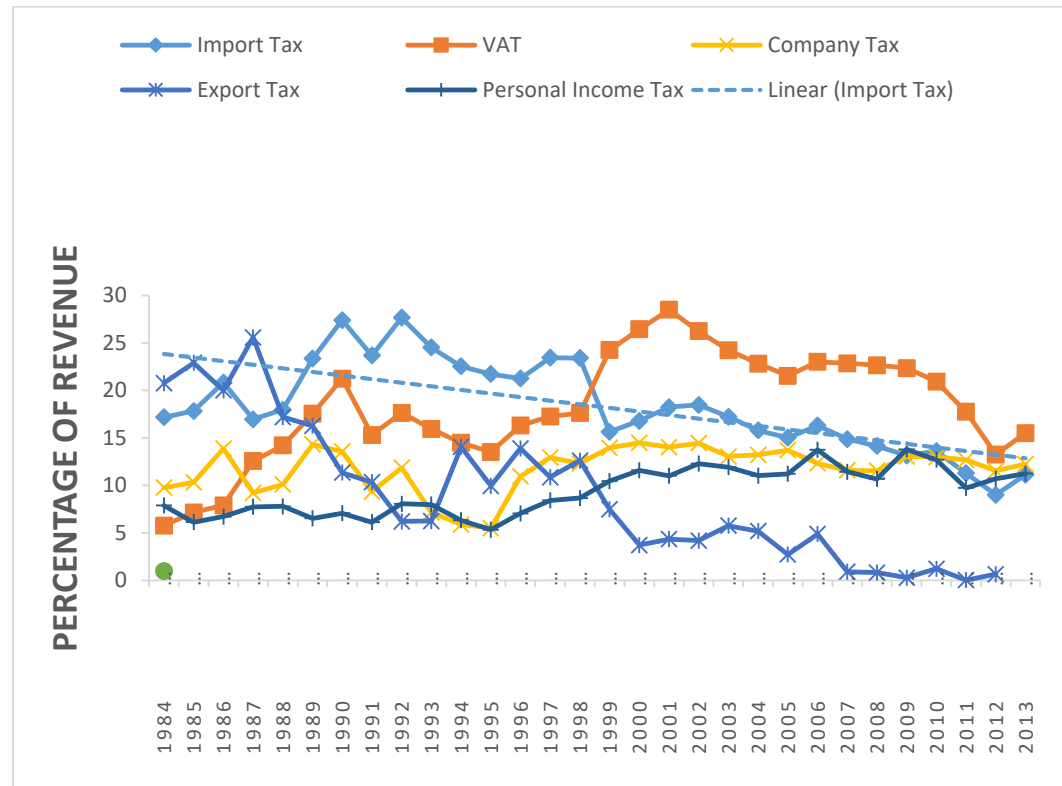


Figure 5: Plot of Main Components of Tax Revenue from Domestic and International Sources

Source: Figure by Author with data from Ghana Revenue Authority, Ministry of Finance and Economic Planning, and ISSER, 2017

The most glaring effect perhaps of the fiscal adjustment is the tremendous increases in almost all sources of government revenue. These increases consequently contributed to the massive restoration of fiscal discipline. For instance, the budget deficit was reversed from 2.6 percent of GDP to a surplus of 1.5 percent in 1983 and 1991 respectively. But, this impressive performance

became very difficult to sustain from 1992 to 2013. The budget moved back again into a deficit amounting to 8.4 percent in 1997, however, this was reduced to 0.89 percent in 2011. Within the same year, total government revenue grew by more than 26 times. This then caused the proportion of revenue to GDP ratio to increase from 5.4 to 29.6 percent from 1984 to 2003 respectively. Moreover, the tax revenue decreased from 12.19 percent of GDP in 1984 to 9.69 percent in 1985. The share declined gradually to 11.4 percent in 1990 before rising sharply to 22.4 percent in 2004 (Figure 5).

The tax policy measures introduced after 1982 led to a sharp rise in the share of international trade taxes in total revenue to 48.8 percent (thus, sum of import and export taxes) in 1983 before declining steadily to 9.67 percent in 2012 (Figure 5). The tax policy measures and the reform process also led to a great change in the relative shares of the components of the international trade taxes, that is import and export duties. While in 1984 some 17.7 percent of the total tax revenue was realized from export duty; by 2012 the proportion of export duty had fallen to 0.67 percent. On the other hand, the proportion of import tax receipts in total tax revenue increased from 17.7 percent in 1984 to 27.4 percent in 1990 before declining to 9.0 percent in 2012 (see Figure 5). Thus, import tax replaced export tax as a major source of revenue originating from international trade taxes after 1987. Since revenue from export tax is mainly duty on cocoa exports, the decline in the former was based on the decline in cocoa export duty revenue. The decline in the cocoa duty was due to the falling cocoa prices on the world market as well

as the government's policy to pay a realistic producer price to cocoa farmers especially in 1981-1982 and the period after 1987.

The contribution of taxes from personal income and company tax to the total revenue was likewise affected by the policy measures. In relation to the total revenue, the proportion of taxes from personal income and company tax increased from 15.96 percent in 1984 to 20.6 percent in 1986 and then declined gradually to 12.2 percent in 1994. Thereafter, the share jumped to 26.8 percent in 2009 (Figure 5). In general, the lack of growth in direct taxes in less developed countries may reflect the relative strength of indirect taxes. But, in Ghana, it was also probable to be the result of the reductions in the marginal and rates of personal and corporate taxes as well as the widening of the tax brackets individually. Obviously, the structure of the personal income tax did not change much during 1984 to 2014. However, it is essential to notice that revenue from company taxes increased its contribution to total tax revenue from 7.4 percent in 1984 to 14.3 percent in 1989, whereas the share of personal income declined from 8.6 percent to 6.5 percent as seen in figure 3.

This development reflected the availability of foreign exchange which permitted large imports of important inputs to support the recovery of the industrial production growth. Also, the abolition of the price control system permitted producers to set prices at domestic market levels and hence increased the sales value and companies' incomes and profits. The decline in the share of income tax revenue was largely the result of an income tax policy that sought to lower the tax burden on personal incomes. Even though, taxes on incomes of self-employed

persons expanded, the increases were very slow compared with the reduction in taxes of incomes of employees.

Figure 5 gives the picture in terms of performance of the main components of tax revenue to the Government of Ghana over the study period, 1984 – 2014.

Theoretical Literature Review

The Expediency Theory

This theory asserts that every tax proposal must pass the test of practicability. It must be the only consideration weighing with the authorities in choosing a tax proposal. Economic and social objectives of the state as well as the effects of a tax system should be treated as irrelevant. This proposition has a truth in it, since it is useless to have a tax which cannot be levied and collected efficiently. There are pressures from economic, social and political groups as every group tries to protect and promote its own interests and authorities are often forced to reshape tax structure to accommodate these pressures. In addition, the administrative set up may not be efficient to collect the tax at a reasonable cost of collection. Taxation provides a powerful set of policy tools to the authorities and should be effectively used for remedying economic and social ills of the society such as income inequalities, regional disparities, unemployment, cyclical fluctuations and so on.

The Socio-Political Theory

Wagner (1883) advocated that social and political objectives should be the deciding factors in choosing taxes. Wagner did not believe in individualist approach to a problem. He wanted each economic problem to be looked at in its social and

political context and an appropriate solution found thereof. The society consisted of individuals, but was more than the sum total of its individual members. It had an existence and entity of its own which needed preservation and taking care of.

Accordingly, a tax system should not be designed to serve individual members of the society, but should be used to cure the ills of society as a whole. Wagner, in other words, was advocating a modern welfare approach in evolving and adopting a tax policy. He was specifically in favour of using taxation for reducing income inequalities. He maintained that private property and inheritance were the result of state policies and not because of any God-given rights. The State, therefore, had the right to control the ownership of property and its inheritance in the interests of the society as a whole. Wagner's ideas, though much criticized at that time, are now the hall-mark of fiscal policies of modern state.

The Benefits-Received Theory

This theory proceeds on the assumption that there is basically an exchange or contractual relationship between tax-payers and the state. The state provides certain goods and services to the members of the society and they contribute to the cost of these supplies in proportion to the benefits received. In this quid pro quo set up, there is no place for issues like equitable distribution of income and wealth. Instead, the benefits received are taken to represent the basis for distributing the tax burden in a specific manner. This theory overlooks the possible use of the tax policy for bringing about economic growth or economic stabilization in the country.

The Cost of Service Theory

This theory is very similar to the benefits-received theory. It emphasises the semi-commercial relationship between the state and the citizens to a greater extent. The implication is that the citizens are not entitled to any benefits from the state and if they do receive any, they must pay the cost thereof. In this theory, the state is being asked to give up basic protective and welfare functions. It is to scrupulously recover the cost of the services and therefore this theory, unlike the benefits received one, specifically implies a balanced budget policy. In the process, the state is not to be concerned with the problems of income distribution. No efforts are to be made to improve income distribution; and no notice is to be taken if the policy of levying taxes according to the cost of service principles deteriorates it further.

Ability to Pay Theory

This approach considers tax liability in its true form-compulsory payment to the state without quid pro quo. It does not assume any commercial or semi-commercial relationship between the state and the citizens. According to this theory, a citizen is to pay taxes just because he can and his relative share in the total tax burden is to be determined by his relative paying capacity. This doctrine has been in vogue for at least as the benefits theory. A good account of its history is found in Seligman. This theory was bound to be supported by socialist thinkers because of its conformity with the ideas and concepts of justice and equity. However, the doctrine received an equally strong support from non-socialist

thinkers also and became a part of the theory of welfare economics. The basic tenet of this theory is that the burden of taxation should be shared by the members of society on the principles of justice and equity. These principles necessitate that the tax burden is apportioned according to their relative ability to pay.

The topic optimal taxation system has for a long-time within facilitated economic theories and puzzled economic policy making. Among the division of economics, the term optimal taxation has come to secure the name which is obvious to economists who have interest in public finance and welfare economics. There are not less than three unique criteria for optimality of the tax system. First one could contend that a good tax system is one which minimize their sourced cost required in assessing collecting and paying the taxes this is every now and again fairly predominant concern of tax administrators, in spite the fact that they emphasize the cost incurred by the tax collectors and tern to disregard those born by the firms and consumers who pay the taxes.

Second alternative tax system can be assessed in terms of justices or fairness. That would seem to be the line of thought all the time which is most natural for the common tax payer to follow, in spite of the fact that this idea of fairness may not be extremely precise and may incorporate consideration which the economists would like to group under a different heading. Third, tax system can be run according to economic efficiency criteria which was the original point of departure for the economic theory of optimal taxation; the optimal tax system which are minimise aggregate loss of any giving tax revenue or level of public expenditure.

The theory bit by bit takes account of distributional concern. As for administrative cost, this has so far not been sufficiently incorporated in the theory. From an efficiency perspective, a perfect tax system is one that is consistent with a pareto optimal resource distribution. Classical solution for this purpose is to support lumps tax which is obviously impartial in every single assessment by consumers and producers. However, not an exceptional useful conclusion to the economists of public finance.

The Standard Theory of Optimal Taxation

Pigou (1932) contended that indirect taxes can be used to enhance the efficiency of the market allocation of resources. In any case, it seems entirely reasonable to acknowledge the illustration of the assumption that the public sector can raise all its tax revenue from pigouvian tax and once this is acknowledged, we confront the second-best issue to make the best of a tax system which is necessary distorted. This is the issue that the optimal tax writings are fundamentally concerned.

Optimal tax policy, is principally based on the underlining works of Ramsey (1927), Mirrlees (1971), Diamond and Mirrlees (1971), (Mirrlees, 1976). There has being a substantial change in the theory over the past decade. Generally, tax policy has progressed in the guidelines proposed by theory along a few dimensions, even though, the recommendation along this dimension are not always conclusive. Among the organization of economic cooperation and development (OECD) countries, high marginal tax rates have decreased, marginal income tax have flattened and commodity taxes are more usually assessed on final goods.

Nonetheless, trends in capital are mixed, and rate still are well above the zero-level suggested by theorists (Karras & Furceri, 2011)

The Standard theory of optimal taxation posits that a tax system should be chosen to boost a social welfare function subject to a set of constraint. Literature on optimal taxation typically considers a social planning as utilitarian; that is social welfare function is based on the utility in the society. The broadest analysis uses a social welfare function that is nonlinear of individual utility, where nonlinearity allows a social planner who prefers a more even-handed distribution of utility.

To simplify the problem confronting the social planner, it is often assumed that everybody in the society has the same preference over consumption and leisure. Sometimes this homogeneity assumption is made a stride further by assuming that the economy is populated by totally indistinguishable individuals. The point of the social planner is choosing a tax system that maximizes the representative consumer welfare, realizing that the consumer will respond to whatever incentives the tax system provides.

After determining an objective function, the following step is to specify the constraints confronting the social planner in the execution of a tax system. In the early contribution, Ramsey (1927) suggested one line of attack: supposed the organizer must raise a specific amount of that such taxes should be imposed in inverse proportion to the representative consumer's elasticity of demand for the good, so that commodities which experience inelastic demand are taxed more heavily. Ramsey's efforts have had a profound impact on theory as well as other fields such as public goods pricing and regulation.

However, from the perspective of the literature on optimal taxation in which the objective is to get the best tax system, it is obviously hard to rule out some conceivable tax systems by assumption. At the point when the social planner is unconstrained in choosing a tax system, then the problem of optimal taxation becomes easy: the optimal tax is simply a lump sum tax. With any market imperfection such as a pre-existing externality, lump-sum tax does precisely what the social planner wants and therefore it is best not to distort consumer choices. The reasons why lump sum taxes are not mostly used is that it equally falls on the poor and rich, placing a greater relative burden on the poor. This implies that, the social planner has to come to grips with heterogeneity in taxpayers' ability to pay. The taxes would not depend on any choice an individual makes, so it would not distort incentives, and the planner could achieve equality with no efficiency costs.

Mirrlees (1971) analysed the second thought on optimal taxation models, offering an approach to formalize the planner's problem that deal explicitly with unobserved heterogeneity among taxpayers. In the simplest version of the model, individuals vary in their innate ability to earn income. The planner can observe income, which depends on both the ability and effort, yet the planner can see neither ability nor effort directly. In the event that planner tries to tax those of high ability, people will be discouraged from exerting as much effort to earn that income. Perceiving the unobserved heterogeneity, diminishing marginal utility of consumption, and incentive effects, the focus of Mirrlees approach formalizes the classic trade-off between equality and efficiency that real governments confront, and it has become the dominant approach for tax theorists.

According to Mirrlees (1971) framework, the optimal tax problem is seen as a game of imperfect information among taxpayers and the social planner. The planner would want to impose tax on those with low ability, yet the social planner must ensure that the tax system does not cause those with high ability to pretend being of low ability. Actually, modern Mirrleesian analysis is regularly based on the ‘revelation principle.’ In this classic-game hypothetical result, any optimal distribution of resources can be accomplished through a policy under which individuals wilfully uncover their types in response to the incentives given. Put differently, the social planner must ensure that the tax system provides sufficient motivation for high ability, regardless of the fact that the social planner wants to focus on this group with more taxes.

The robustness of Mirrlees (1971) approach is that it allows the planners to consider all possible tax systems. The weakness of the Mirrlees framework is that it is very complex. Monitoring the incentive-compatibility constraints is necessary so that people do not produce as having lower levels of ability since that makes optimal taxation problem more difficult.

Trade Liberalisation, Exchange Rate Volatility and Tax Revenue

Trade liberalization is mainly thought to be linked to tax revenue through its effect on international trade tax revenue, though the precise relationship depends on several variables, including the nature of trade liberalization and the response of imports and exports to liberalization. Often the first step in trade liberalization is the replacement of quantitative barriers with import duties. This could result in higher trade tax revenue depending on the level of duties that are set and the change

in the value of imports in response to the liberalization measures. Trade liberalization ultimately leads to the reduction of import duties, and thus would be likely to be linked to reduced international trade tax revenue (Ebrill, Stotsky, & Gropp, 1999). The relationship between trade liberalization and tax revenue, including domestic revenue, is also uncertain and depends on a number of factors, including the structure of the tax system and administrative capabilities (Ebrill, Stotsky & Gropp, 1999; Keen & Ligthart, 2002). Often trade liberalization is accompanied by the introduction of a value-added tax (VAT) or other significant domestic tax policy changes.

