UNIVERSITY OF CAPE COAST

TAX REFORMS AND REVENUE MOBILISATION PERFORMANCE IN GHANA: A CASE OF GHANA REVENUE AUTHORITY IN GREATER ACCRA REGION

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BY

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Dissertation submitted to the Department of Accounting of the School of Business, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Business Administration degree in Finance

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in the university or elsewhere

Candidate's Signature…… Date……

Candidate's Name**:** Benjamin Koomson

Supervisors Declaration

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

Signature……..… Date……

Supervisor's Name: Dr. Samuel Kwaku Agyei

ABSTRACT

The main purpose of this study was to examine the impact of tax reforms on revenue mobilisation performance in Ghana. In order to achieve this purpose, secondary data were obtained from the domestic tax division of the Ghana Revenue Authority, and real GDP values were obtained from the Ghana Statistical Service, which facilitated the analysis for this study. The analysis started with unit root, cointegration, and stability tests to establish the data's stationarity. Afterwards, the study employed the Autoregressive Distributed Lag (ARDL) bounds test to establish the relationships among the variables. The results from the data analysis found that all the variables (revenue generation, Value Added Tax and petroleum tax) under this study had a positive relationship with revenue performance and played a significant role in determining how tax reform influences state revenue performance. This study concluded that tax reforms had a significant effect on revenue mobilisation performance in Ghana and that tax revenue mobilisation is relatively responsive to changes in the economic circumstances in the Ghanaian economy. It was recommended that the GRA keep investing in technology-driven initiatives, such as data analytics and risk-based strategies, to find tax gaps and efficiently pursue non-compliant taxpayers. The GRA and the Ministry of Finance should work together to evaluate the efficiency and impact of current tax incentives and exemptions. Also, the GRA should intensify efforts to bring more individuals and businesses into the formal tax net

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DEDICATIONS

To my family.

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CHAPTER ONE

INTRODUCTION

Tax reform and revenue mobilisation play a crucial role in shaping the economic landscape of any nation (Gale & Samwick, 2016). Ghana, a West African nation with a growing economy, has recognised the importance of an efficient tax system to finance public expenditure, promote development, and reduce reliance on external aid. Over the years, the government has implemented various tax reforms to improve the effectiveness and efficiency of revenue collection. Established in 2009 as the main tax administration body, the GRA plays a central role in implementing these reforms. In Greater Accra, Ghana's capital region and economic hub, the GRA has been actively working towards enhancing revenue mobilisation. Through modernisation initiatives, such as the introduction of electronic tax filing systems and taxpayer education programs, the GRA has aimed to simplify tax processes, increase compliance, and minimize tax evasion. These efforts have facilitated revenue collection and fostered a more transparent and business-friendly environment.

The performance of the GRA in Greater Accra has yielded significant results. Tax revenues have experienced steady growth, reflecting improved compliance levels and a broadened tax base. The GRA's adoption of risk-based approaches and data analytics has enhanced its capacity to identify tax gaps and effectively target enforcement measures (Pepera, Abdulai & Agyemang-Dua, 2020). Additionally, the GRA has strengthened collaboration with other stakeholders, including the Ministry of Finance, to streamline tax policies and facilitate coordinated revenue mobilisation efforts.

However, challenges persist in Ghana's tax reform journey. Informality, narrow tax base, and tax exemptions hinder revenue mobilisation. Therefore, this study seeks to examine the impact of tax reforms on the revenue mobilisation performance in Ghana.

Background to the Study

Generally, it is believed that several countries around the world have now realised the need to be effective in their domestic tax revenue mobilisation and judiciously use the collected revenues on priority-driven public goods and services that will promote economic growth, improve basic social services delivery and an enhanced standard of living of its citizens. That means if the state authorities can prevent excessive uncontrolled leakages in tax revenue mobilisation as a result of wide spread tax avoidance, evasion and corruption and reinforce pro-poor tax policies, it will help to alleviate inequitable distribution of wealth and ultimately achieve socio-economic development. However, if the authorities of the state fail in its tax revenue mobilisation obligations and public expenditures are not well managed to the extent that tax administration costs are not well controlled, there would be a lack of funds to provide adequate welfare services for the people as well as carry out any proper developmental agenda and good governance (Dowd, Landefeld, and Moore, 2017). In view of the above observations, there is a need for an effective, fair, and pro-poor tax system reform that can widen Ghana's tax bracket and ensure more transparency, accountability, and responsiveness to social needs. According to Cobham and Janský (2018), widened tax brackets and reforms tend to influence tax revenue mobilisation, enable states to collect more due taxes, and can be used more efficiently and

effectively. Therefore, there would be a need to examine the institutional framework for collecting taxes and compliance improvement as the way forward to get the cooperation and involvement of the citizens, who are the taxpayers, the general public, and civil society, to enhance revenue collection.

Problem Statement

Analysis of the tax revenue performance over the last decade among developed and developing countries around the world as well as in Africa, by Clausing (2016); Dowd, Landefeld, and Moore (2017); Gumpert, Hines, & Schnitzer (2016) found that Ghana tax revenue performance lies at the bottom threshold of the performance range for the developing countries. This suggested that there is room for tax reforms to ensure revenue expansion. A study by World Bank Group (2016) also indicated that tax revenue performance in Ghana as a ratio to Gross Domestic Product (GDP) was 14.31 percent in 2017, which was lower than the sub-Saharan African countries average of 18 percent. Also, in 2016, the rate of growth in Ghana's tax revenue was 17.31 percent, below the 26.9 percent average in Sub-Saharan African countries. Tax authorities were able to identify a number of potential tax revenue reform options, including raising the value-added tax (VAT) that replaced the previous sales tax, reassessing taxpayers' properties to broaden the base of property tax, reevaluating the definition of income for income tax, and further enhancing the quality of tax administration in order to boost tax collections and prevent tax evasion and fraud.

Despite these various revenue enhancement reform options available for Ghana to be used, there are still issues with the taxation system in Ghana. One such issue was that the specific objectives of tax policies in Ghana were

not always clear (Crivelli et al., 2016; Pepera, Abdulai & Agyeman-Dua, 2020). Additionally, tax policies that try to mobilise money from indirect sources have not considered the elasticities involved. Because of this, several institutional and systemic issues with the tax system's efficiency still exist despite all the tax reforms' changes. However, given that the tax administration cannot provide indicators for essential inputs to estimate taxable bases, this has major implications for mobilising tax revenue. For instance, Ghana's tax revenue mobilisation continuously exceeded initial projections between 1987 and 1989 (Pepera, Abdulai & Agyemang-Dua, 2020).

Even in recent times, before covid 19 pandemic, tax authorities were able to exceed the tax revenue target; meanwhile, the national budget consistently reported a budget deficit, and the government had to resort to borrowing from the foreign and domestic financial markets. Can it be that various tax reforms were not well-positioned to cater to Ghana's revenue needs? To address this question in Ghana and other countries worldwide, several pieces of research have been conducted to determine how tax reforms have contributed to revenue generation. However, most of such studies failed to measure the performance and contribution of tax revenue to Ghana's GDP growth using current tax revenue data and the ARDL approach.