Macroeconomic changes also have an influence on tax revenue. Tanzi (1989) presents several wide-ranging hypotheses of the relationship between various macroeconomic variables, including inflation and exchange rates, and tax revenue. Tanzi observes that there is often an inverse relationship between a country's tax revenue and the real level of its official exchange rate. Tanzi argues that overvaluation has a direct effect by suppressing import and export bases measured in domestic currency terms. This reduces collections of international trade taxes and sales and excise taxes, which are usually levied on domestic and imported consumption.

Overvaluation also has indirect effects by reducing the incentive to produce goods for export, encouraging capital flight and currency substitution, weakening the balance of payments, encouraging black markets, and encouraging trade restrictions. He concludes that even in heavily indebted countries, where it is generally assumed that devaluation weakens the fiscal balance through its effect on

debt service, higher revenues may offset increases in debt service so that the overall effect of devaluation is largely an empirical question.

Clark (1973) analysed the impact of unstable exchange rate among players in international trade and concluded to the extent that an exporter imports intermediate inputs from a country whose currency is depreciating, there will be some offset to declining export revenue in the form of lower input costs. In addition, when a firm trade with a large number of countries, the tendency for some exchange rates to move in offsetting directions will provide a degree of protection to its overall exposure to currency risk. However, in developing countries like Ghana, as Alagidede and Ibrahim (2017), the cedi rarely appreciates and the cost of inputs chief of which is power makes trade less profitable and by implication tax revenue to the country.

Hooper and Kohlhagen (1978), and Makin (1978) reached a generally acknowledged conclusion of a clear negative relationship between exchange rate volatility and the level of trade. However, this strong conclusion rests on a number of simplifying assumptions. First, it is assumed that there are no hedging possibilities either through the forward exchange market or through offsetting transactions. For advanced economies where there are well developed forward markets, specific transactions can be easily hedged, thus reducing exposure to unforeseen movements in exchange rates. But it needs to be recognized that such markets do not efficiently exist for the currencies of most developing countries. Moreover, even in advanced economies, the decision to continue to export or import would appear to reflect a series of transactions over time where both the

amount of foreign currency receipts and payments, as well as the forward rate, are not known with certainty.

Theoretically, the effect of exchange rate volatility depends on the interaction of several forces at work. This situation has been analysed by Canzoneri and Clark (1984), De Grauwe and Grimaldi (2005), and Gros (1987). On one hand, if the firm can adjust inputs to both high and low prices, its expected or average profits will be larger with greater exchange rate variability, as it will sell more when the price is high, and vice versa. On the other hand, to the extent that there is risk aversion, the higher variance of profits has an adverse effect on the firm and constitutes a disincentive to produce and to export. If risk aversion is relatively low, the positive effect of greater price variability on expected profits outweighs the negative impact of the higher variability of profits, and the firm will raise the average capital stock and the level of output and exports.

In a more general setting analysing the behaviour of a firm under uncertainty, De Grauwe, (1988) extends the risk-aversion channel and argues that the exact impact on exports of exchange rate volatility rests on the latter's substitution and income effects. Thus, an exporter who is very sensitive to risk will divert goods meant for exports to the domestic market as a coping strategy against the risk posed by exchange rate volatility. On the contrary, the risk averse agent will export more if s/he sees the possibility of making more profit from the volatile exchange rate.

Fierro and Reisen (1990) looked at the variety of channels through which devaluation of the exchange rate impacts on real tax receipts. Their paper seems to

be the first attempt towards empirical evidence. It establishes the causal relationships between the real exchange rate and real tax receipts. The causality test rejects the hypothesis of unidirectional causality running from taxes to the exchange rate. The causal inferences from the Sims test allow the use of the real exchange rate as an exogenous determinant in a simple simultaneous equation model. Their model endogenizes tax yields and tax bases to allow for a test of the significance and relevance of the exchange rate to explain variations in real tax receipts. An important insight results from the distinction of the direct (price) effect and indirect (output) effect of changes in the real exchange rate on tax receipts.

Moreover, there are numerous possibilities for reducing exposure to the risk of adverse exchange rate fluctuations other than forward currency markets. The key point is that for a multinational firm engaged in a wide variety of trade and financial transactions across a large number of countries, there are manifold opportunities to exploit offsetting movements in currencies and other variables. For example, there is a clear tendency for exchange rates to adjust to differences in inflation rates, and recent evidence suggests that such adjustment may be quicker than indicated by earlier studies. Thus, if domestic goods for export are priced in a foreign currency that is depreciating, the loss to the exporter from the declining exchange rate is at least partly offset by the higher foreign-currency export price (Cushman, 1986)

Obstfeld and Rogoff (1998) also provide an analysis of the welfare costs of exchange rate volatility. They extend the ‘new open economy macroeconomic model’ to an explicitly stochastic environment where risk has an impact on the

price-setting decisions of firms, and hence on output and international trade flows. They provide an illustrative example whereby reducing the variance of the exchange rate to zero by pegging the exchange rate could result in a welfare gain of up to one percent of GDP. Bergin and Tchakarov (2003) provide an extension of this type of model to more realistic situations involving incomplete asset markets and investment by firms. They are able to calculate the effects of exchange rate uncertainty for a wide range of cases and find that the welfare costs are generally quite small, on the order of one tenth of one percent of consumption.

A detailed analysis has recently been provided by Bacchetta and Van Wincoop (2000). They developed a simple, two-country, general equilibrium model where uncertainty arises from monetary, fiscal, and technology shocks, and they compared the level of trade and welfare for fixed and floating exchange rate arrangements. They reached two main conclusions. First, there is no clear relationship between the level of trade and the type of exchange rate arrangement. Depending on the preferences of consumers regarding the trade-off between consumption and leisure, as well as the monetary policy rules followed in each system, trade can be higher or lower under either exchange rate arrangement. As an example of the ambiguity of the relationship between volatility and trade in a general equilibrium environment, a monetary expansion in the foreign country would depreciate its exchange rate, causing it to reduce its imports.

However, the increased demand generated by the monetary expansion could offset part or all of the exchange rate effect. Thus, the nature of the shock that causes the exchange rate change can lead to changes in other macroeconomic

variables that offset the impact of the movement in the exchange rate. Second, the level of trade does not provide a good index of the level of welfare in a country, and thus there is no one-to-one relationship between levels of trade and welfare in comparing exchange rate systems. In their model, trade is determined by the certainty equivalent of a firm's revenue and costs in the home market relative to the foreign market, whereas the welfare of the country is determined by the volatility of consumption and leisure.

Moreover, Koren and Szeidl (2003) developed a model which brought out clearly the interactions among macroeconomic variables. They showed that what matters was not the unconditional volatility of the exchange rate as a proxy for risk, as used in many empirical papers in the literature, but rather that exchange rate uncertainty should influence trade volumes and prices through the covariances of the exchange rate with the other key variables in the model. In this general equilibrium context, they stressed that it is not uncertainty per se in the exchange rate that matters, but rather whether this uncertainty magnifies or reduces the firm's other risks on the cost and demand side, and ultimately whether it exacerbates or moderates the risk faced by consumers. In addition, they analysed the extent to which local currency versus producer currency pricing by exporters affects the risks facing the firm; their empirical evidence suggests that risk is higher with the former pricing rule.

Empirical Literature Review

The empirical literature largely deals with the nexus between exchange rate volatility and tax revenue through international trade, as well as sectorial composition of the economy, financial sector strength, inflow of foreign aid among others. In both developed and developing economies, concerns about exchange rate fluctuations have evolved in several dimensions largely due to its impact on exports (Wang & Barrett, 2007; Asseery & Peel, 1991; Arize, Osang, & Slottje, 2008); employment growth (Belke, and Setzer, 2003; Belke, Kaas, & Setzer, 2004); trade (Clark, Dollar, & Micco, 2004; Bredin, Fountas, & Murphy, 2003; Ozturk, 2006; Bahmani-Oskooee, 2001; Tenreyro, 2007); inflation (Danjuma, Shuaibu, & Sa'id, 2013); investment (Servén, 2003; (Kiyota & Urata, 2004; Fuentes, 2006), and more generally economic activity (Kandil, Berument, & Dincer, 2007; Adewuyi & Akpokodje, 2013), and growth (Mundell, 1995; Levy-Yeyati & Sturzenegger, 2001; Danne, 2000); Vieira, Holland, Da Silva & Bottecchia, 2013).

Tatliyer and Yigit (2016) and De Vita, and Abbott(2004), investigated how exchange rate volatility influences foreign trade in US and Turkey respectively. The study used quarterly time series data covering the period 1990 to 2015. The Johansen cointegration test, VECM, as well as the VAR Granger causality test were employed for the study. The findings showed that, exchange rate volatility had no long run effect on exports in Turkey. Using the ARDL bounds testing approach to cointegration, De Vita and Abbott (2004) examined exchange rate volatility on US exports to the rest of the world. It was found out that exchange

rate volatility significantly affects the volume of exports in most cases, though the magnitude and signs varied across markets of destination.

Tchokote, Uche and Agboola (2015) also found mixed results for some selected West African Countries (Ghana, Gambia, Togo, Cote d'Ivoire and Nigeria) in their study on the effect of exchange rate volatility and exports, using the Johansen cointegration estimation technique. Again, Serenis and Tsounis (2015) examined the effect of exchange rate volatility on sectoral exports of Germany, Sweden and the U covering the period 1973 to 2010. The autoregressive distributed lags (ARDL) estimation technique was employed and the findings indicated that with respect to UK and Germany, there existed a long run relationship between exchange rate volatility and the level of exports. However, the results showed no effects on exports in Sweden.

Specifically, Chelliah (1971) found that a higher per capita income reflecting a higher level of development is held to indicate a higher capacity to pay taxes as well as a greater capacity to levy and collect them. There is also the consideration that, as income grows countries generally become more urbanized. Urbanization thus brings about a greater demand for public services while at the same time facilitating tax collection.

A study on exchange rate volatility and export performance in the WAMZ countries conducted by Tarawalie, Sissoho, Conte, and Ahoritor (2013), employing the Dynamic OLS (DOLS) estimation technique revealed mixed findings. In particular, the results showed a negative relationship between exchange rate volatility and exports of Liberia, Nigeria and Sierra Leone, positive relationship

with exports of the Gambia, and no effect on exports of Ghana and Guinea. This therefore implies that there is no significant implication on tax revenue from trade.

Tarawalie, Sissoho, Conte, and Ahortor (2013), investigates the effects of exchange rate volatility on output growth and inflation in the West African Monetary Zone (consisting of Ghana, The Gambia, Guinea, Liberia, Nigeria and Sierra Leone) following exchange rate regime shift. Results from their study reveal that while exchange rate volatility is inflationary across all the countries, its effect on output growth differ. Specifically, volatility and depreciation in particular negatively affects real GDP growth in Liberia and Sierra Leone but positively impacts on output in the other countries albeit weakly. The difference in direction and magnitude of effect is not far-fetched from the differences in macroeconomic conditions prevailing in each country.

Ahmed and Muhammad (2010) attempted to search the determinants of tax buoyancy of 25 developing countries. Their study revealed that growth in import and manufacturing sector has positive impact on growth of tax collection. The effect of the agricultural sector is insignificant but unlike of the previous studies which found insignificant impact of service sector on tax buoyancy this study found positive and significant impact on tax buoyancy due to the development of service sector in 1990s. Monetary growth which is a chief cause of inflation also influence positively on tax collection. Finally, increase in budget deficit has positive influence on tax collection by demanding more resource mobilization from the governments, however, at the same time the growth in grants inversely influences

on tax collection because government in developing countries avoids unpopular steps of imposing taxes for domestic resource mobilization.

Besides the studies which employed cross-sectional and panel data analyses, there are some studies which examined the issue at hand in a single-country framework. Chaudhry and Munir (2010) is one of them. They attempted to empirically analyse the determinants of low tax revenue in Pakistan by employing time series econometric techniques over the period 1973-2009. They investigated whether economic policies, external variables and social indicators along with elements of tax base can account for part of the variation in the tax revenue performance. Their empirical results suggest that openness, broad money, external debt, foreign aid and political stability are the significant determinants of tax efforts in Pakistan with expected signs. The results also indicate that the determinants of low tax revenue in Pakistan are narrow tax base, more dependence on agriculture sector, foreign aid and low level of literacy rate. Finally, they concluded that Pakistan economy can generate high tax to GDP ratio by boosting the openness, literacy level, political stability and broadening the tax base and by controlling income inequality, tax evasion and tax exemptions.

Eichengreen 2008) argues that maintaining appropriate and stable exchange rate volatility enables countries to explore their growth and development capacities. Excess exchange rate volatility has been identified to reduce the level of economic growth by creating business uncertainty, deteriorates competitiveness, lower productivity and profits as well as increasing domestic prices. This clearly has welfare implications and should be a policy concern. Changes in real exchange

rate need to be guided by aligning exchange rate with fundamentals. This in effect maintains external competitiveness and domestic stability.

Sen Gupta (2007) investigated revenue performance of a large set of developing countries over the past 25 years. He found that several structural factors like per capita GDP, share of agriculture in GDP and trade openness are significant and strong determinants of revenue performance. He also looked at the impact of foreign aid and foreign debt on revenue mobilization. The findings suggest a strong negative and significant relationship between agriculture share and revenue performance. It is estimated that a one percent increase in the share of agriculture sector could reduce revenue performance by as much as 0.4 percent. The results indicate that although foreign aid improves revenue performance significantly, debt does not. Among the institutional factors, he found corruption has a significantly negative effect on revenue performance. Political and economic stability are other effective factors, but only across certain specifications. On the other hand, countries that put greater emphasis on taxing income, profits and capital gains, perform better. Structural factors are found to be significant across all income groups, when the analysis is conducted over the sub-samples based on income level.

Auerbach (2006) points out a relatively stable ratio of U.S. federal tax revenues from non-financial corporations to GDP. He defends that this probably masks a declining ratio of corporate profits of these corporations relative to GDP and an increasing average tax rate on these profits. He claims that the average corporate tax rate rose steadily between 1996 and 2003 in large part because of the importance of tax losses, reflecting the asymmetric treatment of gains and losses

under the corporate income tax and caused by a growing dispersion in profit outcomes among firms (i.e. many firms have losses even when the overall rate of profit is not low)

Trade liberalization can also have some effects on the domestic exchange rates as well as fiscal structure. Agbeyegbe, Stotsky, and WoldeMariam (2004) investigated the relationship between the tax revenue, trade liberalization and changes in the exchange rate using a panel data set of 22 sub-Saharan countries. Their results suggest that trade liberalization, agricultural share, industrial share, government consumption, and terms of trade exert a positive effect on total tax revenue, and inflation exerts a negative effect. They explain the unexpected positive effect of agricultural share by the influence of exports in providing a tax handle. On the other side, the sign of agricultural sector share turns to negative when the independent variable is income tax revenue, while the industrial sector's share remains same.

The relationship between foreign aid and tax revenue is essentially an empirical question. Pivovarsky, Clements, Gupta, and Tiongson (2003) pointed out that net foreign aid has a negative impact on the total tax revenue, which seems to be driven by a negative impact of grants on tax revenue, whereas loans are associated with increased domestic tax revenue. One potential explanation they offer for why this might be the case is that loans may imply the need of a repayment, which serves as an incentive to increase the domestic tax effort. Also, Clist and Morrissey (2011) showed that the effect of foreign aid on tax revenue is positive since a break point in the mid-1980s in developing countries.

Matlanyane and Harmse (2002) examined the revenue implication of trade liberalization in South Africa using an Ordinary Least Square (OLS) estimation technique for data covering 1974 to 2000. The study found that trade liberalization had significant influence on custom revenue and that increase in import may lead to a reduction in trade tax revenue. The study therefore suggested that supportive macroeconomic policies are a prerequisite for successful effect of trade liberalization of trade tax revenue.

Teera (2002) used time series data on Uganda to examine the determinants of tax revenue share in that country. He used the Error Correction Model (ECM) and found that, there is a positive relationship between per capita income and total tax revenue as well as income taxes. This finding lends support to the hypothesis that, as countries develop tax bases develop more than proportionately to the growth in income.

Asseery and Peel (1991) also examined the influence of volatility on multilateral export volumes of five industrial countries. The novelty in their paper is the use of an error correction framework. It is argued that the non-robust results found in previous empirical work may be due to the fact that the export variable and some of its determinants are potentially non-stationary integrated variables. The volatility measure is based on the residuals from an ARIMA process for the real exchange rate. For all countries except the United Kingdom, they find that volatility has a significant positive effect on exports over the 1973 to 1987 period.