For instance, a research by Asaolu, Dopemu, and Monday (2015) researched the impact of Tax Reforms on Revenue Generation in Lagos State, Nigeria. This study used time series data from 1999 to 2012 and the OLS approach to analyse the contribution of tax to revenue mobilisation in Lagos using quarterly data. This study did not use the ARDL approach or address the

contribution of tax revenue to GDP and the impact of tax reform on the Ghanaian economy. Also, Gale and Samwick (2016) researched the effect of income tax changes on economic growth at the Brookings Institute, UK. The study focused on how changes in individual income taxes affect long-term economic growth. This study emphasised how income tax affected the measurement of economic growth and did not address how the entire tax reform influenced revenue performance. The study was also tailored to the UK economy and did not address taxation in Ghana. In addition, Nwala and Gimba (2019) conducted a similar investigation into the Effect of Tax Reforms on Revenue Generation in Nigeria. This study used the Ordinary Least Square (OLS) approach and focused on taxation in the Nigerian economy. It failed to use the ARDL approach and did not address the Ghanaian economy's tax revenue mobilisation challenges and performance.

A further study was conducted by Nwanakwere (2019) for Tax and Economic Growth in Nigeria: An ARDL Approach. The research used Autoregressive Distribution Lag (ARDL) and divided taxes into corporation income tax (CIT), petroleum profit tax (PPT), value-added tax (VAT), exercise and custom duties before examining each tax's impact on the economy.

A report on Ghana's tax reform and revenue productivity was published in 198 (Kusi, 2019). With the help of estimated tax buoyancies and elasticities, this research analysed the revenue productivity of Ghana's complete tax system and individual taxes. The paper also investigates potential avenues for raising additional funds using numbers gathered from 1983 to 1993 and a calculated tax-to-GDP ratio. However, this study was carried out a

long time ago, over two decades, and a lot of structural changes in the tax system in Ghana took place. The study also failed to use the ARDL approach to measure Ghana's tax revenue performance. A further study of tax reform's effect on emerging economies' ability to raise funds was conducted by Kamasa, Nortey, Boateng, and Bonuedi (2021). Time series data were analysed using the ARDL, dynamic Least squares, and completely modified least square methods from 1980-2018. This research was conducted in Ghana, but the ARDL was employed, the buoyancy and elasticities of the Ghanaian tax system were highlighted, and the econometric contribution of tax reforms in Ghana to revenue mobilisation was emphasised. It failed to measure Tax revenue performance in relation to the contribution of tax to GDP as recommended by IMF (2018). Yin, Wemah, and Abugre (2016) studies paid attention to the assessment of the tax stamp strategies and income tax compliance among private enterprises in Ghana, while current studies from Kamasa, Nortey, Boateng, and Bonuedi (2022) focused on the impact of tax reforms on revenue mobilisation in developing economies. Anecdotal evidence from the researcher indicates a dearth of studies examining the effect of tax reforms on revenue mobilisation performance in Greater Accra using the current data, ARDL, and tax-to-GDP approach as a measure of revenue productivity. Therefore, it is against this gap identified in the literature that the study investigates the effect of tax reforms on revenue mobilisation performance in Ghana.

Purpose of the Study

The general purpose of this study is to examine the impact of tax reforms on revenue mobilisation performance in Ghana.

Research Objectives

Specifically, the study aims at achieving the following objectives:

1. Examine the effect of corporate tax reforms on revenue generation performance in Ghana
2. Determine the effect of Value Added Tax reform on revenue generation Performance in Ghana
3. Analyse the effect of petroleum tax reform on revenue generation performance in Ghana.

Research Questions

This study provided answers to the following questions in order to achieve the above research objectives

1. What is the effect of corporate tax reforms on revenue generation performance in Ghana?

2. How does Value Added Tax reform affect revenue generation performance in Ghana?

3. How does petroleum tax reform affect revenue generation performance in Ghana?

Research Hypotheses

Based on the research questions, the following hypothesis were tested

H_O1: Corporate tax reform has no significant effect on revenue generation performance in Ghana

H_O2: Value Added Tax reform has no significant effect on revenue generation performance in Ghana

H_O3: Petroleum tax reform has no significant effect on revenue generation performance in Ghana

Significance of the Study

This study's outcome will benefit the Ghana Revenue Authority (GRA) in tracking how taxes to reform policies affect revenue generation performance. Additionally, GRA may determine whether tax changes are productive by estimating the impact of specific tax policy innovations on revenue mobilisation. From there, they might focus their efforts on changing the less productive reforms in order to increase the total productivity of tax revenue. Also, projections of tax revenue performance from 2000 to 2021 will assist in clarifying the advantages and disadvantages of the tax schemes. This study will also contribute to the literature by assisting students and researchers who want to conduct similar studies on tax reforms' impact on Ghana's tax revenue performance.

Delimitation of the Study

This study confined itself to the effects of tax policy reforms on revenue mobilisation in Ghana only. Secondary data from the Domestic Tax Revenue office in Greater Accra, the headquarters of GRA, were utilised in this study. As a percentage of Ghana's overall tax revenue collection, it focuses on four primary tax policies: corporate tax, value-added tax, petroleum tax, and personal income tax. It excludes other tax reforms such as the national reconstruction levy, NHIS, communication, covid relief levies because data for these were not available in early 2000, which is the base year for this study.

Limitations of the Study

This study used secondary data on tax revenue obtained from Accra's domestic tax revenue office. Therefore, any miscalculation at the formative stage of the data tends to affect the outcome of this study. Again, some key information needed for analysis may not be available to analyse the needed documents. This study faces several limitations, including the non-availability of data and relevant documents for analysis. Despite the limitations, the researcher could gather enough data per the research tasks and questions.

Definition of Terms

Corporate Income Tax: This is also known as corporation tax, a direct tax imposed on the income or capital gains of corporations, companies, or analogous legal entities. In Ghana, the corporation tax rate was 35% of companies' operating profit.

Petroleum Profit Tax: As amended, this tax was imposed upon hydrocarbons under the petroleum profit tax Act of 1959. It is applied to the net income from oil and gas discoveries made under the grant of petroleum authorisation.

Value Added Tax: This is the tax imposed on the amount by which the value of goods and services has been increased at each stage of its production, distribution, or sale to the end consumer. It is known in some countries as a goods and service tax.

Personal Income Tax is based on how a person earns each income. It is a tax levied on the wages, salaries, dividends, interest, and other income a person earns throughout the year.

Tax to GDP Ratio: It measures the ratio of a country's tax revenue compared to the country's gross domestic product. It is used to measure revenue performance relative to the economic growth of a country**.**

Autoregressive Distribution Lag (ARDL): It is a standard least square regression that includes lags of both the dependent variable and independent lags as repressors. It helps to establish long-term relationships between variables.

Organisation of the Study

The study was conducted in five chapters. Chapter one dealt with the introduction, background to the study, statement of the problem, the purpose of the study, research questions and hypotheses, the significance of the study, delimitations, and limitations. The second chapter examined the theoretical framework, conceptual and literature review highlighting research and other writers' perspectives. Chapter three covered the research methods, including design, population, sampling processes, data collection instrument, pre-testing, validity and reliability of the research instruments, data collection procedures, data processing and analysis, and ethical considerations. The results were presented in chapter four, and the outcomes were examined. Chapter five focused on the study summary, major findings of the study results, conclusions, recommendations, and suggestions for inquiry.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This study examined the impact of tax reforms on revenue mobilisation performance in Ghana. This chapter covers the study's theoretical, conceptual, and empirical literature. The theoretical literature discusses the essential theories on how tax policy reforms affect economic activity. The empirical literature reviews previous similar studies and conceptual reviews deal with the themes key to this topic that form part of this study.

Theoretical Review

Theories are set of prepositions and assumptions that can be translated into reality. The main theories underlining this study that was reviewed in the subsequent paragraphs of this chapter included the cost of service theory, ability to pay theory, and proportionate tax theory.

The cost of service theory

Some economists contend that if the state charges its citizens for services at their actual costs, the concept of equity or justice in taxation will be satisfied. According to Animasaun (2016), the cost of service principle cannot be fully applied in situations where services provided to the broad public cannot be easily allocated to specific individuals. For instance, because it is impossible to calculate accurately, the supply of power on the street and the majority of state expenses cannot be established for each person. For instance, how can the cost of the police, military, and other services be calculated and allocated to the citizens who benefit from them? According to this theory's

application to this research, taxes is necessary because some costs cannot be effectively allocated to specific residents, necessitating the imposition of taxation on individual citizens.

Pricing public utilities and services according to the cost of service theory is predicated on the principle that service fees should be set at a level that adequately compensates service providers for their efforts. When a nation changes its tax system to increase efficiency, justice, and revenue, it is said to have enacted tax reform (Liu, Costanza, Farber, & Troy, 2010). There are several methods to examine how tax changes have affected Ghana's ability to bring in money:

Rationalising the Tax System Increasing the number of people and companies subject to taxation is one strategy for reforming the tax system. This may be accomplished by tightening the rules and requiring more people to comply. The government's potential income may be increased by expanding the tax base.

Changes to the tax rate: Changing tax rates is another part of tax reform. The government's goals will determine whether tax rates are lowered or raised (Paientko & Oparin, 2020). While higher tax rates may bring in more money from people with a larger disposable income, lower tax rates might encourage economic growth and compliance.

Ability to Pay Theory

The most well-known and widely accepted tenet of equity or justice in taxation is that a nation's citizens should contribute to the government in accordance with their financial capacity. According to Anom (2016), it seems fair and acceptable for taxes to be assessed based on a person's ability to pay

them. For instance, the first individual should be required to pay more taxes than the second if the first person's taxable capacity is higher. Justice appears achievable if taxes are imposed based on this principle, but our challenges lie in determining who is capable. The issue with defining who can pay arises when this theory is put into practice.

Proportionate Theory

J. S. Mill and numerous other classical economists proposed the proportional taxation theory to address the idea of justice in taxes. These economists believed that equal sacrifice would be required if taxes were applied in proportion to an individual's income. But contemporary economics takes a different stance. According to Chijioke et al. (2018), when income rises, its marginal utility falls. Only by raising taxes on those with high incomes and lowering them on those with low incomes can the equality of sacrifice be realised. In every modern tax system, they advocate a progressive tax structure (Peter et al., 2016).

Conceptual Review

One definition of taxes is an obligation a government imposes on its citizens to generate revenue for general management. In order to control and advance society, Van't Riet and Lejour (2018) define taxes as the method or process that compels communities or groups of people to contribute a specified amount of money in a predefined manner. According to the DTRO (2019) news programme, reforms are necessary to improve the national economy since taxes are dynamic. Policy makers and administrators regularly conduct tax reform to reflect changing economic, social, and political situations (Trslv et al., 2018). Changes in tax legislation may have an impact

on how the government administers and collects taxes. To increase the efficiency of the present tax system, it may be necessary to implement a new tax rate, a new legislative requirement, or a new assessment technique. Tax reform measures are implemented to enhance contemporary taxes and greatly lessen the system's complexity and lack of transparency (Spengel et al., 2016). Tax changes also seek to improve the tax code's accountability, responsibility, and clarity. They also want to reduce the amount of taxes that the government charges each and every one of its constituents.

Trend Analysis in Ghana's Revenue Performance

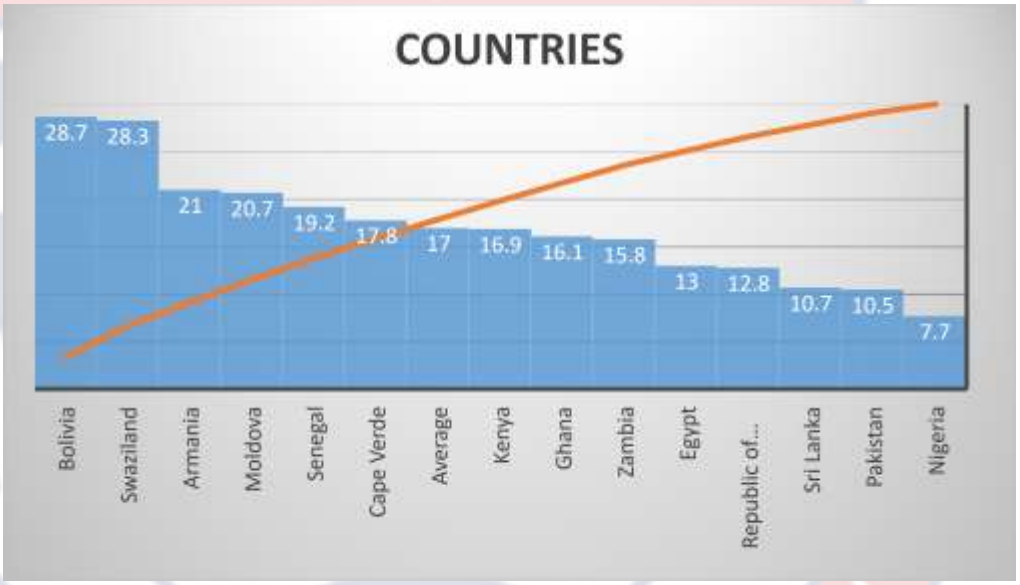


Figure 1: Tax to GDP Ratio

Source: IMF World Revenue Longitudinal Database

According to data from the IMF's World Revenue Longitudinal Database, Ghana's revenue performance is below the average globally. Ghana's revenue performance, measured in terms of tax to GDP ratio, is below the world average of 17.0 for lower-middle-income countries, according to information from the IMF's World Revenue Longitudinal Database. Similar to Ghana's results, Kenya's income performance is below

average. Senegal, Swaziland, and Cape Verde are superior to Ghana in sub-Saharan Africa regarding revenue performance. According to this report, significant adjustments to the tax administration system are needed to improve Ghana's revenue collection capabilities.

It can be noted from Fig.1 that Ghana lies below Kenya, which is also below the average tax-to-GDP ratio expected by IMF from Lower Middle-Income Countries. Notwithstanding, empirical review from other authors suggests how tax reforms affect revenue mobilisation in Ghana, Africa, and other European countries.

Empirical Review

The empirical review will examine research done by the earlier writers on the impact of tax reform on Ghanaian, African, and European revenue performance. For instance, Akitoby, Baum, Hackney, and Harrison (2019) investigated in England the strategies used by European countries to produce significant increases in tax income. According to the research, revenue performance was defined as an increase in the tax-to-GDP ratio of at least 0.5 percent during three years. The researchers created a new data collection with 55 significant gains in tax revenue in developing markets and low-income nations to address the study's problems. The study found that: (i) complex tax administration reforms frequently go hand in hand with tax policy measures; and (ii) the sustainability of the episodes depends on tax administration reforms as the important compliance areas, such as risk-based audits, registration, filing, payment, and reporting as where reforms should be taken into consideration. Indirect tax reforms and exemptions are the most common tax policy measures that nations typically enact.

Gale and Samwick (2016) of the Brookings Institute in the UK investigated the impact of income tax reform on economic growth. The study focused on how changing personal income tax rates are impacted by GDP growth over time. This study focused on the effect of the income tax on GDP growth rates; it did not look at the wider effects of tax reform on tax revenue. The relationship between changes in tax laws and European investment from 1981 to 2012 was also the subject of an experiment (Bolwijn et al., 2018). Using time series data forced the researchers to adopt Ordinary Least Squares for their study. Total capital formation was used to measure investment, while changes in the value-added tax, corporate income tax, excise tax, and other levies were used to measure tax revisions. The impacts of customs and excise taxes were found to be negative and negligible, but the effects of value-added tax and corporate income tax were positive and considerable.