The early empirical work on the effect of exchange rate variability and trade surveyed by the International Monetary Fund group in 1984 did not yield

consistent results, with many studies yielding little or no support for a negative effect. For example, Farrell, DeRosa, and McCown (1983) and the IMF(1984) as cited in Tarawalie, Sissoho, Conte and Ahoritor (2013), present detailed surveys of the early empirical work. They conclude that majority of studies are unable to establish a systematically significant link between measured exchange rate variability and the level of trade, whether on an aggregate or on a bilateral basis. Bilateral results are somewhat more supportive of the view that volatility has a negative effect on trade. However, majority of these studies include relatively few observations on the floating exchange rate period.

Cushman (1983) used a volatility measure similar to that of Hooper and Kohlhagen (1978) but extended the sample size and used real as opposed to nominal exchange rates. Out of fourteen sets of bilateral trade flows between industrial countries, he found a negative and significant effect of volatility for six cases. For developing countries such as Ghana, since the country is generally not competitive, any significant exchange rate volatility is likely to yield the same results on trade and by extension tax revenue.

Pindyck (1982) argues that increased price variability can result in increased average investment and output as the firm adjusts to take advantage of high prices and to minimize the impact of low prices. This finding makes it clear that exchange rate volatility is not necessarily bad as it profits expectant firms. Therefore, it is possible for the country to generate more tax revenue from their activities when volatility arises. However, in the developing part of the world, firms

do not really make use of hedging or forward contracts and therefore volatility could still be petrifying to tax revenue generation.

Hooper and Kohlhagen (1978) utilized the model of Ethier (1973) for traded goods and derived equations for export prices and quantities in terms of the costs of production reflecting both domestic and imported inputs, other domestic prices, domestic income, and capacity utilization. Exchange rate risk was measured by the average absolute difference between the current period spot exchange rate and the forward rate last period, as well as the variance of the nominal spot rate and the current forward rate. They examined the impact of exchange rate volatility on aggregate and bilateral trade flow data for all G-7 countries except Italy. They found essentially no evidence of any negative effect.

Chapter Summary

This chapter reviewed relevant literature putting the study into perspective. Specifically, historical perspective of taxation, forms and types of taxes, theories of optimal taxation were reviewed. Also, the channels and relationship between tax revenue, exchange rate volatility as well other several macroeconomic variables were reviewed. The empirical literature made it clear the effects of exchange rate volatility and the control variables on tax revenue are illusive both at country and cross-country level, one reason this study is important.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter looked at the procedures that were espoused to achieve the objectives of this study. The chapter essentially focused on how the whole study was done. The Research Design, Model Specification, Data Sources, Definitions of Variables, Estimation Procedures, and justification for the inclusion of variables were covered in this chapter.

Research Design

Consistent with the objectives of the study, quantitative research design was employed to investigate the relationship between Tax Revenue (the dependent variable) and exchange rate volatility (the independent variable) in Ghana. As compared to qualitative design, the major strength of research design is how it take full advantage of replicability, objectivity, and generalisability of findings. Therefore, this design ensures that the researcher sets aside his experiences, discretions or perceptions, and biases to ensure objectivity in the conduct of the study and deductions that would be drawn. Interestingly, quantitative research designs are either descriptive, where subjects usually measured once or experimental, subjects measured before and after a treatment.

Theoretical Model Specification

Actual tax revenues as a share of GDP is one of the most commonly used measures of tax effort for single-country or cross-country tax comparison. The biggest advantages of this measure are that it is easy to obtain and gives a quick overview of tax trends over a period of time. As indicated in and endorsed by Musgrave (1987), Rojchaichaninthorn (2008), and Brafu-Insaidoo and Obeng (2008), this measure is more suitable for studies focusing on countries with similar economic structures and at the same level of income.

Generally, the buoyancy of a tax is obtained by assuming the following functional form:

$$TR = \alpha Y^\beta \varepsilon \quad (1)$$

Equation 1 can be rewritten in double log as seen below:

$$\ln TR = \ln \alpha + \beta \ln Y + \ln \varepsilon \quad (2)$$

From equations 1 and 2, we can write $(\partial TR / \partial Y)(Y / TR) = \beta$, which gives a measure of buoyancy. The buoyancy measures growth in tax revenue as a result of growth in income, reflecting the combined effects of tax base expansion and discretionary changes in tax rates, base definition, and changes in collection and enforcements of the law (Brafu-Insaidoo & Obeng, 2008)

By augmenting 1, we write an equation as seen in equation 3 incorporating several tax handles:

$$TR = \alpha Y^\beta X_i^{\gamma_i} \varepsilon \quad (3)$$

By writing equation 3 in double log, we obtain equation 4 as shown below:

$$\ln TR = \ln \alpha + \beta \ln Y + \gamma_i \sum_1^n X_i + \ln \varepsilon \quad (4)$$

Where X_i , is the vector of tax handles (trade openness, exchange rate, foreign aid, total debt, exchange rate volatility, etc.) while γ_i are the partial elasticities.

Empirical Model Specification

By augmenting the models used by Teera (2002) and Le, Moreno-Dodson, and Rojchaichanthorn (2008), the study estimated a model in which tax revenue was functionally related to level of economic growth and several tax handles. The specification of econometric model for this study considers the relevant influential variables discussed previously, and presents a slight deviation from the existing literature.

To explore the dynamic association among tax revenue and the five main macroeconomic variables namely GDP per capita (GPC), Trade Openness (OPN), Inflation rate (INF), Foreign Aid (AID), and the ratio of industrial output to GDP (IND) were controlled for. In addition, since exchange rate volatility (EXV) is not an economic variable, it was together with the interaction between trade openness and exchange rate volatility (OPNEXV) calculated and incorporated in the model. The study specified a model which expresses tax revenue to GDP as a function of these tax handles. The specification of the functional model is shown in equation 5 below:

$$TR/GDP = f(INF, IND, GPC, OPN, AID, EXV, EXVOPN) \quad (5)$$

Equation (5) was transformed to a structural model as seen in equation (6) below:

$$\left(\frac{TR}{GDP}\right)_t = f(.) = INF_t^{\beta_1} IND_t^{\beta_2} AID_t^{\beta_3} GPC_t^{\beta_4} OPN_t^{\beta_5} EXV_t^{\beta_6} EXV * OPN_t^{\beta_7} e^\varepsilon \quad (6)$$

Using the logarithmic transformation of the variables in equation (6), the empirical specification of the model above was written as seen in equation (7) below:

$$\ln(TR/GDP)_t = \beta_0 + \beta_1 \ln INF_t + \beta_2 \ln IND_t + \beta_3 \ln AID_t + \beta_4 \ln GPC_t + \beta_5 \ln OPN_t + \beta_6 \ln EXV_t + \beta_7 (\ln EXV * \ln OPN)_t + \varepsilon_t \quad (7)$$

where; TR = Tax to GDP ratio, β_0 = tax intercept, GPC = Gross Domestic Product Per Capita, OPN = Trade Openness, IND = Industry output to GDP ratio, INF = Inflation rate, EXV = Exchange Rate Volatility, $EXVOPN$ = Exchange Rate Volatility-Trade Openness interaction while ε is the error term.

Modeling Exchange rate volatility

The chief explanatory variable of this study was exchange rate volatility. Since exchange rate volatility is not observable, it had to be generated. Since real exchange rate is sometimes characterised by high-time-varying volatility, the assumption of constant variance is inappropriate hence linear models are unable to explain a number of important features of exchange rate related impacts. It is therefore appropriate to use models that allow the variance to depend upon its history to examine the real exchange rate volatility.

Various methods have been employed to generate exchange rate volatility in the literature. These include the moving average standard deviation, autoregressive conditional heteroscedasticity(ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH) developed by (Bollerslev, 1986). There are several versions of the GARCH model but this study settled on the GARCH (1,1) model as defined in equation (9) below, because of its parsimony and ability to capture volatility in most time series (Tarawalie, Sissoho, Conte & Ahortor 2013). The study considered Generalised Autoregressive Conditional Heteroskedastic (GARCH) models which allow variances of errors to be time dependent. However, it was important to test for the presence of time varying effect (ARCH Effect). If the test results show evidence of heteroscedasticity, then (GARCH) models are appropriate for estimating the series and if the results prove that there are no ARCH Effect, then (GARCH) models cannot be used.

The GARCH (1,1) modeling process commences with mean equation (8) which expresses changes in the real effective exchange rate, *RER*, as a function of its lagged value. The error term, e_t is normally distributed with zero mean and a variance, h_t . The variance, h_t is then used to specify the GARCH (1,1) model of interest as in equation (9).

$$\Delta(\ln RER)_t = c_1 + \beta \Delta(\ln RER)_{t-1} + e_t \quad (8)$$

$$e_t \approx N(0, h_t)$$

$$h_t = c_2 + e_{t-1}^2 + h_{t-1} \quad (9)$$

where: $\Delta(\ln RER)$ = difference log of the real effective exchange rate from period t to $t - 1$

h_t = variance of the error term e_t

e_{t-1}^2 = the ARCH term

h_{t-1} = the GARCH term

From equation 9, the variance equation has one ARCH term (i.e. e_{t-1}^2) and one GARCH term (h_{t-1}). The dependent variable (h_t) represents the conditional variance, α and β represent the lagged squared error term (ARCH effect) and conditional volatility (GARCH effect) respectively. Both α and β measure the overall volatility. A large error coefficient, α indicates that volatility reacts intensely to internal movements, while a large GARCH coefficient, β indicates that shocks to conditional variance take a long time to die out, which means that volatility is persistent (Brooks, Smith, Hill & O'Dowd, 2002). If $(\alpha + \beta)$ in the variance equation is very close to one, that means high persistence in volatility and implies inefficiency in the market.

Justification of the Inclusion of the Variables

Tax Revenue (TR)

Total tax revenue as a percentage of GDP indicates the share of a country's output that is collected by the government through taxes. It can be regarded as one measure of the degree to which the government controls the economy's resources. Tax revenue used in the econometric model denotes taxes collected by the Ghana Revenue Authority (GRA) that the government uses to finance its expenditure. That

is, total revenue collected by the central government through GRA. It follows the work on ‘determinants of tax revenue efforts in developing countries’ by Sen Gupta (2007). It brings to bear the need for developing countries to maximize tax revenue to finance government expenditure hence, its inclusion in the model. Tax revenue was proxied by tax-to-GDP and measured as a ratio of tax collected compared to national gross domestic product (GDP). The data for this variable was obtained from the 2016 edition of the World Development Indicators (WDI).

Gross Domestic Product Per Capita (GPC)

It is an economic measure denoting the value of all goods and services produced in a given year at current prices per the entire population. It generally reflects the overall sophistication and development or well-being of the entire population. An increase in GPC can increase the taxable capacity of a country’s tax revenue through a larger share of the private sector’s resources ceded to the government as taxes to provide public goods and services. Fundamentally, an increase in GPC depicts the ability of the citizenry to spend or afford basic necessities and hence the ability to pay taxes therefore, its inclusion in the model.

Economic development is assumed to bring about both an increased demand for public expenditure (Tanzi, 1987) and a larger supply of taxing capacity to meet such demands (Musgrave, 1969). A higher per capita income reflecting a higher level of development is held to indicate a higher capacity to pay taxes as well as a greater capacity to levy and collect them (Chelliah, 1971) and therefore its inclusion in the model. GPC was measured by GDP per the total population. The

data for this variable was sourced from the 2016 edition of the World Development Indicators (WDI). It is thus expected to impact positively on tax revenue

Inflation (INF)

The Consumer price index is an index of prices used to measure the change in the cost of basic goods and services in comparison with a fixed base period. INF is used to measure the average change over time in the prices paid by consumers for a market of consumer goods and services. It is constructed using the prices of a sample of representative items whose prices are collected periodically. The annual percentage change in the INF is used as a measure of inflation. Inflation rate is a reflection of macroeconomic instability.

A high rate of inflation is generally harmful to growth because it raises the cost of borrowing and thus lowers the rate of capital investment but could be beneficial to revenue through inflation tax. However, at low levels of inflation, the likelihood of such a trade-off between inflation and growth is minimal. Inflation is therefore used as an indicator to capture macroeconomic instability (Asiedu & Lien, 2004; Asiedu, 2006) and therefore, its inclusion in the model The variable was measured by the yearly inflation averages and sourced from the 2016 edition of the World Development Indicators (WDI). It is expected that its coefficient will be positive.

Trade Liberalization (OPN)

The impact of trade liberalization on tax revenue is investigated in more detail in terms of the performance of the overall tax system. Domestic tax reform, which usually is implemented at the same time as trade is liberalized, is an important instrument for raising tax yield. In general, the productivity of the overall tax system should be improved after the tax reform takes place. However, as mentioned earlier, the effect of trade liberalization on the overall tax system is equivocal.

Trade openness may either improve or deteriorate tax bases, depending on many different factors. On one hand, fiscal revenue can be improved if trade liberalization is accompanied by such supportive situations as a large expansion in international trade volume, economic growth, employment, a rise in income level, and devaluation of exchange rate. On the other hand, fiscal revenue could fall if trade liberalization is associated with a shrink in trade volume, job losses, and deterioration in corporate profit.

Although it is difficult to determine accurately the direction of change in overall tax revenue as a result of trade liberalization, changes in tax revenue can be measured by applying the concept of tax buoyancy and tax elasticity since tax revenue depends crucially on revenue productivity and tax structure (Suliman, 2005). Certain features of overseas trade make it more amenable to taxation than domestic activities, and in developing countries, the overseas trade sector is typically the most monetized sector of the economy. The administrative ease with which trade taxes can be collected makes them an attractive source of government

revenue when administrative capabilities are scarce (Linn & Weitzel, 1990) and therefore its inclusion in the model. The variable was proxied by trade openness which is the sum of total export and import to GDP. The data was obtained from the 2016 edition of the World Development Indicators (WDI). It is expected to have a positive effect on tax revenue.

Share of Industry in GDP (IND)

Manufacturing enterprises are easier to tax than agricultural enterprises since business owners typically keep better books of accounts and records. The industrial sector can generate larger surpluses if production is efficient. From antiquity to contemporary administration of the country, efforts have been made to improve the industrial base so as to improve tax revenue generation. As the level of manufacturing goes up tax revenue is also expected to increase. On the other hand, a vibrant mining sector dominated by a few large firms can generate large taxable surpluses (Sen Gupta, 2007) and therefore its inclusion in the model. Therefore, the variable is expected to impact positively on tax revenue generation. The data for this variable was sourced from the 2016 edition of the World Development Indicators (WDI).

Foreign Aid (AID)

The relationship between foreign aid and tax revenue is one of the much-debated issue in the literature. For instance, Pivovarsky, Clements, Gupta, and Tiongson (2003) argue that net foreign aid has a negative impact on the total tax revenue,

which they observe that it is motivated by a negative impact of grants on tax revenue, whereas loans are linked with improved ability to mobilise tax revenue. One possible explanation they offer for why this might be the case is that loans may imply the need of a repayment, which serves as an incentive to increase the domestic tax effort. Also, there is a general concern that aid may decrease taxation revenue in recipient countries. In fact, the results in Franco-Rodriguez, Morrissey, and McGillivray (1998) 's study on Pakistan were in agreement with this concern. The data for this variable was obtained from the 2016 edition of the World Development Indicators (WDI). It is expected that foreign impacts adversely on tax revenue.

Data Sources

The data for this study were secondary obtained from the 2016 edition of the World Development Indicators (WDI). Ghana. Annual Time Series data on these selected macroeconomic variables; Tax revenue as a ratio to GDP, Trade Openness, Foreign Aid, GDP per capita, are included in the model to ascertain its impact on tax revenue. The period selected for the study was be from 1984 to 2014.

Unit Root Test

It is very important to test for the statistical properties of variables when dealing with time series data. Time series data are rarely stationary in level forms. Regression involving non-stationary time series often lead to the problem of spurious regression. This occurs when the regression results reveal a high and

significant relationship among variables when in fact, no relationship exist. Moreover, Stock and Watson (1988) have also shown that the usual test statistics (t, F, DW, and R2) will not possess standard distributions if some of the variables in the model have unit roots. A time series is stationary if its mean, variance and auto-covariance are independent of time.