Olaoye and Kehinde (2017) conducted an empirical study on Value-Added Tax and economic development in Nigeria using ordinary least square techniques to ascertain the relationship between GDP (as a proxy for growth) and VAT. The statistics show that variations in VAT revenue collections caused a significant amount of the observed economic growth volatility. This lends credence to the concept that raising taxes might increase government revenue in Nigeria. It might be argued that the study's findings are incorrect since time series data are often non-stationary and do include longitudinal trend sections, and a stationarity test was not carried out.

Beer et al. (2018) looked at the possibility that e-taxation might lessen tax avoidance and dishonest tax officials conduct in Nigeria. Three research questions and hypotheses might be used to encapsulate the article's objectives.

The data was generated using both primary and secondary sources. Means and standard deviations were calculated from the collected data, and then the three hypotheses were assessed using the Z-test. Evidence shows that introducing E-taxation in Enugu might improve tax collection efforts while reducing local tax evasion. The current study looked at revenue mobilisation performance in the Ghanaian context.

Additionally, it was shown that computerised taxes might reduce tax officials' dishonesty. This suggests that the government has not made much headway in establishing its e-tax administration since some tax administrators and taxpayers may not be aware of Nigeria's online tax assessment/collection. Given the high degree of taxpayer compliance, the author concludes that electronic taxes should be introduced to stop the flow of public monies into individual pockets (Birks, 2017).

Oti and Odey (2016) examined the effects of Nigeria's recent tax reform on the nation's revenue since the reform's adoption in 2012. The model was examined using the Engle-Granger Causality test and the Johansen co-integration test. Nigeria's tax reforms employed the value-added tax, corporate income tax, customs and excise duties, and petroleum profit tax as replacement taxes throughout the study period. A longitudinal investigation of the link between changes in tax rates and federal government revenue in Nigeria supported the idea.

To close this gap, Ogbonna and Appah (2016) used data gathered between 1981 and 2007 to empirically assess the effects of tax reform on Nigeria's economic progress. They checked for unit roots and approximated the system using cointegration and an error correction approach. The findings

demonstrated that taxes on personal and corporate income considerably aided economic growth. This validates Soetan's (2017) findings showing that tax change increases economic growth despite the estimating approach's shortcomings.

Pantamee and Mansor (2016) investigated the effect of tax reforms and economic circumstances on tax collections in Kenya after the country launched the tax modernisation initiative to increase revenue collection. A correlational research strategy was used to examine the impact of tax reform on earnings. The research indicated that although economic circumstances positively affected tax collections, tax modifications in Kenya had a negative and substantial connection with tax revenues. An unanticipated result of Kenya's tax revisions was found in the study. The correlations between the variables were studied, but not the causal link between them.

In their investigation of Ghana's revenue sources, Pepera, Abdulai, and Dua (2020) looked at the extent to which micro, small, and medium-sized businesses collaborated with the income tax administration. This research assessed how successful small and medium-sized enterprises (SMEs) in the Nkwanta South District of Ghana complied with the district's income tax administration. The study employed a mixed-method approach and comprised 210 SMEs, ten key informants, and a sample. The key factors affecting tax compliance among micro, small, and medium-sized firms (MSMEs) were a lack of tax knowledge, high tax rates, a high cost of living, and excessive family spending. The analysis found institutional weakness, a lack of resources, widespread opposition to taxes, a lack of coordination among taxing bodies, and political interference as the root causes of tax administration

problems. This study concluded that present processes should be tightened and made simpler to maintain efficient income tax administration in Ghana.

Kusi (2019) used research from 1998 that examined the effects of tax reform on Ghana's revenue output. This research evaluated the revenue-generating potential of Ghana's overall tax system and individual taxes by estimating tax buoyancies and elasticities. The tax to GDP ratio is calculated using data from 1983–1993, and other sources of revenue are evaluated. However, many substantial changes have been made to Ghana's tax system since this study was completed over 20 years ago. Furthermore, the study did not evaluate Ghana's tax revenue performance using the ARDL method.

To learn how tax reform affects revenue collection in underdeveloped countries, Kamasa, Nortey, Boateng, and Bonuedi (2021) looked at data from Ghana. Multiple methods, including ARDL, dynamic Least Squares, and a modified version of the Least Squares, were applied to time series data spanning 1980-2018. Using the ARDL, researchers in Ghana looked at the responsiveness and adaptability of the country's tax structure, focusing on the econometric impact that reforms to the tax system have had on revenue collection. Contrary to the advice of the International Monetary Fund, it did not link tax collection efficiency with the tax's contribution to GDP. In contrast to the findings of Oriakhi and Ahuru (2014), the study finds that changes in the Company Income Tax and the Petroleum Profit Tax do not entirely explain federal revenue. The analyses' findings were consistent with those of Bradbury (2018), who demonstrated that Ghana's tax reform significantly influenced revenue collection throughout the period under discussion.

Conceptual Framework

The concept of tax reforms looks at the weaknesses in existing tax laws and modifies them if it finds that an opportunity exists that such modifications will result in greater productivity of tax revenue performance. This review considered the reforms that have taken place on company income tax, value-added tax, petroleum tax, and personal income tax and how it has affected revenue performance in Ghana. This can be represented as a diagram below.

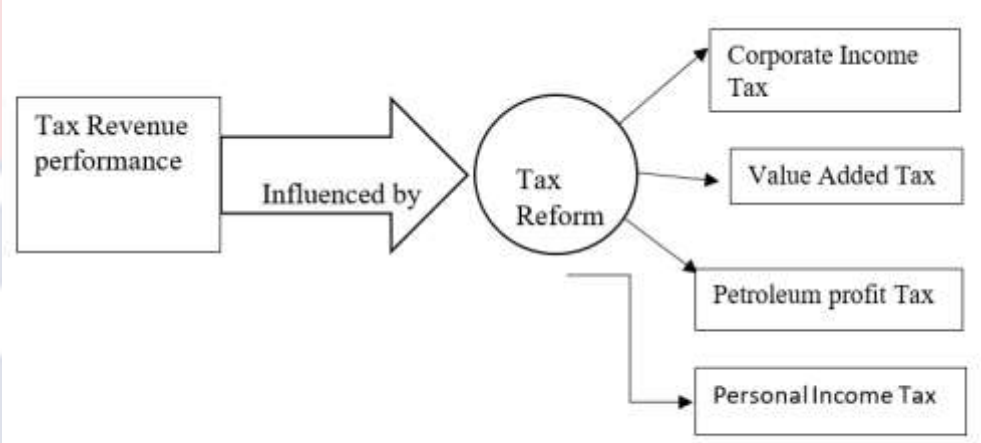


Figure 2: Conceptual Frame

Source. Author's own construct.

The Figure shows that tax revenue generation performance is influenced by tax reform in the selected taxes such as Value Added Tax, Corporate income tax, Petroleum profit tax, and personal income tax. The explanations of each component of the diagram are discussed in the subsequent paragraphs.

Measuring Revenue Performance

The swift growth in tax revenue collection may occasionally result from reforms and decisions made about fiscal policy. Some of the reported tax increases may result from changes in the composition of economic products or fluctuations in the business cycle. In order to remove the cyclical component

from the tax revenue to GDP ratio and depict its structural component solely, this study will apply output elasticity to tax revenue, a frequently employed technique in literature. Using the cyclically adjusted tax revenue-to-GDP ratio as a starting point will be helpful. This is being done because the IMF (2018) recommended that nations aim for a revenue-generating performance of 0.5 percent of GDP per year to strengthen institutions and support economic growth.

Tax Reforms in Ghana

There have been several taxation reforms in Ghana since adopting the IMF's Economic Recovery Program in Ghana that saw many structural adjustments in the Ghanaian economy. This study will limit itself to four main tax reforms Corporate Income Tax (CIT), Petroleum Profit Tax (PPT), "Value Added Tax (VAT) as well as "Personal Income Tax (PIT) respectively (Wawire, 2020).

Corporate Income Tax (CIT)

The Ghanaian government passed the Income Tax Act 2015 (Act 896) 2015 to address corporate income tax. The Act defined a company as any firm or corporation incorporated by or pursuant to any law in force in Ghana other than a corporation sole. In Ghana, the Registrar General Department handles limited liability company registration. A registered business should conclude with Limited (Ltd) or Public Company (Plc). Income taxes paid by corporations fall under the "direct taxes" category because the burden falls on the companies themselves and is not passed on to other entities (Heckemeyer, Overesch, & Overesch, 2017). The appropriate tax entity tasked with, among other things, assessing and collecting corporations income tax is the Ghana

Revenue Authority (GRA), which the Ministry of Finance oversees. 2009 saw a change to the general corporate income tax, now 25%. (IHS, CPB & Dondena, 2017). However, enterprises primarily involved in the hotel industry pay a lower rate of 22%, whereas mining and upstream petroleum industries pay CIT at 35%. After reviewing the CIT, is the tax revenue better, or has retrogression set in? These call for investigation and analysis.

Petroleum Profit Tax (PPT)

Taxes on petroleum profit are assessed against profits from petroleum-related businesses. All businesses involved in producing and transporting petroleum are required to pay tax under the Petroleum Profits Tax Act of 1987 (PNDC Law 188) (Jansky & Palansky, 2018). Ghana has altered this legislation multiple times throughout the years. Any company that conducts petroleum activities within a given accounting period is subject to the Petroleum Profits Tax, which is collected, assessed, and payable on its profits.

The upstream oil business is subject to a tax known as the petroleum profit tax (PPT), according to Reynolds and Wier (2016). All the parts of oil mining, prospecting, and exploration leases related to rents, royalties, margins, or profit-sharing are at the heart of this issue. It has been established that the profits from the sale of the oil and associated materials the business uses in its refineries, as well as any other profits the company gets in connection with or as a consequence of its petroleum activities, are included in the taxable income of a petroleum corporation. Enyi (2016) states that the petroleum tax represents 70% of government income and 95% of Nigeria's foreign currency gains. As such, it is the most significant tax in the nation. According to Nto (2016), petroleum profits in Ghana were first taxed in 1959, following the

passage of the Petroleum Profits Tax Act 1959, which was intended to take effect back on January 1, 1958. In its current form, the Petroleum Profit Tax Act, 2004 (as revised in 2007) builds on the basis laid by this Act.

Value Added Tax (VAT)

In January, Ghana implemented a value-added tax (VAT) under the provisions of Act No. 102 of 1995 to replace sales tax, but it was repealed and reintroduced later due to political pressure, and its implementation truly began in January 1998. Fifteen of the Act's 42 sections have been revised since its introduction. As a result of amendments made in 2013, the Value-Added Tax Act gave a new name in 2013: VAT Act 870. 17 categories of commodities and 24 categories of services were initially subject to value-added tax. However, necessities like food, medicine, literature, newspapers, magazines, housing, commercial vehicles, spare parts, and the services of community and people's banks were exempt from VAT. In 2017, VAT underwent yet another round of revisions, becoming known as ACT 987. This amendment gave the new flat rate structure for VAT the green light, making it easier to collect VAT and the National Reconstruction Levy. The agreed-upon split between the GRA, the NHIS, and the GETFUND was 80% (20%) (20%) (60%) of all revenues. The NHIS fee of 2.5% and the GETFUND levy of 2.5% were uncoupled from the VAT rate of 12.5% in 2018. (Ogbonna & Appah, 2016).

Personal Income Tax

Micro, small, and medium-sized businesses (MSMBs) contribute significantly to Ghana's GDP through the Individual's Share of Personal Income Tax (PIT). The income tax that company owners and employees pay significantly contributes to the federal budget. Tax collectors and government authorities have had a hard time enforcing compliance with this system of taxes. The most important and significant factors of tax compliance among taxpayers in Ghana are the lack of tax education, the high tax rate, the low-income level, and the high level of household spending (Peperah, Abdulai, & Dua, 2019). Other issues with tax administration in Ghana include a lack of resources, a negative public attitude towards tax payment, poor coordination between tax departments, political interference, and weak institutions. Reform and simplification of Ghana's current tax administrative systems were suggested as a possible way forward for policymakers and tax-collecting entities. Due to these challenges of collecting personal income tax, there is a controversial discussion in the Ghanaian parliament as of November 2021 to pass an e-levy bill to reform and improve Personal Income Tax revenue.

Chapter Summary

This chapter outlined and reviewed the opinions of authors of the previous relevant studies on tax reforms and their effects on tax revenue mobilisation in Ghana and other countries in Europe and Africa. It started with the theoretical and empirical and ended with the conceptual reviews of the literature.

CHAPTER THREE

RESEARCH METHODS

Introduction

The study examined the impact of tax reforms on revenue mobilisation performance in Ghana. This chapter presented research methods that guided this study. It comprises the following subheadings; the research approach, research design, data collection procedure, data analysis, stationarity tests for time series properties, measurement of study variables, and model specification.

Research Approach

The three main research approaches such as quantitative, qualitative, and mixed approaches, are available for researchers to choose from based on the purpose of the study. A quantitative research method is used to analyse relationships between variables statistically. This research wants to establish a relationship between revenue generation performance and tax reform policies such as value-added tax (VAT), corporate income tax (CIT), and petroleum profit tax (PET). Therefore, the study adopted a quantitative approach to collect secondary data on Ghana's tax reform and revenue performance.

Research Design

Researchers usually choose a particular research design depending on their research approach. The correlational design is the appropriate research option for a study to measure the relationships among quantitative variables without any intervention in the research processes. The study used descriptive and correlational design methods to obtain information on revenue

performance on value-added tax, corporate income tax, petroleum profit tax, and total revenue generated by GRA.

Data Collection Procedure

Twenty-two years, from 2000 to 2021, were covered by the data for this study. Thus, data were collected from secondary sources from the annual report bulletin of the Ghana Revenue Authority domestic tax revenue office in Accra. Also, tax-to-GDP ratio information was obtained from the Bank of Ghana financial soundness indicators database.

Data Analysis Technique

Based on quarterly tax revenue data from the Domestic Tax Revenue Division office of The Ghana Revenue Authority (GRA) between 2000 and 2021, the research performed the upgraded Dickey-Fuller and Phillips-Perron unit root tests for stationarity. The Autoregressive Distributed Lag (ARDL) limits testing of cointegration was then used to identify the short- and long-term relationships. The research calculated the Error Correction Model to examine the short-term impact of tax revenue changes on GDP (ECM). This made it possible for the study to present the results of the subsequent statistical analyses, including descriptive statistics for time series data spanning 2000 to 2019 and the use of ordinary least square estimates for multiple regression analysis. The E-view software also tested for heteroscedasticity and variance Inflation Factor (VIF) to determine tax reform's effect on revenue performances.