The study employed a several unit root tests. This was done to ensure reliable results of the test for stationarity due to the inherent individual weaknesses of the various techniques. The study used the Philips-Perron (PP) and Augmented Dickey Fuller (ADF) tests. These tests are similar except that they differ with respect to the way they correct for autocorrelation in the residuals. The PP nonparametric test generalizes the ADF procedure, allowing for less restrictive assumptions for the time series in question. The null hypothesis tested was that the variable under investigation had a unit root against the stationarity alternative. In each case, the lag-length was chosen using the Akaike Information Criteria (AIC) and Schwarz Information Criterion (SIC) for both the ADF and PP test. The sensitivity of ADF tests to lag selection renders the PP test an important additional tool for making inferences about unit roots. The basic formulation of the ADF was specified as follows:

$$X_t = \mu + \alpha X_{t-1} + \gamma t + \varepsilon_t \quad (10)$$

Subtracting X_{t-1} from both sides gives:

$$\Delta X_t = \mu + (1 - \alpha)X_{t-1} + \gamma t + \varepsilon_t \quad (11)$$

The t-test on the estimated coefficient of X_{t-1} provides the Dickey Fuller test for the presence of a unit-root. The Augmented Dickey Fuller (ADF) test is a modification of the Dickey Fuller test and involves augmenting the above equation by lagged values of the dependent variables. It is made to ensure that the error process in the estimating equation is residually uncorrelated, and also captures the possibility that X_t is characterized by a higher order autoregressive process. Although the DF methodology is often used for unit root tests, it suffers from a restrictive assumption that the errors are independent and identically distributed. Therefore, representing $(1 - \alpha)$ by ρ and controlling for serial correlation by adding lagged first differenced to equation (11) gives the ADF test of the form:

$$\Delta X_t = \mu + \rho X_{t-1} + \gamma \tau + \sum_{i=1}^{\rho} \phi_i \Delta X_{t-i} + \varepsilon_t \quad (12)$$

Where X_t denotes the series at time t, Δ is the first difference operator, μ , γ , ϕ are the parameters to be estimated and ε_t is the stochastic random disturbance term.

The ADF and PP test the null hypothesis that a series contains unit root (non-stationary) against the alternative hypothesis of no unit root (stationary).

That is:

$$H_0: \rho = 0 \text{ (} X_t \text{ is non-stationary)}$$

$$H_0: \rho \neq 0 \text{ (} X_t \text{ is stationary)}$$

Estimation Technique

Autoregressive Distributed Lag (ARDL) Model

In order to establish and analyse the long-run relationships as well as the dynamic interactions among the variables of interest empirically, the autoregressive distributed lag cointegration procedure developed by Pesaran, Shin and Smith (2001) was used.

The basis for using the ARDL to estimate the model centred on the following reasons: First, the ARDL cointegration procedure is comparatively more effective even in small sample data sizes as is the case in this study. This study covers the period 1984–2014 inclusive. Hence, the total observations for the study is 31 which is relatively small. Second, the ARDL enables the cointegration to be estimated by the Ordinary Least Square (OLS) technique once the lag of the model is known. This is however, not the case of other multivariate cointegration procedures such as the Johansen Cointegration Test developed by Johansen (1992). This makes the ARDL procedure relatively simple. Lastly, the ARDL procedure does not demand pretesting of the variables included in the model for unit roots compared with other methods such as the Johansen approach. It is applicable regardless of whether the regressors in the model are purely $I(0)$, purely $I(1)$ or mutually cointegrated.

Following Pesaran, Shin and Smith (2001) as summarized in Choong, Yusop, and Liew (2005), an expression of the relationship between the variables under study using the ARDL approach to cointegration was expressed as follows:

$$\begin{aligned}
\Delta \ln TR_t = & \delta_0 + \phi \ln TR_{t-1} + \alpha_1 \ln INF_{t-1} + \alpha_2 \ln IND_{t-1} + \alpha_3 \ln AID_{t-1} + \\
& \alpha_4 \ln GPC_{t-1} + \alpha_5 \ln OPN_{t-1} + \alpha_6 \ln EXV_{t-1} + \alpha_5 (\ln EXV * \ln OPN)_{t-1} + \\
& \sum_{i=1}^{\rho} \beta_1 \Delta \ln TR_{t-i} + \sum_{i=1}^{\rho} \beta_2 \Delta \ln INF_{t-i} + \sum_{i=1}^{\rho} \beta_3 \Delta \ln IND_{t-i} + \\
& \sum_{i=1}^{\rho} \beta_4 \Delta \ln AID_{t-i} + \sum_{i=1}^{\rho} \beta_5 \Delta \ln GPC_{t-i} + \sum_{i=1}^{\rho} \beta_6 \Delta \ln OPN_{t-i} + \\
& \sum_{i=1}^{\rho} \beta_7 \Delta \ln EXV_{t-i} + \sum_{i=1}^{\rho} \beta_8 \Delta (\ln EXV * \ln OPN)_{t-i} + \varepsilon_t
\end{aligned} \tag{13}$$

Where, ϕ and α_i represent the short run elasticities while β_i are the short run elasticities.

Test for Cointegration

The Autoregressive Distributed Lag (ARDL) Cointegration Test, otherwise called the Bounds Test developed by Pesaran, Shin and Smith (2001) was used to test for the cointegration relationships among the series in the model. Two or more series are said to be cointegrated if each of the series taken individually is non-stationary with I(1), while their linear combination are stationary with I(0). In a multiple non-stationary time-series, it is possible that there is more than one linear relationship to form a cointegration.

Having satisfied the criteria that the variables were a mixture of I(0) or I(1), the ARDL bounds test for cointegration was carried out. The ARDL Bounds testing procedure essentially involves three steps. The first step in the ARDL bounds testing approach was to estimate equation (13) by OLS in order to test for the existence or otherwise of a long-run relationship among the variables. This was

done by conducting an F-test for the joint significance of the coefficients of lagged levels of the variables.

The hypothesis would be:

$$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = 0$$

$$H_1: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq \theta_6 \neq \theta_7 \neq 0$$

The test which normalizes Tax Revenue (TR) was denoted by

$$F_{TR}(TR, GPC, INF, OPN, EXV, EXVOPN, AID, IND).$$

Two asymptotic critical bounds values provide a test for cointegration when the independent variables are $I(d)$ (where $0 \leq d \leq 1$): a lower value assuming the regressors are $I(0)$ and an upper value assuming purely $I(1)$ regressors.

Given that the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship is rejected regardless of the orders of integration for the time series. On the flip side, if the F-statistic falls below the lower critical values, the null hypothesis is accepted, implying that there is no long-run relationship among the series. However, if the F-statistic falls between the lower and the upper critical values, the result becomes inconclusive.

In the second stage of the ARDL bounds approach, once cointegration is established, the conditional ARDL ($p, q_1, q_2, q_3, q_4, q_5$), the long-run model for TR_t was estimated as:

$$\begin{aligned}
\Delta \ln TR_t = & \gamma + \sum_{i=l}^p \beta_{li} \Delta \ln TR_{t-i} + \sum_{f=1}^n \beta_{2f} \Delta \ln INF_{t-f} + \\
& \sum_{g=1}^n \beta_{3g} \Delta \ln IND_{t-g} + \sum_{k=1}^n \beta_{4k} \Delta \ln AID_{t-k} + \sum_{j=1}^n \beta_{5j} \Delta \ln GPC_{t-1} + \\
& \sum_{r=1}^n \beta_{6r} \Delta \ln EXV + \sum_{m=1}^n \beta_{7m} \Delta (\ln EXV * \ln OPN)_{t-m} + \sum_{q=1}^n \beta_{8q} \Delta \ln OPN + \mu_t
\end{aligned}
\tag{14}$$

This involved selecting the orders of ARDL ($p, q_1, q_2, q_3, q_4, q_5$) model in the variables using Akaike Information Criterion (Akaike, 1973).

The third and the last step in the ARDL bound approach is to estimate an Error Correction Model (ECM) to capture the short-run dynamics of the system given a shock or disequilibrium.

Error-Correction Model (ECM)

The concepts of Error Correction Models (ECM) and cointegration are closely associated in time series analysis and often used together to characterize the relationships between the series being studied. In essence, it can be shown that, with re-parameterization, the error-correction model is a standard VAR in first differences augmented by error-correction terms. An Error-Correction Mechanism (ECM) is a way of combining the long run, cointegrating relationship between the levels variables and the short-run relationship between the first differences of the variables. The principle behind the error-correction model is that often, there exists a long-run equilibrium relationship between two economic variables. In the short run, however, there may be disequilibrium. With the error-correction mechanism, a proportion of the disequilibrium is corrected in the next period.

According to Kremers, Ericsson, and Dolado (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing cointegration is through the error correction term. Thus, the study discerns that the variables in the model show evidence of moderate response to equilibrium when shocked or disturbed in the short-run. Theoretically, it is debated that an error correction mechanism exists whenever there is a cointegrating relationship among two or more variables. The error correction term is thus obtained from the negative and significant lagged residual of the cointegration regression. The error-correction process is thus a means to reconcile short-run and long-run behaviour. The ECM generally provides the means of reconciling the short-run behaviour of an economic variable with its long-run behaviour.

The ECM was specified as follows:

$$\begin{aligned} \Delta \ln TR_t = & \gamma + \sum_{i=l}^p \beta_{li} \Delta \ln TR_{t-i} + \sum_{f=1}^n \beta_{2f} \Delta \ln INF_{t-f} + \\ & \sum_{g=1}^n \beta_{3g} \Delta \ln IND_{t-g} + \sum_{k=1}^n \beta_{4k} \Delta \ln AID_{t-k} + \sum_{j=1}^n \beta_{5j} \Delta \ln GPC_{t-1} + \\ & \sum_{r=1}^n \beta_{6r} \Delta \ln EXV + \sum_{m=1}^n \beta_{7m} \Delta (\ln EXV * \ln OPN)_{t-m} + \sum_{q=1}^n \beta_{8q} \Delta \ln OPN + \\ & \rho ECM_{t-1} + \mu_t \end{aligned} \quad (15)$$

From equation (13), ρ represents the short-run dynamics coefficients of the model's convergence to equilibrium. ECT_{t-1} is the Error Correction term. The coefficient of the Error Correction term, ρ measures the speed of adjustment to obtain equilibrium in the event of shocks to the system. The absolute size of the error term, ECT_{t-1} , determines the speed of adjustment of the model to long-run equilibrium when it is shocked.

Granger Causality Test

The study of causal relationships among economic variables has been one of the main objectives of empirical econometrics. According to Engle and Granger (1987), cointegrated variables must have an error correction representation. One of the implications of Granger representation theorem is that if non-stationary series are cointegrated, then one of the series must granger cause the other (Gujarati, 2009). To examine the direction of causality in the presence of cointegrating vectors, Granger causality is conducted based on the following:

$$\Delta Y_t = \delta_0 + \sum_{i=1}^p \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^p \phi_{1i} \Delta X_{t-i} + \omega_{1i} ECT_{t-1} + v_t \quad (16)$$

$$\Delta X_t = \delta_0 + \sum_{i=1}^p \beta_{2i} \Delta X_{t-i} + \sum_{i=1}^p \phi_{2i} \Delta Y_{t-i} + \omega_{2i} ECT_{t-1} + u_t \quad (17)$$

Where X_t and Y_t are our stationary dependent and independent variables, ECT_{t-1} is the error correction term, p is the optimal lag order while the subscripts t and $t-i$ denote the current and lagged values. If the series are not cointegrated, the error correction terms will not appear in equations 16 and 17. To find out whether the independent variable (X) granger-causes the dependent variable (Y) in equation 16, we examine the joint significance of the lagged dynamic terms by testing the null hypothesis:

$$H_0: \phi_{1i} = 0$$

implying that the independent variable (X) does not granger-cause the dependent variable (Y), against the alternative hypothesis that

$$H_1: \phi_{1i} \neq 0$$

implying that the independent variable (X) granger-cause the dependent variable (Y).

Similarly, to find out whether the independent variable (Y) granger-cause the dependent variable (X) in equation 15, we examined the significance of the lagged dynamic term by testing the null hypothesis that:

$$H_0: \phi_{2i} = 0$$

implying that the independent variable (Y) does not granger-cause the dependent variable (X), against the alternative hypothesis that

$$H_1: \phi_{2i} \neq 0$$

implying that the independent variable (Y) granger-cause the dependent variable (X). Using the standard F-test or Wald statistic, four possibilities exist: First, rejection of the null hypothesis in equation (16) but failing to reject the null in equation (17) at the same time implies unidirectional causality running from X to Y. Second, a rejection of the null hypothesis in equation (17) but at the same time failing to reject the null in equation (16) implies unidirectional causality running from Y to X. Third, simultaneous rejection of the two null hypotheses indicates bi-directional causality. Fourth, simultaneous failure to reject the two null hypotheses indicates independence or no causality between the variables of interest.

Data Analysis

The study employed both descriptive and quantitative analysis. Graphs and tables were employed to aid in the descriptive analysis. Unit root test procedures

were specified. Furthermore, the study adopted the bounds testing approach of cointegration to obtain both the short and long-run estimates of the variables involved. All estimations would be carried out using Econometric software Eviews 9.0 package.

Chapter Summary

This chapter developed and presented the methodological framework appropriate for conducting the study. The model was developed from the theoretical formulations of tax revenue performance. Annual time-series data on real GDP, tax revenue to GDP, inflation, industrial output as a share of GDP, GDP per capita, real effective exchange rate and trade liberalisation from 1984 to 2014 was employed for the study. Stationarity tests for ADF and PP procedures were also presented. Also, the ARDL and Bounds testing approach to cointegration test as well as the GARCH procedures were also presented to enable us examine the long-run and short-run dynamics among the variables. Finally, the chapter presented the procedure for Granger-causality technique to determine the direction of causality among the variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This section presents and discusses the results of the study. The purpose is to understand the empirical relationship between tax revenue and exchange rate volatility in Ghana. The study first tested for unit root in order to determine the stationarity status of the variables using the Augmented Dickey-Fuller (ADF) and Phillips Peron (PP) tests and further tested for cointegration and causality using the Autoregressive Distributed Lagged Model (ARDL) and the Pair-wise Granger causality test respectively. The analysis of these tests then helped to establish the relationship between tax revenue and exchange rate volatility.

Descriptive Statistics

In this section, the study presented descriptive statistics of the variables involved. The descriptive statistics is based on the true values (level) of the variables. The descriptive statistics include mean, median, maximum, minimum, standard deviation, skewness, kurtosis, sum, sum squared deviation and number of observations.

Table 1: Descriptive Statistics of the Series.

	TR	INF	IND	AID	GPC	OPN	EXV	EXV*OPN
Mean	14.375	22.177	23.325	8.5919	777.07	69.426	-0.0993	-4.8671
Median	13.877	18.031	26.558	9.5685	721.21	71.594	-0.1286	-7.2928
Max	21.752	59.461	28.938	16.338	1251.4	116.04	0.6766	67.446
Min	9.6980	8.7268	11.153	2.8631	551.63	18.814	-0.6229	-50.209
Std.Dev.	2.8331	12.529	5.3438	3.5785	198.40	25.308	0.3097	24.043
Skew	0.9502	1.1320	-0.5079	0.1557	1.0966	-0.1477	0.3961	0.6616
Kurtosis	3.6064	3.8368	1.8252	2.0498	3.2302	2.1498	2.9153	4.3203
J. Bera	5.1400	7.5253	3.1156	1.2913	6.2815	1.0463	0.8202	4.5136
Prob	0.0765	0.0232	0.2105	0.5243	0.0432	0.5926	0.6635	0.1046
Sum	445.63	687.50	723.08	266.34	24089	2152.2	-3.0811	-150.88
Ss Dev.	240.80	4709.7	856.71	384.17	1180972	19215.8	2.8790	17342
Obs	31	31	31	31	31	31	31	31

Note: SS Dev. represents Sum of Squared Deviation, Std Dev. represents Standard Deviation, J. Bera represents Jarque Bera, Prob represents Probability, Skew represents Skewness while Obs stands for Observation.
Source: Author's Computation using Eviews 9.0

It could be observed from Table 1 that all the variables have positive average values and median with the exception of exchange rate volatility and the interaction term (trade openness and exchange rate volatility). This is normal considering the series involved. For instance, the mean tax-to-GDP is approximately 14 percent while the average inflation rate is also 22 percent. The average GDP per capita income of Ghanaians over the study period was also GH¢ 777. Also, the minimal deviation of the variables from their means as shown by the

standard deviation gives indication of slow growth rate (fluctuation) of these variables over the period of consideration. The Jarque-Bera statistic which shows the null hypothesis that all the series are drawn from a normally distributed random process cannot be rejected for all the variables.

Moreover, in terms of skewness, the descriptive statistics shows that all the variables are positively skewed implying that the majority of the values are less than their means with the exception of industrial contribution to GDP and trade openness. Furthermore, the standard deviation of the variables from their means are quite low when compared to their respect means with the exception of trade openness, exchange rate volatility and the trade openness-exchange rate volatility interaction. This is normal considering the fact that the variables change easily depending on the nature and extent of instability in the goods market at any point in time.