Stationarity Tests for Time Series Properties

All of the variables utilised in the estimation in this study had their time series properties investigated to produce accurate results because the secondary data used for this analysis spans the years 2000 to 2021.

This was accomplished using many tests, including the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP). In the literature, it has been suggested that the inferences that may be taken from such modelling frameworks are undermined by the fact that most economic time series data display strong co-movements. The ADF and PP tests are used to determine the integration order. That is, the required shifts in a variable before it stabilises.

Measurement of Variables of the Study

Revenue performance serves as the primary dependent variable in this study. The percentage was calculated by dividing GRA's yearly income in Ghana by that year's GDP. IMF (2018) recommends that governments aim for revenue increases of 0.5 percent per year to strengthen institutions and promote economic development; this is why the tax-to-GDP ratio will be utilised. The results of the discrepancy analysis stood in for the period's actual revenue performance. In 2018, Ghana's tax as a percentage of GDP was 14.1%, up from 13.8% in 2017. In 2018, the average of all 30 African nations was 16.5%, a rise of about 0.1 percentage points over the previous year. The average of the 30 African nations has risen by 1.4 percentage points from 2010 to 2018; it was 15.1% then and is now 16.5%. Ghana's tax-to-GDP ratio rose from 10.9% to 14.1% over the same period, a 3.2 percentage point improvement. In 2018, Ghana's tax rate was 14.1% of GDP, while in 2000, it was just 7.8%. Taxes on value-added, corporations, petroleum profits, and

individuals comprise the independent variables. Accra's Office of Domestic Tax Revenue provided the numbers for these explanatory factors.

Model Specification

In this study, the hypothetical relationship between revenue performances and the selected tax reform variables, which are value-added tax, personal income tax, corporate income tax and petroleum profit tax, was modelled for analysis. Revenue performance is the function of value-added tax, personal income corporate income tax, and petroleum profit tax. The functional relationship between revenue performance and tax reforms is presented as follows.

$$RevP = \int(TVAT, PPT, CITPIT) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The econometrics model for this analysis will be presented as follows:

$$RevP_t = \propto + \beta_1 TVAT_{t_1} + \beta_2 PPT_{t_2} + \beta_3 CIT_{t_3} + \beta_4 PIT_{t_4} + \mu_t \ldots\ldots\ldots..(2)$$

Where:

$RevP_t$= Revenue performance is the proxy of the actual annual revenue generated divided by GDP for the period under review. This was compared to the tax-to-GDP ratio threshold of 0.5, as suggested by IMF (2018), as a good performance indicator.

$\propto$ = The constant Term or the intercept

TVAT= Total Value Added Tax generated for the period

PPT = Petroleum profit tax generated for the period

CIT = Corporate Income Tax generated for the period

$\beta_1, \beta_2, \beta_3 and\ \beta_4 =$ Beta coefficients

$\mu =$ Error term which was not included in the model

t = time period under review

The research employed a bound testing method based on the Auto-Regressive Distributed Lag (ARDL) model to analyse the long-term and short-term connections between financial results and tax policies. This aids in resolving the issue of drifting time series variables and aids in identifying the series' short- and long-term relationships. In contrast to the classical approach, the ARDL bound testing approach can be applied to time series data that are either of the same order or a different order of integration, that is, I(0) or I(1) series, or both I(0) and I(1). This is why Pesaran et al. (2001) chose the ARDL approach over Eagle and Granger (1987) and Johansen and Juselius (1990) for the long-run cointegration test. Additionally, the ARDL technique is more suitable and provides superior research outcomes for analyses of both short-term and long-term relationships with small sample sizes. In order to apply ARDL, the above equation (2) was stated in linear form and transformed into the ARDL model as follows:

$$InRevP_t = \propto_0 + \beta_1 InTVAT_t + \beta_2 InPPT_t + \beta_3 InCIT_t + \beta_4 InPIT_t + \mu_t \ldots\ldots (3)$$

To determine the short and long-term relationship between revenue performance and tax reforms, equation (3) is transformed as follows:

$$\Delta InRevP_t = \propto_0 + \emptyset InTVAT_{t-1} + \gamma_1 InPPT_{t-1} + \gamma_2 InCIT_{t-1} + \gamma_3 InPIT_{t-1} + \sum_{i-1}^{\rho} \beta_1 \Delta InRevP_{t-0} + \sum_{i-1}^{\rho} \beta_2 \Delta InTVAT_{t-0} + \sum_{i-1}^{\rho} \beta_3 \Delta InPPT_{t-0} + \sum_{i-1}^{\rho} \beta_3 \Delta InCIT_{t-0} + \sum_{i-1}^{\rho} \beta_4 \Delta InPIT_{t-0} + \mu_t$$

where $\emptyset$ and γ represent the long-run relationship while $\beta_1 - \beta_4$ are the short-run relationships. The study estimated the results after establishing

the co-integration among the variables using the ARDL approach. The study computed the coefficients of the lagged variables to identify the long-run relationship, while the coefficients of the summations represent the short-run relationship. The F-test was carried out on the joint null hypothesis that the coefficient of the lag variables was zero, indicating no long-run relationship among the lag level variables. The hypothesis can be defined as follows:

$H_1: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ (There is no long-run relationship)

$H_0: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ (There is a long-run relationship).

Chapter Summary

The research's methodology and models were presented in this chapter. This comprises the methodology and design of the study, the population, the sample, and methods for data collecting and analysis. It also discussed the main factors employed to carry out this study.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction-

The study examined the impact of tax reforms on revenue mobilisation performance in Ghana. To achieve this purpose, secondary data was obtained from the domestic tax division of The Ghana Revenue Authority, and real GDP values were obtained from the Ghana Statistical Service, facilitating the analysis for this study. The analysis started with descriptive statistics, after which unit root tests were performed to establish the stationarity of the data. Also, the cointegration test, unit root test and stability test were carried out.

Short- and long-term associations were then determined using a test of cointegration using Autoregressive Distributed Lag (ARDL) limits. Below are the descriptive statistics, stationarity test results, cointegration test results, summary of multiple regression analysis, heteroskedasticity test results, and variance inflation factor analysis that were generated from the data that was analysed to explore the impact of tax reform on revenue performance: Table 1 shows that the amount of tax revenue generated during the period under review as against the Gross Domestic Product in Purchases values in a million Ghana cedis. A careful study of the trend in Revenue performance which is the tax to-GDP ratio suggested that tax revenue in Ghana keeps increasing annually due to good tax administrative procedures and reform policies. However, these rising tax revenues fall below the IMF recommended annual tax-to-GDP ratio of 0.5, which is required of any nation to finance its budget deficit. This means Ghana needs to increase its tax revenue as its GDP keeps rising yearly. From Table 1, Total VAT (TVAT) = Domestic VAT + Import

VAT, Total Personal Income Tax (TPIT) = Tax from self Employed + Tax from PAYE, TR= Total tax Revenue, GDP = Gross Domestic Product in purchase value in a million Ghana cedis, CIT=

Company Income Tax, PPT= Petroleum Profit Tax, and RevP= Revenue

Table 1: Trend in Total Tax Revenue to GDP Ratio

YEAR	GDP	TR	TR/GDP	CIT	PPT	TVAT	TPIT
2000	8,029	441.46	0.054983	69.67	53.18	148.67	55.86
2001	9,787	655.70	0.066997	96.66	64.66	221.81	79.12
2002	12,784	860.80	0.067334	127.11	108.00	268.84	108.23
2003	15,775	1,278.28	0.081032	179.46	170.59	383.46	163.94
2004	18,272	1,686.50	0.092299	251.19	300.75	527.21	209.74
2005	22,140	2,057.60	0.092935	317.62	376.30	625.60	259.89
2006	25,994	2,370.82	0.091206	315.37	415.17	744.28	351.02
2007	30,640	3,040.26	0.0992252	423.37	455.94	1,001.43	417.81
2008	42,524	3,743.76	0.0880387	512.69	396.54	1,099.41	576.77
2009	48,441	4,625.88	0.0954951	780.50	283.50	1,348.80	855.60
2010	60,565	5,951.45	0.0982655	981.40	275.20	1,629.30	1,078.20
2011	80,774	8,718.53	0.1079373	1,301.60	427.50	2,287.50	1,431.20
2012	102,335	11,743.19	0.1147524	2,416.90	427.50	2,907.30	2,409.80
2013	123,650	13,161.19	0.1064390	2,653.40	583.90	3,300.40	2,590.40
2014	155,433	17,142.29	0.1102873	3,307.70	600.20	4,748.63	3,253.30
2015	180,399	22,156.61	0.1228200	4,059.70	694.20	5,797.40	3,821.20
2016	215,077	27,688.48	0.1287375	5,077.60	1,365.70	6,692.60	4,211.10
2017	256,671	33,623.79	0.1309995	6,330.50	1,254.30	8,365.60	5,337.60
2018	300,596	39,164.73	0.1302902	8,387.40	1,398.70	8,003.00	6,497.00

2019	349,480	43,167.80	0.1235200	11,913.30	1,618.50	8,930.20	7,682.00
2020	391,941	36,177.95	0.092305	11,807.70	1,939.20	14,377.04	8,054.01
2021	459,131	45,569.55	0.099252	14,479.75	2,267.69	18,607.03	10,215.08

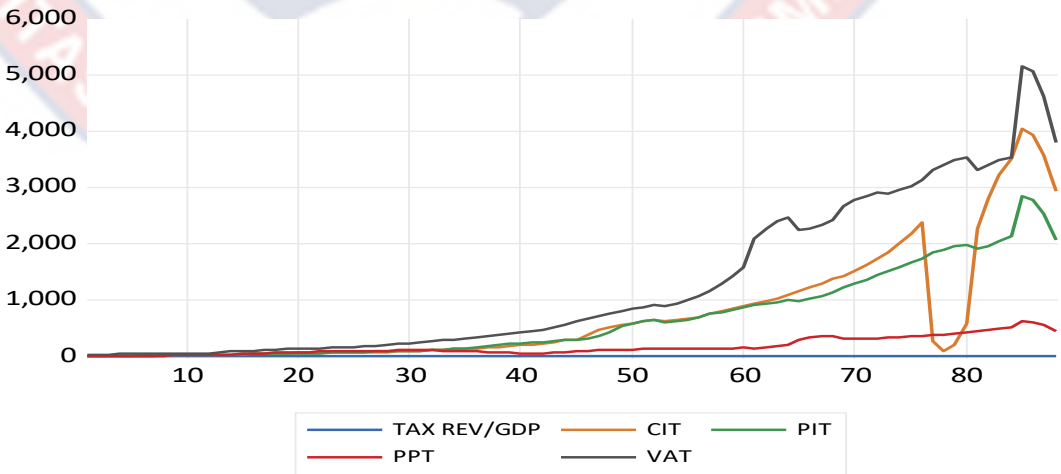
Source: GRA and GSS (2022) RevP=TR/GDP, TVAT=domestic +export vat TPIT=self-employed tax + PAYE, CIT=company income tax, and TR=annual total tax revenue in millions of cedis.

Measuring Revenue Performance

The above yearly trend in tax and GDP were quartered, and percentage changes in tax to GDP ratio and changes in individual taxes were used to measure revenue performance. This was informed by the IMF's (2018) assertion that for a country to enjoy economic prosperity, it should be able to generate at least 0.5 of its GDP as tax revenue. That means as GDP grows, the tax revenue must also increase in proportion so there will be match-ups. The trend in revenue performance has been summarised in Figure 3

In order to determine why there was a steep decline in tax revenue performance at the upper end of the tax-to-GDP ratio, the percentage change in individual tax revenue was analysed, and the results were presented in Figure 3 below:

Figure 3: Tax revenue performances 2000 to 2021



Source: Author's own construct (2022)

From the graph in Figure 3, it can be seen that tax revenue performance has not been stable. Revenue from VAT and petroleum profit tax (PPT) seems to be the most stable. However, revenue from company income tax (CIT) is the most unstable tax element, which was responsible for a steep decline in tax to GDP ratio in Figure 3, which required further investigation to determine the reason for this instability in (CIT).

Unit Root Test Results

Revenue performance (TR/GDP) was calculated by calculating the percentage change in Tax revenue to GDP ratio (TR/GDP), Company Income Tax (CIT), Petroleum Profit Tax (PPT), and Total Personal Income Tax (TPIT) were calculated and tested using the ADF and Phillips-Perron (PP) unit root test to determine the order of integration among these variables (TPIT). When absolute values estimated were higher than test critical values, it was assumed that the data series was stationary; otherwise, it was not. From Table 2, it was noted that the data series was not stationary at the conventional level. However, the data became stationary at the first difference level considering their values 7.44722, -7.23503, 95.0247 and 130.385 in relation to their associated p-value of 0.00,0.0000,0.000,0.000 and 0.000, respectively. Therefore, the null hypothesis that the data has a unit root is rejected after the first difference test. Table 2 displayed the group unit root test as it has been indicated:

Table 2: Unit Root Test Results

Group unit root test: Summary

Series: TAX_REV_GDP_CIT_PIT_PPT_VAT_GDP

Date: 08/17/22 Time: 04:40

Sample: 188

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 7

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistics	Prob.**	Cross-sections	Obs
Null: Unit root (assumes individual unit root process)				
Levin, Lin & Chu t*	7.44722	1.0000	6	497
Null: Unit root (assumes individual unit root process)				
Im Pesaran and Shin W-stat	-7.23503	0.0000	6	497
ADF- Fisher Chi-square	95.0247	0.0000	6	497
PP- Fisher Chi-square	130.385	0.0000	6	516

** Probabilities for Fisher test are computed using an asymptotic Chi-square Distribution. All other tests assume asymptotic normality.

Source: Authors own computation using Eview, 2012 version.

Descriptive Statistics

The descriptive statistics test results provided a brief descriptive coefficient that summarised the data set used in this study. It also represented the entire variables of the study. These variables were analysed using “mean,” “maximum,” “minimum,” “standard deviation,” and “skewness and kurtosis,” with 37 observations of the variables used in the study. The mean indicates the

average value of the series, and the standard deviation shows how the data differ from the average. These were summarised in Table 3:

Table 3: Descriptive Statistics Test Results

Stats	TR/GDP	CIT	GDP	PPT	PIT	VAT
Mean	0.074920	743.9756	33073.44	177.0709	677.9613	1274.348
Median	0.072847	247.6266	17483.06	113.2024	298.8971	590.6999
Maximum	0.100403	4039.399	129043.1	637.5370	10.00157	514.227
Minimum	0.039129	12.55313	1499.492	9.938281	756.8241	26.18008
Std.Dev.	0.016728	996.5969	3451.00	157.4253	1.101942	1391.535
Skewness	0.433776	1.758957	1.072101	1.170744	1.101942	0.993212
Kurtosis	2.456093	5.364364	3.033559	3.350325	3.160731	2.795641
Jargue-Bera	3.844428	65.87510	16.86201	20.55274	17.90411	14.62137
Probabili	0.146283	0.000000	0.000218	0.000034	0.000129	0.000668
Sum	6.592946	65469.85	2910463	15582.24	59660.59	112142.6
Sum Sq.Dev	0.024345	86408861	1.02E+11	2156070	4983209	1.68E+08
Observation	88	88	88	88	88	88

Source: Author's own computation using Eview, 2012 version

The Jarque-Bera (JB) test statistic is a goodness-of-fit test that is always positive if the dataset is normally distributed and checks to see if the skewness and kurtosis of the sample data match the normal distribution. All JB values are positive, and skewness and kurtosis are relatively close to zero, indicating that the data follows a normal distribution. In addition, I cannot reject the null hypothesis that data are not regularly distributed because all of the P-values of the tests are less than 0.05, except the GDP-to-revenue ratio. Therefore, it cannot be concluded that the dataset is not regularly distributed.