Evidence of Real Exchange Rate Volatility in Ghana

Appendix C shows the result which provides evidence of ARCH Effect in the exchange rate series used for the study. The coefficient of the squared residuals for the series is significant at 1 percent. The implication of this result is that the real exchange rate contains time varying effect, hence linear models cannot realistically explain its behavioural pattern. There is therefore a justification for adopting GARCH) models for estimating the volatility in real exchange rate.

The result in Appendix D provides evidence of high and persistent volatility in the exchange rate. The coefficient, β , which captures the influence of

new shocks on volatility, and parameter, α , which measures the persistence of volatility shocks, are both significant at 1 percent. The sum coefficients of α and β is approximately equal to one indicating that the volatility is highly persistent suggesting the presence of volatility clustering – a period where large (small) changes in exchange rate shock is followed by large (small) changes over a longer period. This creates a trend in the market that participants can follow in order to make excessive profit in a violation of market efficiency hypothesis. Moreover, the ARCH [1] which is the serial LM test shows the absence of serial correlation in the residuals.

Trend Analysis on Tax to GDP and Exchange Rate Volatility

In order to respond to the first objective, a trend analysis of the tax to GDP from 1984 to 2014 is shown below.

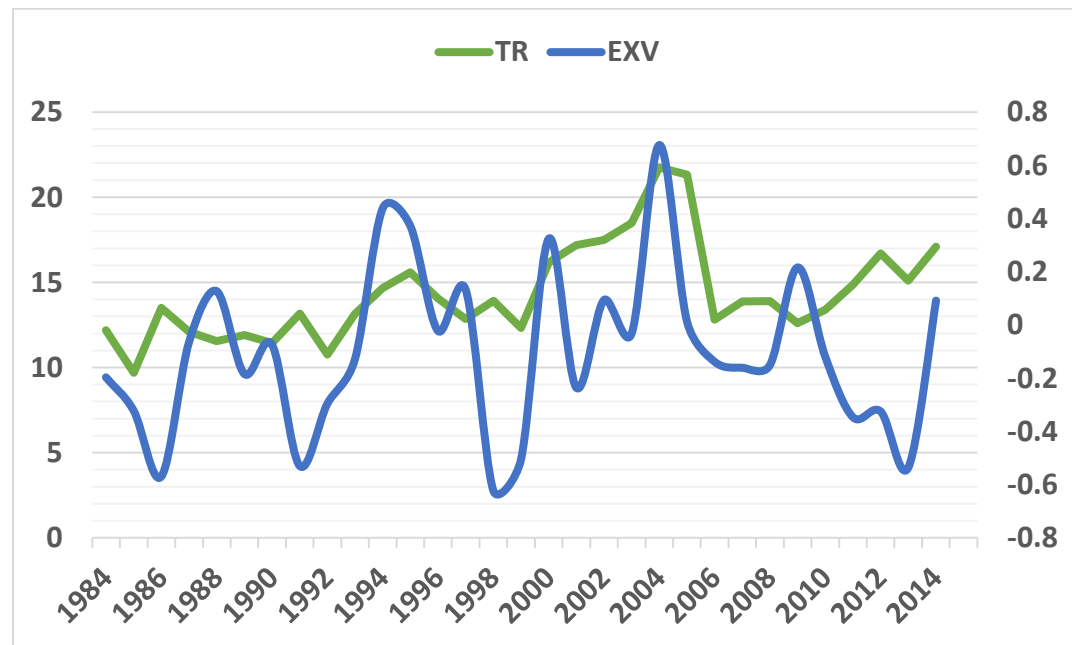


Figure 6: Trend of Tax to GDP and Exchange Rate Volatility (1984 – 2014)
Source: Author with data from WDI, 2017

Figure 6 shows the overall trend of tax revenue to GDP over the study period. Three broad classes of taxes were. These are direct taxes, indirect taxes, and international trade taxes. As shown under chapter three of this study, trade taxes were the dominant in 1984 but lost its position to direct and indirect taxes by 2010. A careful look at Figure 6 reveals a sharp dip in the trend of tax to GDP from 2005 to 2006. This is the period re-basement of the economy was done. From 2006 to 2014, there has been fluctuations in the trend of tax to GDP. In this period also, the local currency witnessed some significant depreciation against its major trading partners. As we noted in Figure 5, trade taxes have been declining or fluctuating downward from 1998 to 2014.

Specifically, Ghana's tax performance increased from 10.7 percent in 1992 to 15.6 percent in 1995 and reduced thereof to 12.8 percent in 1997. More significant in the period, was the sharp decline in the percentage of tax to GDP in 2004 from 21.8 percent to 12.8 percent in 2006. From 2006 to 2014, the trend shows a more vivid instability in tax-to-GDP.

Also, Figure 6 above shows annual volatility of Ghana's real effective exchange rate over the study period. The descriptive statistics revealed an average negative volatility value. A careful look at the figure clearly shows a more downward volatile nature in both the first and second decades of the study period. Specifically, the sort of volatility that characterised the exchange rate was visible and dominant from 1985 to 1995. This had a ramification on the percentage of tax to GDP as it reduced from 13.5 percent in 1986 to 11.5 percent in 1990 before rising to 13.2 percent in 1991.

Moreover, from 2004, where the exchange rate was volatile upward (improved strength of the currency), Ghana's tax to GDP was 21.8 percent. This was very encouraging but the figure reduced sharply to 12.8 percent in 2006 before rising to 13.8 percent in 2008. From 2008, the volatility has generally been downward (decreasing strength of the local currency). In this period, 2008 to 2014, where the volatility of the exchange rate seems prevalent, tax to GDP fell from 13.8 percent in 2008 to 12.6 percent in 2009 and increased thereof to 16.7 percent in 2012 before declining to 15.1 percent in 2013 and again increased to 17.1 percent in 2014. This clearly shows that there is some form of dependency of Ghana's tax performance on exchange rate volatility.

Unit Root Test Results

Even though the cointegration technique used for this study does not require the pre-testing of the variables for unit roots, it is however imperative to perform this test to verify that the variables are not integrated of an order higher than one. The purpose is to ascertain the absence or otherwise of $I(2)$ variables to extricate the results from spurious regression. Thus, in order to ensure that some of the variables are not integrated at higher order, there is the need to complement the estimated process with unit root tests.

Unit root tests were conducted to investigate the statistical properties of the variables. As a result, the ADF and PP tests were applied to all the variables in levels and in first difference in order to formally establish their order of integration. To be certain of the order of integration of the variables, the test was conducted

with intercept and time trend in the model. The optimal number of lags included in the test was based on automatic selection by Schwarz-Bayesian Criteria (SBC), and Akaike Information Criteria (AIC). The study used the P-values in the parenthesis to make the unit root decision, (that is, rejection or acceptance of the null hypothesis that the series contain unit root) which arrived at similar conclusion with the critical values.

The results of ADF and PP tests for unit root with intercept and trend in the model for all the variables are presented in Table 2 and Table 3 respectively. The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis is based on the McKinnon (1996) critical values as well as the probability values.

Table 2: Results of Unit Root Test with Trend and constant: ADF Test

Level			First Difference		
Variables	ADF-Statistics	Lag	Variables	ADF-Statistics	Lag I(0)
LTR	-2.4886[0.1281]	1	Δ LTR	-7.3034[0.0000]***	0 I(1)
LOPN	-2.0136[0.2797]	1	Δ LOPN	-5.0645[0.0003]***	1 I(1)
LINF	-3.4767[0.0159]**	1	Δ LINF	-4.5805[0.0012]***	0 I(0)
LIND	-3.0981[0.0375]**	1	Δ LIND	-6.3926[0.0000]***	0 I(0)
LAID	-1.08972[0.7066]	1	Δ LAID	-5.3079[0.0002]***	0 I(1)
LGPC	3.5970[1.0000]	1	Δ LGPC	-3.0170[0.0450]***	1 I(1)
EXV	-4.3886[0.0016]***	0	Δ EXV	-7.3652[0.0000]***	1 I(0)
EXV*OPN	-5.0013[0.0003]***	1	Δ EXVOPN	-8.3097[0.0000]***	0 I(0)

Table 3: Results of Unit Root Test with constant and trend: PP Test

Levels			First Difference			
Variables	PP-Statistics	BW	Variables	PP-Statistics	BW	I(0)
LTR	-3.1706[0.1093]	2	Δ LTR	-7.4866[0.0000]***	4	I(1)
LOPN	-1.3894[0.8434]	3	Δ LOPN	-3.5787[0.0495]***	3	I(1)
LINF	-4.0251[0.0186]**	11	Δ LINF	-15.7639[0.0001]***	28	I(0)
LIND	-2.8745[0.1842]	1	Δ LIND	-6.1668[0.0001]***	2	I(1)
LAID	-1.7776[0.6903]	5	Δ LAID	-6.2502[0.0001]***	5	I(1)
LGPC	0.4542[0.9986]	2	Δ LGPC	-3.7210[0.0368]***	2	I(1)
LEXV	-4.1935[0.0127]**	7	Δ LEXV	-19.858[0.0000]***	28	I(0)
LEXV*OPN	-4.8953[0.0024]***	5	Δ LEXVOPN	-24.3537[0.0000]***	28	I(0)

Note: ***, **, * indicates the rejection of the null hypothesis of non- stationary at 1%, 5%, 10% level of significance respectively, Δ denotes the first difference, BW is the Band Width and I(0) is the lag order of integration. The values in parenthesis are the P-values.

Source: Author's Computation using Eviews 9.0

From the unit root test results in Table 2, the null hypothesis of the presence of unit root for some of the variables in their levels cannot be rejected since the P-values of the ADF statistics were not statistically significant at any of the three conventional levels of significance with the exception of log of industry (LIND), exchange rate volatility (EXV), the interaction term between trade openness and exchange rate volatility (EXVOPN), and inflation (LINF) which were stationary at 5 percent or 10 percent significant levels. However, at first difference, the variables became stationary. This is because the null hypothesis of the presence

of unit root (non-stationary) is rejected at 1 percent significant levels for all the estimates except Per capita income which was stationary at 5 percent.

The PP test results for the presence of unit root with trend and intercept in the model for all the variables are presented in Table 3. From the unit root test results in Table 3, the null hypothesis of the presence of unit root for majority of the variables in their levels cannot be rejected since the P-values of the PP statistics were not statistically significant at any of the three conventional levels of significance with the exception of exchange rate volatility (EXV), the interaction term (EXVOPN), and inflation (LINF) which were stationary at 5 percent significant levels. However, at first difference, the variables become stationary. This is because the null hypothesis of the presence of unit root (non-stationary) was rejected at 1 percent significant levels for all the estimates but Per capita income and trade openness which were significant at 5 percent level. The PP unit root test results in Table 3 are in line with the ADF test in Table 2, suggesting that most of the variables are integrated of order one, $I(1)$, when intercept and time trend are in the model.

It was therefore clear from the unit root results discussed above that all the variables were integrated of order zero, $I(0)$, or order one, $I(1)$. Since the test results have confirmed the absence of $I(2)$ variables, the estimation technique was thus appropriate for estimation.

Cointegration Analysis

This section presents the long run relationship between tax revenue, exchange rate volatility and the other control variables.

Table 4: Bounds test results for cointegration

Critical Value Bound of the F-statistic: intercept and no trend						
K	90% Level		95% Level		99% Level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
7	1.92	2.89	2.17	3.21	2.73	3.9

Source: Author's Computation, using Eviews 9.0

Since the focus of this study is to establish the relationship between tax revenue and exchange rate volatility, it was important to test for the existence of long-run equilibrium relationship between these two variables within the framework of the bounds testing approach to cointegration. Given that the study employed annual data, a lag length of 2 for annual data was used in the bounds test. Pesaran, Shin and Smith (2001) suggested a maximum lag of two for annual data in the bounds testing to cointegration. After the lag length was adopted, an F-test for the joint significance of the coefficients of lagged levels of the variables was conducted. Thus, each of the variables in the model was taken as dependent variable and a regression was run on the others.

Pesaran, Shin and Smith (2001) indicates that “this OLS regression in the first difference are of no direct interest” to the bounds cointegration test. It is

however, the F-statistics values of all the regressions when each of the variables is normalized on the other which are of great importance. This F-statistics tests the joint null hypothesis that the coefficients of the lagged levels are zero. In other words, there is no long run relationship between them. The essence of the F-test is to determine the existence or otherwise of cointegration among the variables in the long run. The results of the computed F-statistics when LTR is normalized (that is, considered as dependent variable) in the ARDL-OLS regression are presented in Table 4.

From Table 4, the F-statistics that the joint null hypothesis of lagged level variables (i.e. variable addition test) of the coefficients is zero was rejected at 5 percent significance level. Further, since the calculated F-statistics for $F_{LTR}(\cdot) = 5.378451$ exceeded the upper bound's critical value of (3.2) at 5 percent level of significance. Therefore, null hypothesis of no cointegration (i.e. long run relationship) between Tax Revenue and its determinant was rejected.

$$F_{LTR}(LTR|LOPN, LINF, LIND, LAID, LGPC, LEXV, LEXVOPN) = 5.3784^{**}$$

This result indicates that there is a unique cointegration relationship among the variables in Ghana's tax revenue and that all the determinants of tax revenue can be treated as the 'long-run forcing' variables for the explanation of tax revenue in Ghana. Therefore, there is existence of cointegration among the variables in the tax revenue performance equation and hence we therefore proceed with the tax revenue to GDP equation

Long-Run Results (Tax Revenue is the Dependent Variable)

Table 5 shows the long run estimate based on the Schwartz Bayesian criteria (SBC). The selected ARDL (1, 0, 1, 0, 0, 0, 1, 1) passes the standard diagnostic test (serial correlation, functional form, normality and heteroscedasticity) as can be seen at Table 7. The coefficients indicate the long run elasticities.

Table 5: Estimated Long Run Coefficients using the ARDL Approach

ARDL (1, 0, 1, 0, 0, 0, 1, 1) selected based on SBC Dependent Variable: LTR

Regressor	Coefficient	Standard Error	T-Ratio
LINF	0.0335	0.0445	0.7528
LIND	0.8480***	0.1559	5.4393
LAID	0.2265***	0.0571	3.9663
LGPC	0.6227***	0.1458	4.2693
LOPN	-0.3078**	0.1104	-2.7880
LEXV	-0.8546***	0.2649	-3.2256
LEXV*LOPN	0.0132***	0.0033	3.9399
CONS	-4.0153***	1.1242	-3.5715

Note: ***, **, and * represent 1%, 5% and 10% level of significance in respective terms. Source: Author's Computation using Eviews 9.0

The long run results reveal that exchange rate volatility is disadvantageous to tax revenue generation in Ghana. The coefficient of exchange rate volatility is negative and statistically significant at 1 percent level of significance. With a coefficient of -0.8546, it means that an increase in the volatility of real effective exchange rate of Ghana by 1 percent leads to approximately 0.85 percentage points reduction in tax revenue. Exchange rate volatility is considered in this perspective

as risk to trade. Ideally, in this study, exchange rate volatility affects tax revenue through trade. The result has theoretically underpinning in that the more the real exchange rate of a country becomes volatile, the more trade becomes riskier and for small open economy like Ghana, its consequence is felt on tax revenue, foreign exchange and real output.

The result concurs that of Eichengreen (2008), Adamu (2005), Mordi (2006), Tarawalie, Sissoho, Ahoritor, and Conte (2013), and Adam (2005) for instance, explores the impact of exchange rate volatility on private investment and confirms an adverse effect. Mordi, (2006) employing GARCH model argues that failure to properly manage exchange rates can induce distortions in consumption and production patterns and that excessive currency volatility creates risks with destabilizing effects on the economy. This result implies that exchange rate volatility is an important factor explaining the revenue mobilization efforts and therefore cannot be overlooked. It also shows that in investigating the effect of international trade on expected tax revenue, it is imperative to consider the impact of exchange rate volatility since it has implications for trade. The result however, contradicts the findings of Pindyck (1982) who asserts that volatility could be profitable to firms and therefore expected tax revenue.

From the long run results, in the presence of exchange rate volatility, the more the country liberalises trade with the outside world, the more the country loses tax revenue. The net effect of trade openness-exchange rate volatility interaction is shown below from the estimated equation below:

$$LTR = -4.0153 + 0.0335LINF + 0.8480LIND + 0.2265LAID +$$

$$0.6227LGPC - 0.3078LOPN - 0.8546LEXV + 0.0132LEXV * LOPN$$

$$\frac{\partial(LTR)}{\partial(dLOPN)} = -0.3078 + 0.0132\overline{EXV}, \text{ from the descriptive statistics, } \overline{EXV} = -0.0993$$

$$\frac{\partial(LTR)}{\partial(LOPN)} = -0.3078 + 0.0132(-0.0993)$$

$$\frac{\partial(LTR)}{\partial(LOPN)} = -0.3091^{**}$$

The result shows the net effect of exchange rate volatility and trade openness on tax revenue. The result means that when Ghana opens up its economy by some percentage points to the rest of the world, the net effect of the exchange rate volatility - trade openness interaction on tax revenue is -0.3091. The test for the joint significance, as shown in Appendix E, is statistically significant at 5 percent. This means that in a case of exchange rate volatility, the more the economy opens up to external trade, the more the economy loses tax revenue. Specifically, in the presence of exchange rate volatility, a 1 percent increase in trade openness leads to approximately 0.31 percentage point decline in tax revenue. A possible explanation for this could be that for developing countries like Ghana whose trade receipts are mainly from primary products, frequent misalignment of the exchange given the fairly elastic nature of their products leads to some marginal shortfalls in tax revenue.

On the contrary, it is evident that a percentage point increase in exchange rate volatility given trade openness affects Ghana's tax revenue generation

performance. From the estimated equation, the net effect of exchange rate volatility-trade openness interaction is shown below.

$$LTR = -4.0153 + 0.0335LINF + 0.8480LIND + 0.2265LAID +$$

$$0.6227LGPC - 0.3078LOPN - 0.8546LEXV + 0.0132LEXV * LOPN$$

$$\frac{\partial(LTR)}{\partial(LEXV)} = -0.8546 + 0.0132\overline{LOPN}, \text{ from the descriptive statistics, } \overline{LOPN} =$$

$$2.2729$$

$$\frac{\partial(LTR)}{\partial(LEXV)} = -0.8546 + 0.0132(2.2729)$$

$$\frac{\partial(LTR)}{\partial(LEXV)} = -0.8246^{**}$$

The net-effect of the exchange rate volatility-trade openness interaction shows that a 1 percentage point increase in exchange rate volatility in the presence of trade openness results in approximately 0.8 percentage point decline in tax revenue generation. The petrifying effect of exchange of exchange rate volatility on tax revenue is thus evident. The test for the joint significance shows that the result is statistically significant at 5 percent. The result brings to the fore the effect of exchange rate volatility on tax revenue due to the risk it imposes on trade players as argued by Obeng (2017).

From the result in Table 5, an unconventional result was obtained for openness to trade. The coefficient of trade openness of -0.3078 shows that a 1 percent increase in openness to trade results in decline in tax revenue by approximately 0.3 percent in the long run, ceteris paribus. The result is statistically significant at 5 percent significance level. Trade openness is ambiguous in terms of

its relationship with tax revenue depending on the level of economic development among others. Openness to trade is often theorized to raise tax revenue due to its impact on economic growth through channels such as access to advanced technology from abroad, greater access to a variety of inputs for production and access to broader markets that raise the efficiency of domestic production through increased specialization. However, the results indicate the opposite. Openness to trade rather has a deleterious effect on tax revenue.

The result is not surprising in the Ghanaian case as businesses often lose out on competition as trade liberalisation encourages the importation of cheaper commodities into the economy relative to locally manufactured ones. In consequence, several industries have frozen up and are out of operation (for instance, Komenda sugar factory, Kumasi jute factory, Zuarungu meat processing factory, Bolgatanga rice mills, Pwalugu tomato canning factory, and Wenchi tomato factory). The results suggest that, in the long run, domestic producers in response to the increased foreign competition might have adopted some skill-biased technical change. Thus, trade liberalization worsened the income distribution, which in turn affected tax revenue generation by the central government adversely. This means that increased trade openness has been impacting adversely on tax revenue over the study period. Rodrik (2008) indicated that trade liberalization must be accompanied by complementary adjustment policies, particularly macroeconomic reform, and must go along with a long list of conditions, in order to be effective. One of many conditions is that there must be

no adverse effects on the fiscal balance, or if there are, there must be alternative and expedient ways of making up for the lost fiscal revenues.

The result is however inconsistent with theoretical expectation of the classical views on the role of trade in the macro economy. Empirically, the result concurs the studies of Khattry and Rao (2002), and Matlanyane and Harmse (2001) who found negative relationship between trade openness and trade tax revenue. The result could be that the volume of trade did not increase following a tariff cut in these countries which means that the tax base cannot be increased. As a result, trade openness will lead to a reduction in trade tax revenue. The result however contradicts the works by Pupongsak (2009) who found a positive effect of trade openness on trade tax revenue in Thailand. Nwosa, Saibu and Funkele (2012) also found a positive relationship between trade openness and trade tax revenue.

Moreover, foreign aid has a significant positive effect on tax revenue performance across most specifications. The long run result show that an increase in foreign aid by 1 percent improves tax revenue performance by as much as 0.23 percent and is significant at 1 percent. A key distinction appears to be whether the aid is used productively or simply to finance current consumption expenditures. Moreover, the composition of aid has an important effect on revenue performance. The result is in line with the findings of Sen Gupta (2007), Clist (2010), and Benedek, Crivelli, Gupta and Muthoora (2014). For example, Benedek, Crivelli, Gupta and Muthoora (2014) find that concessional loans are associated with higher domestic revenue mobilization, while grants have the opposite effect. Sen Gupta (2007) pointed out that if foreign aid comes primarily in the form of loans, then the

burden of future loan repayments may induce policymakers to mobilize higher revenues. However, aid in the form of grants may create a moral hazard problem if it decreases incentives to increase the tax base. For instance, there is a general concern that aid may decrease tax revenue in recipient countries. The result is therefore not surprising in Ghana as the continuous dependence on foreign aid has raised the sovereign debt of the country necessitating higher tax net. This result however run afoul to some empirical findings on the implication of foreign aid for tax revenue. For instance, Pivovarsky, Clements, Gupta and Tiongson (2003) and Chaudhry and Munir (2010), in which the latter asserts that net foreign aid has a negative impact on the total tax revenue, which seems to be driven by a negative impact of grants on tax revenue,

Also, the coefficient of GDP per capita carried an expected positive sign and is statistically significant at 1 percent significance level. With a coefficient of 0.6227, it means that as GDP per capita increases by 1 percent, the tax revenue rises by approximately 0.62 percent, *ceteris paribus*. A review of tax systems in developing countries reveal a positive relationship between per capita income and total tax revenue. This finding lends support to the hypothesis that as countries develop, tax bases develop by some proportionate to the growth in income. A higher economic development supposing a lower average citizens' resistance to pay their taxes, because of their lower money marginal utility and a greater proportion of them who surpass an exempt income level. In addition, a high rate of economic growth and a sizeable GDP per capita favour the state's capacity to collect taxes. Several studies including but not limited to Chelliah (1971), Teera (2002), and Sen

Gupta (2007) support this claim. Besley and Persson (2009) argued that the lack of availability of 'tax handles' might limit revenue collection at low levels of income and these limitations should become less severe as the economy develops. Economic development is assumed to bring about both an increased demand for public expenditure (Tanzi, 1987) and a larger supply of taxing capacity to meet such demands (Musgrave, 1969). A higher per capita income reflects a higher level of economic development and indicates a higher capacity to pay taxes as well as a greater capacity to levy and collect them (Chelliah, 1971). There is also the consideration that, as income grows countries generally become more urbanised. Urbanisation per se brings about a greater demand for public services while at the same time facilitating tax collection (Tanzi, 1987). However, Bird and Vaillancourt (2008) have also argued that tax revenue decline in low income countries even though nominal value of GDP per capita improves because it does not realistically depict the improvement in the real incomes of citizens.

Finally, the results show that the coefficient of industry is positive and statistically significant signaling a favourable influence on tax revenue. Industry is positive and statistically significant at 1 percent with a coefficient of 0.8480 indicating an increase in tax revenue of approximately 0.85 percent if there is a 1 percent increase in the share of industrial contribution to GDP. In developing countries like Ghana, manufacturing enterprises are easier to tax than agricultural enterprises since business owners typically keep better books of accounts and records.

One of the main motives of the erstwhile inward-looking growth strategy (Import Substitution Industrialisation) was to ensure widespread growth of the industrial sector. This was in a way intended to enhance easier revenue mobilisation than relying on international trade taxes. This is particularly due to tariff revenue losses at the ports and borders. The result realised from the impact of industrial sector on tax revenue is in conformity to that of Agbeyegbe, Stotsky and WoldeMariam (2004), and Ahmed and Muhammad (2010) in which the latter concludes that the manufacturing sector developing countries has positive impact on growth of tax collection.

The long-run results indicate that any disequilibrium in the system as a result of a shock can be corrected in the long run by the error correction model (ECM). Hence, the ECM that estimated the short-run adjustments to equilibrium is presented as follows.

$$\text{ECM} = \text{LTR} - [0.0336*\text{LINF} + 0.8480*\text{LIND} + 0.2266*\text{LAID} + 0.6227*\text{LGPC} - 0.3078*\text{LOPN} - 0.8546*\text{LEXV} + 0.0133*(\text{LEXV}*\text{LOPN}) - 4.0153]$$

The ECM stands for the rate of adjustment to restore equilibrium in the dynamic model following a disturbance.

Short Run Results (dLTR is the Dependent Variable)

The existence of a long run relationship among tax revenue and its exogenous variables allows for the estimation of long run estimates. The short-run estimates also based on the Schwartz Bayesian Criteria (SBC) employed for the estimation were reported in Table 6.

Table 6: Estimated Error Correction Model using the ARDL Approach.

ARDL (1, 0, 1, 0, 0, 0, 1, 1) selected based on SBC. Dependent Variable: dLTR

Regressors	Coefficient	Standard Error	T-Ratio
dLINF	0.0478*	0.0250	1.9135
dLIND	0.4956***	0.0946	5.2343
dLAID	0.2430***	0.0491	4.9459
dLGPC	0.6837*	0.3582	1.9086
dLOPN	-0.3734**	0.1575	-2.3708
dLEXV	-0.5433***	0.1206	-4.5042
dLEXVOPN	0.0077***	0.0014	5.1828
ECT(-1)	-0.9377***	0.1170	-8.0099
R-Squared	0.9118	R-Bar-Squared	0.8580
S.E. of Regression	0.0710	F-stat. F (9, 20)	16.9358*** [0.000]
Mean of Dependent Variable	2.6529	S.D. of Dependent Variable	0.1854
Residual Sum of Squares	0.0909	Equation Log-likelihood	44.407
Akaike Information. Criterion	-2.1605	Schwarz Bayesian Criterion	-1.6000
DW-statistic	1.9605		

Note: ***, **, and * represent 1%, 5% and 10% level of significance in respective terms.

Source: Author's Computation, using Eviews 9.0

Some descriptive statistics can be obtained from Table 6. From the Table, it can be observed that the adjusted R^2 is approximately 0.86. It can therefore be explained that approximately 86 percent of the variations in tax revenue is explained by the independent variables. Also, a DW-statistics of approximately 1.96 reveals that there is no autocorrelation in the residuals.

The negative coefficient of the Error Correction Term (ECT) is an indication that any shock that takes place in the short-run will be corrected in the long-run. The rule of thumb is that, the larger the error correction coefficient (in absolute terms), the faster the variables equilibrate in the long-run when shocked (Acheampong, 2007). The result showed that the coefficient of the lagged error correction term ECT (-1) exhibits the expected negative sign (-0.9377) and is statistically significant at 1 percent. This indicates that approximately 94 percent of the disequilibrium caused by previous year's shocks converges back to the long run equilibrium in the current year.

The short run dynamics reveal that exchange rate volatility is detrimental to tax revenue mobilisation in Ghana. The study sort to examine the relationship between exchange rate volatility and tax revenue. The result answers the first hypothesis. The coefficient of exchange rate volatility is negative and statistically significant at 1 percent level of significance. The coefficient of -0.5434 reveals that an increase in the volatility of real effective exchange rate of Ghana by 1 percent leads to approximately 0.54 percent decline in tax revenue.

In fact, in this study, exchange rate volatility affects tax revenue through trade. This result is theoretically imperative in that the more the real exchange rate

of a country becomes volatile, the more trade become riskier and for small open economies like Ghana, its implication is felt on tax revenue, and foreign exchange and real output. Mordi (2006) employing GARCH model argues that failure to properly manage exchange rates can induce distortions in consumption and production patterns and that excessive currency volatility creates risks with destabilizing effects on the economy. Both measures of short-term and long-term exchange rate volatility showed negative effects on tax revenue. This result implies that exchange rate volatility is an important factor in explaining the tax revenue generation efforts and cannot be overlooked. It also shows that in investigating the effect of international trade on expected tax revenue, it is imperious to consider the impact of exchange rate volatility since it has implications for trade.

From the short run results, given exchange rate volatility, the more the country liberalises its trade with the rest of the world, the more the country loses tax revenue. The net effect of the trade openness-exchange rate volatility interaction is shown as follows.

$$dLTR = 0.0478dLINF + 0.4956dLIND + 0.2430dLAID + 0.6837dLGPC - 0.3734dLOPN - 0.5433dLEXV + 0.0077dLEXV * LOPN$$

$$\frac{\partial(dLTR)}{\partial(dLOPN)} = -0.3734 + 0.0077\overline{EXV}, \text{ from the descriptive statistics, } \overline{EXV} = -0.0993$$

$$\frac{\partial(dLTR)}{\partial(dLOPN)} = -0.3734 + 0.0077(-0.0993)$$

$$\frac{\partial(dLTR)}{\partial(dLOPN)} = -0.3742***$$

The result shows that the net effect of exchange rate volatility of tax revenue when the country opens up its economy by some percentage to the rest of the world. The net effect of the exchange rate volatility - trade openness interaction on tax revenue is -0.3742. The test for the joint significance as shown in Appendix F shows that the net effect is statistically significant at 1 percent. This means that in a case or presence of exchange rate volatility, a 1 percent increase in trade openness leads to approximately 0.37 percentage point loss in tax revenue. This is not surprising because for developing countries like Ghana whose trade receipts are mainly from primary products, frequent instability in the exchange given the fairly elastic nature of their products leads to some marginal dip in tax revenue.

However, from the results, given trade openness, a percentage point increase in exchange rate volatility affects Ghana's tax revenue generation performance. The net effect of the exchange rate volatility-trade openness interaction is shown from the estimated equation below.

$$dLTR = 0.0478dLINF + 0.4956dLIND + 0.2430dLAID + 0.6837dLGPC - 0.3734dLOPN - 0.5433dLEXV + 0.0077dLEXV * LOPN$$

$$\frac{\partial(dLTR)}{\partial(dLEXV)} = -0.5433 + 0.0077\overline{LOPN}, \text{ but from the descriptive statistics,}$$

$$\overline{LOPN} = 2.2729$$

$$\frac{\partial(dLTR)}{\partial(dLEXV)} = -0.3734 + 0.0077(2.2729)$$

$$\frac{\partial(dLTR)}{\partial(dLEXV)} = -0.3559***$$

The net-effect of the exchange rate volatility-trade openness interaction shows that a 1 percent increase in exchange rate volatility given trade openness results in approximately 0.4 percentage point reduction in tax revenue generation in Ghana. The result as shown in Appendix F is statistically significant at 5 percent. The finding is in agreement with Obeng (2017) who showed that exchange rate volatility is a risk factor to trade. This in effect, has a deleterious impact on tax revenue.

Consistent with long run results and a priori expectation, the coefficient of industry is positive and statistically significant signaling a favourable influence on tax revenue. Industry is positive and statistically significant at 1 percent with a coefficient of 0.4956 indicating an increase in tax revenue of approximately 0.5 percent if there is a 1 percent increase in the share of industrial contribution to GDP. This result is not startling in developing countries. In developing countries like Ghana, manufacturing enterprises are easier to tax than agricultural enterprises since business owners typically keep better books of accounts and records. Right from the first republic, the country sort to develop its industrial base in a bid to spur development. One of the main motives of the erstwhile inward-looking growth strategy (Import Substitution Industrialisation) was to ensure widespread growth of the industrial sector. This was in a way intended to enhance easier and sustainable tax revenue mobilisation from the industries than relying on international trade taxes. This is particularly due to tariff revenue losses at the ports and borders. The revenue-expenditure gap of Ghana could be remedied by ensuring the widespread

growth of the industrial sector as rigorously pursued and succeeded by the developed world.

Additionally, the coefficient of GDP per capita carried an expected positive sign and is statistically significant at 1 percent significance level. With a coefficient of 0.6837, it means that as GDP per capita increases by 1 percent, the tax revenue rises by approximately 0.68 percent, *ceteris paribus*. This reaffirms the quest for developing countries like Ghana to improve the GDP per capita by ensuring a sustained economic growth while controlling population growth. A review of tax systems in developing countries reveal a positive association between per capita income and total tax revenue including. The finding offers support to the assertion that as countries develop, tax bases develop more than proportionately to the growth in income.

In a more theoretical sense, in a series of studies, income or GDP per capita is consistently used as an explanatory variable because the more income a population enjoys, the greater should be its capacity to pay taxes, that is, it can better afford taxation. At the same time, Wagner's Law holds that public goods are luxury goods and, thus, the payment for public goods should rise with incomes. Empirically, Musgrave (1969) contends that lack of availability of 'tax handles' might limit revenue collection at low levels of income and these limitations should become less severe as the economy develops. Economic development is expected to bring about both increased demand for public expenditure (Tanzi, 1987) and a larger supply of taxing capacity to meet such demands (Musgrave, 1969). A higher per capita income reflecting a higher level of development is held to indicate a

higher capacity to pay taxes as well as a greater capacity to levy and collect them (Chelliah,1971).

There is also the consideration that, as income grows countries generally become more urbanised. Urbanisation per se brings about a greater demand for public services while at the same time facilitating tax collection as pointed out by (Tanzi, 1987). Contemporary evidence shows that GDP per capita is strongly linked with urbanization in developing countries and it is argued that urbanization increases the need for tax revenues and the capacity to tax. On the demand side, greater urbanization leads to a greater need for public services. However, on the supply side, urbanization leads to larger taxable bases as economic activity tends to be concentrated in urban areas (Khattry & Rao, 2002)

Furthermore, the short run dynamics as presented in Table 6 indicate that trade openness has a suppressing effect on tax revenue. The coefficient of trade openness of -0.3734 shows that a 1 percent increase in openness to trade will result in decline in tax revenue by approximately 0.37 percent in the long run, *ceteris paribus*. The result is statistically significant at 5 percent. Openness to trade is often theorized to raise tax revenue and by extension growth through trade from channels such as access to advanced technology from abroad, greater access to a variety of inputs for production and access to broader markets that raise the efficiency of domestic production through increased specialization. However, the results in this study is contradictory and as such point to the ambiguous nature of trade openness in terms of its effect. Openness to trade rather has a deleterious effect on tax revenue. The result is not surprising in the Ghanaian case as most businesses are

unable to expand because of keen competition as trade liberalisation encourages the importation of cheaper commodities into the economy relative to locally manufactured ones.

In consequence, several industries have frozen up and are out of operation. The results suggest that, in the long run, domestic producers in response to the increased foreign competition might have adopted some skill-biased technical change. This finding is in line with Khattry and Rao (2002), and Matlanyane and Harmse (2002), Brafu-Insaidoo and Obeng (2008), Bonaglia and Fukasaku (2003), and Agbeyegbe, Stotsky and WoldeMariam (2004). Agbeyegbe, Stotsky and WoldeMariam (2004) argues that for small open economies, a reduction in import tariff associated with trade liberalisation often leads to a drop in trade tax revenue. (Ebrill, Stotsky and Gropp, 1999) provide a clear-cut explanation of the effect of trade liberalization on trade tax. They state that the revenue implications depend largely on the volume of imports after trade is liberalized. Therefore, due to the elasticity of imports for developing countries, a reduction in tariff other than quantitative restriction leads to a decline in tax revenue from trade. The findings of this study contradicts that of Pupongsak (2010) and Nwosa, Saibu, and Fakunle (2012) who concluded that trade liberalization accompanied by the appropriate macroeconomic policies can be undertaken to enhance overall revenue yield and economic growth in the long run.

Foreign aid has a significant positive effect on total tax revenue performance. For low income countries like Ghana, an increase in foreign aid improves total tax revenue performance, this relationship is statistically significant

at 1 percent level of significance. With a coefficient of 0.2430, a percentage increase in foreign aid will improve tax revenue by approximately 0.24 percent. The result is in line with the expected sign and is supported using studies by Hisali (2013) who finds that aid could lead to an increase tax revenue performance. Aid directly increase consumption taxes such as VAT and Excise duties. Consumption taxes are mainly paid by the final consumer which explains the positive relationship between foreign aid and indirect tax revenue performance.

Empirically, foreign aid has a significant effect on tax revenue performance. Sen Gupta (2007) argues that if foreign aid comes primarily in the form of loans, then the burden of future loan repayments may induce policymakers to mobilize higher revenues. However, aid in the form of grants may create a moral hazard problem if it decreases incentives to increase the tax base. For instance, there is a general concern that aid may decrease taxation revenue in recipient countries. In his study, Sen Gupta (2007) found that concessional loans were linked with higher domestic revenue mobilization, while grants had the contradictory effect. In fact, the results in Franco-Rodriguez, Morrissey, and McGillivray's (1998) study on Pakistan were in agreement with this concern. Also, Gambaro, Meyer-Spasche and Rahman (2007) found evidence that there is a positive association between aid inflows and tax revenue, which is primarily driven by the positive relationship between grants and tax revenue. The result in this study deviates from the findings of Thornton (2014) who found out that tax to GDP ratio decreases following aid inflows. Emphatically, Thornton (2014) proposes a one dollar increase in aid causes a 0.52 percentage point drop in the tax-to-GDP ratio.

Furthermore, the short run dynamics reveal that inflation has a positive relationship with total tax revenue performance. The coefficient is statistically significant at 10 percent level of significance. The result shows that an increase in inflation by 1 percent induces total tax revenue generation by approximately 0.05 percent, all other things being equal. An unanticipated inflation benefits government because government gains tax revenue as nominal income increases. The increase in nominal income pushes people into higher tax brackets. Inflation is generally considered a tax for all as both foreigners and indigenes are directly affected by it. Rad (2003), argues that there are several channels through which the consequence of seigniorage, inflation tax raises tax revenue. First, inflation increases personal tax revenue and national insurance contributions as wages increase. They do so because governments rarely index higher tax thresholds in line with inflation – a concept called “fiscal drag”. This means inflation pushes more people into higher rate tax brackets (money illusion) and the government benefits from increased tax revenues accordingly. Second, as a general rule, provided inflation is fairly low and does not change too quickly, business profits increase in line with inflation in the economy. This is very useful for governments as its mean corporate tax revenue also increase. Therefore, any rise in profits which companies have made since the appreciable increase in the price level will have directly translated to increased tax revenue. Lastly, in relation to the international Fisher effect, increasing or higher levels of inflation indicate higher levels of interest rate which leads to inward interest rate arbitrage which raises international tax revenue (Rad, 2003).

However, it is widely argued that high levels of inflation affect the economy as well as the society significantly and adversely. The possible explanation is that an increase in inflation reduces profitability of companies as well as consumption of goods and services which directly reduces direct taxes and consumption taxes. Indirectly, the effect of inflation on tax revenue is that it causes many economic problems like poverty, unequal distribution of wealth, market imperfections, deficit in balance of payments and unemployment which lowers GDP in real terms, GDP per capita and consequently tax revenue. Stockman (1981) argued that individual's welfare falls whenever there is an increase in inflation to the benefit of the government.

Post Estimation (Model Diagnostic) Tests

Diagnostic tests were conducted for the model. Table 7 below presents the summary of the results of the various tests.

Table 7: Diagnostic Tests

Test	Chi/F Version
Serial Correlation	F (2, 16) =1.8750 [0.1855]
Functional Form	F (1, 17) = 1.0735 [0.3147]
Normality	CHSQ(2) = 0.3146[0.8544]
Heteroscedasticity	F (11, 18) = 0.6768[0.7427]

Source: Author's Computation using Eviews 9.0.

The tests as reported in Table 7 indicate that the estimated model passes the Langrangean multiplier test of residual serial correlation among variables. Also, the estimated model passes the tests for functional form misspecification using square of the fitted values. The model also passed the normality test based on the skewness and kurtosis of the residuals. Thus, the residuals are normally distributed across observations. Finally, the estimated model passes the test for heteroscedasticity test based on the regression of squared residuals on squared fitted values.

Specifically, The Table 7 shows the Breusch-Goddfrey Serial Correlation LM test for the presence of autocorrelation. The result of the test shows that the p-value of 0.1855 which is approximately 19 percent is greater than the critical value of 0.05 (5%). This shows the non-existence of autocorrelation. The white heteroscedasticity test above shows that the p-value of about 0.7472 which is approximately 75 percent is more than the critical value of 0.05 or 5 percent. That is, we accept that there is no heteroscedasticity. This shows that there is no evidence of heteroscedasticity since the p-value is considerably in excess of 0.05 and conclude the errors are not changing over time. Table 7 also shows that the Ramey RESET test shows that the p-value of approximately 31 percent (0.3147) and this is greater than the critical value of 0.05 or 5 percent. This shows that there is no apparent non-linearity in the regression equation and it would be concluded that the linear model is appropriate.

Stability Tests

Pesaran, Shin and Smith (1985) suggests that the test for the stability for parameters using cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) plots be conducted after the model is estimated. This is done to eliminate any bias in the results of the estimated model due to unstable parameters. Also, the stability test is appropriate in time series data, especially when one is uncertain about when structural changes might have taken place.

The results for CUSUM and CUSUMSQ are depicted in Figures 7 and 8 respectively. The null hypothesis is that coefficient vector is the same in every period and the alternative is that it is not (Bahmani-Oskooee and Nasir, 2004). The CUSUM and CUSUMSQ statistics are plotted against the critical bound of 5 percent significance level. According to Bahmani-Oskooee and Nasir (2004), if the plot of these statistics remains within the critical bound of the 5 percent significance level, the null hypothesis that all coefficients are stable cannot be rejected.

Figure 7 depicts the plot of CUSUM for the estimated ARDL model. The plot suggests the absences of instability of the coefficients since the plots of all coefficients fall within the critical bounds at 5 percent significance level clearly showing convergence. Thus, all the coefficients of the estimated model are stable and therefore we can say that the coefficients are not changing systematically over the period of the study.

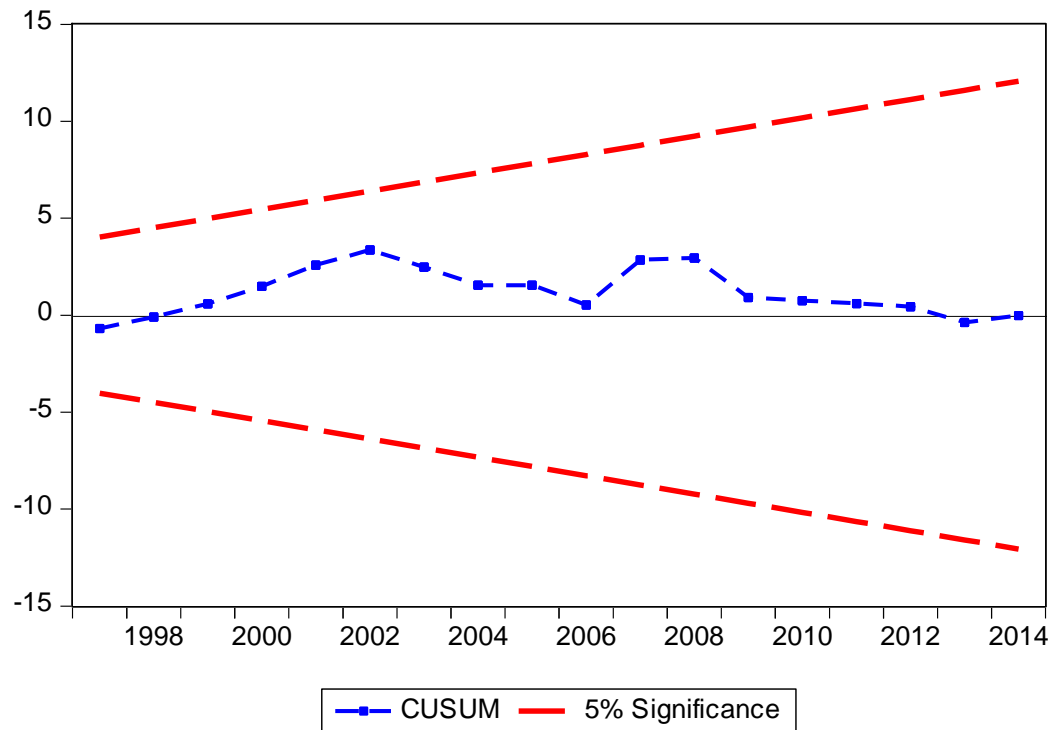


Figure 7: Graph of Cumulative Sum of Recursive Residuals

Source: Author's Computation using Eviews.

Figure 8 also depicts the plot of CUSUMSQ for the estimated ARDL model. The plot also suggests the absences of instability of the coefficients since the plots of all coefficients fall within the critical bounds at 5 percent significance level. Thus, all the coefficients of the estimated model are stable over the period of the study in the sense that they are not changing erratically.

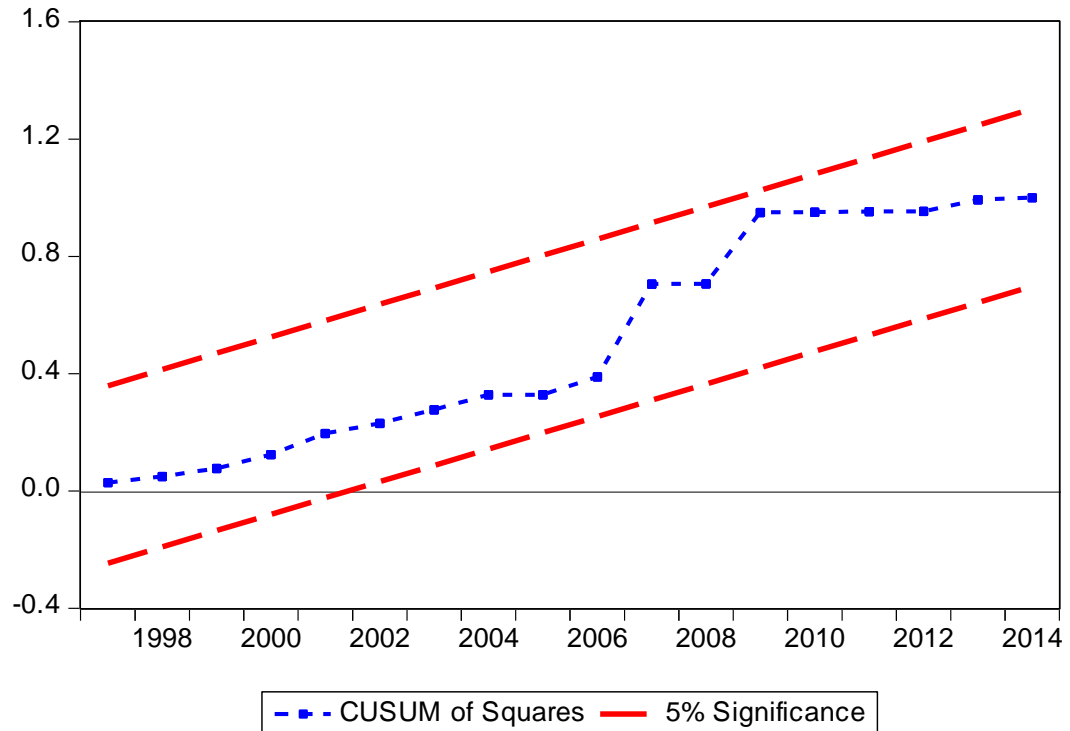


Figure 8: Graph of Cumulative Sum of Square Recursive Residuals

Source: Author's Computation using Eviews.

Granger Causality Tests

In order to examine the predictability of exchange rate volatility on tax revenue, Granger causality test was applied to measure the linear causation among the variables. Employing the Pairwise granger causality test attributed to Engle and Granger (1987), the following results were obtained as depicted in Table 8: In testing for causality between variables, the following outcomes can be expected: a test concludes that a variable Granger causes the other when the set of coefficients for the two variables are statistically significant.

Table 8: Results of Pair-Wise Granger Causality Tests

Null Hypothesis	F-Statistics	Probability
EXV does not Granger Cause LTR	4.0206	0.0312**
LTR does not Granger Cause EXV	1.1196	0.3429
LAID does not Granger Cause LTR	0.2174	0.8061
LTR does not Granger Cause LAID	3.3475	0.0522*
LOPN does not Granger Cause LTR	1.9379	0.1659
LTR does not Granger Cause LOPN	1.6478	0.2135
LGPC does not Granger Cause LTR	0.8696	0.4319
LTR does not Granger Cause LGPC	0.6458	0.5331
LIND does not Granger Cause LTR	3.0231	0.0675*
LTR does not Granger Cause LIND	1.0738	0.3575
LINF does not Granger Cause LTR	0.6224	0.5451
LTR does not Granger Cause LINF	1.4488	0.2547

Note: ***, **, and * denote significance level at 1%, 5% and 10% respectively

Source: Author's computation using Eviews

Thus, causality can be assumed to move from one variable to the other. On the other hand, a test concludes that a variable does not Granger cause the other, when the set of coefficients on the variables are not statistically significant. Table 8 reports the results for the Granger causality between the variable of interest in the study. The test informs policymakers on the predictability of a variable on the other.

From the Table, the null hypothesis that exchange rate volatility (EXV) does not Granger cause tax revenue (LTR) is rejected at 5 percent significance level

meaning that the lag values or histories of exchange rate volatility together with that of tax revenue help in explaining or predict variations in tax revenue better than it can using only lag values of tax revenue. On the other way around, Granger causality cannot be rejected implying that the lag values of tax revenue with the lag values of trade openness do not predict variations in exchange rate volatility. The results suggest a unidirectional causality from exchange rate volatility to tax revenue. The result is in line with the second objective of the study which is to examine the direction of causality between exchange rate volatility and tax revenue. The hypothesis of no directional causality between exchange rate volatility and tax revenue is rejected at 5 percent and the alternative accepted which implies that there is directional causality between exchange rate volatility and tax revenue and it is unidirectional running from exchange rate volatility to tax revenue. This shows that an increasing level of exchange rate volatility which shows riskiness to international trade is detrimental to tax revenue generation.

Moreover, the results in Table 8 show a rejection of the null hypothesis that the industrial sector (LIND) does not Granger Cause tax revenue (LTR) at 10 percent significance level. However, the null hypothesis that tax revenue does not Granger cause industrial contribution to GDP is not rejected implying that the lag values of tax revenue together with that of industry do not predict variations in foreign industrial contribution to GDP. Thus, there is a unidirectional causality from industry to tax revenue.

Lastly, Table 8 shows that the null hypothesis that tax revenue does not Granger cause foreign aid is rejected. This is because the coefficient resulting from

the test is statistically significant at 10 percent leading the study to conclude the existence of a unidirectional causality running from tax revenue to foreign aid. However, the null hypothesis that tax revenue does not Granger cause foreign aid cannot be rejected since the resulting coefficient from the test is not statistically significant implying that the lag values of tax revenue together with that of foreign aid do not causality predict variations in foreign aid. Thus, a unidirectional causality between foreign aid and tax revenue is found. This is an indication that foreign aid is a critical variable in achieving tax revenue in Ghana. In the empirical literature, the study or thesis is in consonance with the findings of Thornton (2014) who found a unidirectional relationship between tax revenue and foreign aid and that it runs from foreign aid to tax revenue. Gambaro, Meyer-Spasche and Rahman (2007) found evidence that there is a causality between aid inflows and tax revenue, which is primarily driven by the positive relationship between grants and tax revenue. Gambaro, Meyer-Spasche and Rahman (2007) found a unidirectional relationship running from foreign aid to tax revenue.

Chapter Summary

This chapter examined the time series properties of the data used for estimation and also presented and discussed the results. Unit root test was conducted by employing both the ADF and the PP techniques which showed that some of the series had to be differenced once to achieve stationarity. The implication is that all the series were integrated of order zero $I(0)$ and one, $I(1)$. The presence of non-stationary variables implies the possibility of the presence of a

long-run relationship, which the study verified using bounds testing approach to cointegration. Granger-causality test suggested uni-directional causality between exchange rate and tax revenue, indicating support for the literature that exchange rate volatility influences tax revenue but not vice versa. Given the findings, the implication is that volatility-tax nexus should be estimated in a single equation framework.

The results indicated the presence of cointegrating relationship between tax revenue and exchange rate volatility. Whereas industry, GDP per capita, foreign aid, and inflation exerted positive and statistically significant impact on tax revenue while a negative effect was realized from trade openness and exchange rate volatility to tax revenue. The results of the ECM showed that the error correction term for tax revenue did carry the expected negative sign.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter summarizes, concludes and gives policy recommendations emanated from the study for the consideration of planners and managers of the economy. The aim is to show the major findings in the study and also suggest policy recommendations as to the way forward to ensure a steady and sustainable tax revenue. The target of the research was to empirically investigate the relationship between exchange rate volatility and tax revenue in Ghana.

Summary

The focus of this study was to investigate the relationship between exchange rate volatility and tax revenue to determine if a long run or short run relationships exist among variables. In totality, the study examined exchange rate volatility together with some control variables and tax revenue using an Auto Regressive Distributed Lag Model that was developed by Pesaran, Shin and Smith (2001).

The results revealed that in the long-run, only exchange rate volatility and trade openness exerted a statistically significant negative effect on tax revenue. This shows that per the findings, trade openness and exchange rate volatility are detrimental to tax revenue generation in Ghana. Nonetheless, GDP per capita, foreign aid, and share of industry in GDP proved tax revenue inducing.

The short-run results, in conformity to what was found in the long run, revealed that GDP per capita, foreign aid, inflation, and the share of the industrial

sector to GDP have a positive and significant influence on tax revenue. However, the short run dynamics also revealed that trade openness and the variable of interest, exchange rate volatility, have deleterious effect on tax revenue.

Moreover, the Granger causality test, which establishes the predictive power of exchange rate vitality on tax revenue based on its past values or behaviour proved significant. The test shows that there is a uni-directional causality from exchange rate volatility to tax revenue.

The existence of a long-run relationship among exchange rate volatility and tax revenue. is further confirmed by a negative and statistically significant coefficient of the lagged error correction term and the size of this coefficient suggest that, any disequilibrium caused by previous year's shocks converges back to the long-run equilibrium in the current year at a rate of 93 percent.

Conclusions

The study empirically determined the relationship between exchange rate volatility - tax revenue in Ghana using data set for the period 1984 to 2014. The theoretical and empirical evidence revealed the following:

In the empirical literature analysis reviewed, the study generally explored the relationship between exchange rate volatility, trade openness, and tax revenue on Ghana and others countries over several decades to present and it was clear that the bulk of the literature produced mixed relationship between exchange rate volatility and tax revenue.

In order to estimate the long-run relationship and short-run dynamic parameters of the model, the Autoregressive Distributed Lagged Model (bounds testing) approach to cointegration was employed. We then started the estimation process by testing for the stationarity properties of the variable using the Augmented-Dickey Fuller (ADF) and Phillips-Peron test statistics. The unit root results suggest that all the variables were stationary after taking first difference with a constant and trend under the ADF test and Philip Peron test statistics. The study then proceeded to examine the long-run and short-run relationships between exchange rate volatility and tax revenue.

Both the long-run and short-run results found statistically significant positive effects of GDP per capita, foreign aid and the share of the industrial sector on tax revenue generation. Inflation was positive and statistically significant only in the short run. However, the more the country liberalizes its trade or experience exchange rate volatility, the more tax revenue declines. The impact of industrial sector to GDP and exchange rate volatility on tax revenue is more pronounced in the long run than in the short run. Also, the net effect of exchange rate-trade openness interaction is tax revenue hindering both in the short run and long run

The diagnostic test results showed that the model passes the test of serial correlation, non-normal errors, and heteroscedasticity as well as the functional form. The graphs of the cumulative sum of recursive residual (CUSUM) test and cumulative sum of squares of recursive residual (CUSUMSQ) test showed that there exists a stable relationship between tax revenue and the selected macroeconomic variables used for the study.

Recommendations

Based on the findings from the study, the following recommendations are proposed.

On macroeconomic stability and particularly on exchange rate, one policy implication of our results is that, domestically, the Bank of Ghana should step-up its exchange rate stabilization efforts to reduce exchange rate risk imposed on exporters. Moreover, the Bank of Ghana should sensitize trade players on the need to patronise hedging or forward contracts. This will go a long way to ensure steady flow of trade and international trade taxes

Coming from the background of the contribution of the industrial sector to tax revenue, it is recommended that, as a way of improving tax revenue, the government should create an establishing environment for the private sector to expand and/or establish new small or medium scale enterprises. The multiple effect of this on the industrial sector and the economy (shown by GDP per capita) as a whole will further improve tax revenue performance since has a significant positive relationship with tax revenue.

The significant negative relationship between trade openness and tax revenue suggests that policies which increase the level of trade openness will be detrimental to increasing revenue generation especially international trade tax revenue. The study recommends that government should take steps to review trade agreements like the Interim Economic Partnership Agreement (I-EPA). In the future, in a bid to increase tax revenue, the government of Ghana through the Ministry of Trade should increase tariff rates marginally.

Limitations

The major drawback to this study was the unavailability of data which is common to Sub-Saharan African countries. We could not use large sample size because missing values for some of the variables in the 1970s.

Moreover, this study used the ARDL approach to cointegration and one major limitation with the method is that it is sensitive to both model specification and lag length selection. The selected lag length has implications for the outcome of the cointegration,

In all, notwithstanding these limitations, the findings of this study retain a considerable degree of reliability and exactness that render this thesis suitable for academic reference and formulations of policies.

Future Direction of Research

It is suggested that for future research on this work, other researchers can expand the sample size and include other macroeconomic variables that are not considered in this model. This can help improve and identify some variables that are crucial to tax revenue generation.

Finally, instead of looking at the impact of exchange rate volatility on tax revenue as a whole, one could study the comparative impact of exchange rate volatility on domestic tax revenue and international tax revenue.

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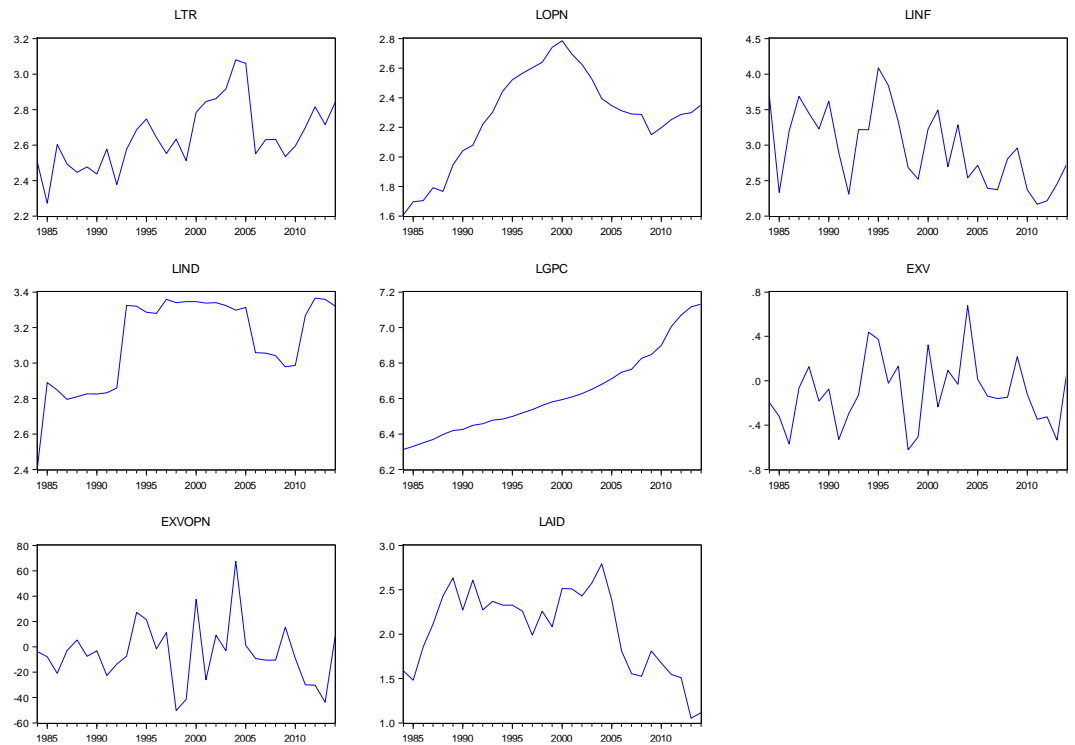
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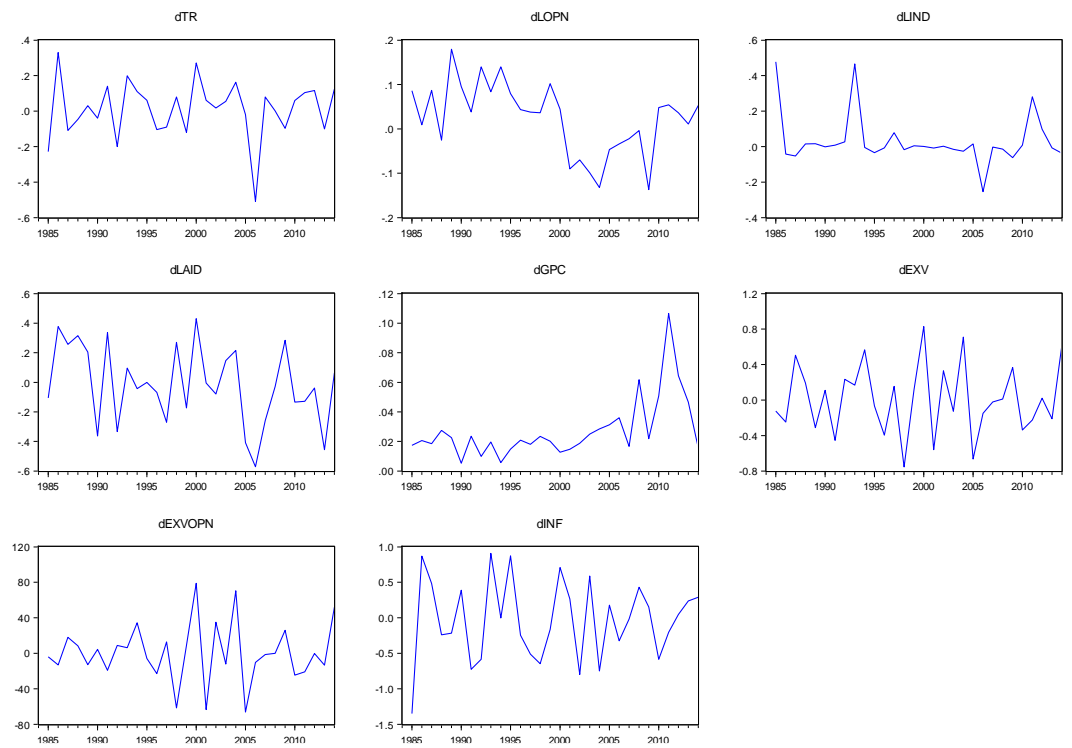
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APPENDICES

APPENDIX A: Plot of Variables (Series) At Level



APPENDIX B: Plot of variables (series) at first difference



APPENDIX C: ARCH Test Result on Real Effective Exchange Rate

SERIES	ARCH	F-Statistics	R-Squared	P-Values
RESID^2				
RER (-1)	0.9166***	4872.17	359.51	0.0000
ARCH [1]		0.0556	0.0559	0.8137

*Note: *** implies 1% level of significance while ARCH [1] is the ARCH LM test.*

Source: Author's Computation, using Eviews 9

APPENDIX D: GARCH (1, 1) Results for Volatility in the Exchange Rate

Variable	Coefficient	Std. Error	Z-Statistic	Prob
CONS	0.0001	2.17E-05	5.1166	0.0000
ARCH (α)	0.4597***	0.0727	6.3233	0.0000
GARCH (β)	0.5869***	0.0417	14.057	0.0000
($\alpha + \beta$)	1.0466			

*Note: *** implies 1% level of significance.*

Source: Author's Computation, using Eviews 9.0

**APPENDIX E: Test for Joint Significance on Trade Openness – Exchange
Rate Volatility Interaction (Short Run)**

F-statistic	4.4600	Prob. F(2,23)	0.0230**
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*Note: ** implies 5% level of significance.*

Source: Author's Computation, using Eviews 9.0

**APPENDIX F: Test for Joint Significance on Exchange Rate Volatility –Trade
Openness Interaction (Long Run)**

F-statistic	5.8100	Prob. F(2,23)	0.0091***
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*Note: *** implies 1% level of significance.*

Source: Author's Computation, using Eviews 9.0