Correlation Analysis

This study intends to examine the nature of relationships between the studied variables over time using the correlation coefficients in the observed variables, and the results have been summarised in Table 4:

Table 4: Correlation Matrix

Variables	TR/GDP	CIT	GDP	PPT	TPIT	TVAT
TR/GDP	1					
CIT	0.7205	1				
GDP	0.6982	0.8879	1			
PIT	0.6918	0.8825	0.9984	1		
PPT	0.7067	0.8855	0.9773	0.9712	1	
VAT	0.7220	0.8748	0.9919	0.9904	0.9664	1

Source: Author's computation using Eview, 2012 version

All the variables exhibited a strong positive correlation with revenue performance which, according to IMF (2018), is measured as the total revenue ratio to GDP. This means all the variables such as company income tax, gross domestic product, petroleum profit tax, total personal income tax, which is made up of self-employed income tax and PAYE, as well as total value added tax which is domestic and import tax generated significant to play a role in determining how tax reform influence revenue performance.

Stationarity Tests

In order to determine the order of integration among the variables in this study, the time series properties of each variable were examined using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test. The variables included Revenue performance (TR/GDP), which measures the

percentage change in the ratio of tax revenue to GDP, Company Income Tax (CIT), Petroleum Profit Tax (PPT), Total Vat (VAT), which is made up of domestic VAT plus import VAT, and Total Personal. The assumption was that the data series is said to be stationary when the absolute values calculated were greater than test critical values and not stationary when otherwise stated. The results for the unit root test are presented in Table 5:

Table 5: Stationarity Test Results

Augmented-Dickey Fuller (ADF) Test Variables	ADF Values	MackinnonCritical Values	Order of Integration
TR/GDP	-5.6782	-3.4356	I(1)
CIT	-5.7780	-3.5745	I(1)
PPT	-5.8975	-3.4753	I(1)
TVAT	-5.7754	-3.4123	I(1)
TPIT	-4.9452	-2.9299	I(0)
Phillip-Perron Test (PP) Test			
Variables	PP values	MacKinnon Critical Values	Order of Integration
TR/GDP	-6.5673	-3.6784	I(1)
CIT	-6.7452	-3.6754	I(1)
PPT	-6.9876	-3.6674	I(1)
TVAT	-5.9967	-3.6754	I(1)
TPIT	-6.8987	-3.6754	I(1)

Source: Author's computation using Eview, 2012 version

From Table 5, it was noted that the data series was not stationary at the conventional level. "However, the Philip-Perron test showed that the data became stationary at the first difference level considering their values -5.3424, -3.4632, -2.7431, and -2.4321 in relation to their associated p-value of 0.0012,0.0011,0.0001,0.000 and 0.000 respectively. As a result, after the first difference test, the null hypothesis that the data has a unit root is rejected. The PP approach is used in the study where it is shown that practically all variables are stationary at a 99 percent significance level in their initial departure from the assumption of constant.

Lag length Selection

Based on the number of regressors included in the revenue performance, the maximum lag length selected using the Akaike Information Criterion (AIC) is 2; as a result, the ARDL model obtained is ARDL (1,1,0,0,1,1). The long-run relationship between revenue performance and tax reform was tested using the OLS estimates and then the F-statistics were calculated for the null hypothesis. $H_0 : \delta = \delta = 0$ and the alternative hypothesis that$H_1 = \delta \neq \delta \neq 0$. The result confirmed that the F-test result was more than zero at a 5% significance level; hence the null hypothesis was rejected, and the alternative was accepted, indicating a long-run relationship between tax revenue performance and the tax policy reforms in Ghana. The study used the Akaike Information Criterion (AIC) to select the optimum lag length used in the Vector Error Correction Model. The AIC selected lag length 3; the results are displayed in Table 6.

Table 6: Lag length Selection Criteria

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.503959	Prob. F(2, 70)	0.6063
Obs*R-squared	1.220722	Prob. Chi-Square (2)	0.5432

Test Equation:

Dependent Variable: RESID

Date: 8/18/22 Time: 07:52

Sample: 388

Included observations: 86

Presample missing value lagged residuals set to zero.

Variables	Coefficient	Std. Error	t-Statistic	Prob.
TAX_REV_GDP(-1)	0.121460	0.356251	0.340941	0.7342
TAX_REV_GDP(-2)	-0.117881	0.336211	-0.350618	0.7269
CIT	1.90E-08	8.69E-07	0.0218161	0.9826
CIT (-1)	-1.43E-06	4.34E-06	-0.330143	0.7423
CIT(-2)	1.32E-06	3.85E-06	0.343273	0.7324
PIT	2.21E-06	1.04E-05	0.211192	0.8334
PIT(-1)	-1.86E-06	9.87E-05	-0.188048	0.8514
PPT	-2.59E.06	2.08E-05	-0.124897	0.9010
PPT(-1)	1.14E-06	4.36E-05	0.261271	0.7947
PPT(-2)	-7.58E-06	2.81E-05	-0.270015	0.7849
VAT	-6.53E-07	3.78E-06	-0.172561	0.8635
VAT(-1)	-1.49E-07	3.83E-06	-0.038769	0.9692
VAT(-2)	5.40E-07	2.16E-06	0.249997	0.8033
C	-0.000382	0.002277	-0.167752	0.8673
RESEID(-1)	-0.170702	0.381329	-0.447650	0.6558
RESEID(-2)	0.052370	0.187450	0.279383	0.78808
R-squared	0.014194	Mean dependent var		1.65E-17
Adjusted R-squared	-0.197050	S.D. dependent var		0.001917
S.E of regression	0.002097	Akaike info criterion		-9.330157
Sum squared resid	0.000308	Schwarz criterion		-8.873534
Log likelihood	417.1967	Hannan-Quinn criter.		-9.146387
F-statistics	0.067195	Durbin –Watson stat		2.005400
Prob (F-statistic)	1.000000			

Source: Authors' own Computation (2022)

Co-Integration Analysis

Using the crucial values from MacKinnon-Haug-Michelis (1999), the number of cointegrating vectors, trace test, and maximum Eigenvalue test were calculated. All variables were analysed assuming they did not follow a deterministic trend and their constants were small. The Akaike and Schwartz information criteria were used to decide which test to use. In Table 7 below, you will find the outcomes of both the trace test and the highest Eigen value for the unconstrained co-integration rank test:

Table 7: Cointegration Test Results

Date: 08.18.22 Time: 13:40

Sample (adjusted): 488

Included observations: 85 after adjustments

Trend assumption: Linear deterministic trend (restricted)

Series: TEX_REV_GDP CIT PIT PPT VAT

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rant Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob**
None *	0.366358	100.4672	88.80380	0.0056
At most 1	0.312340	61.68414	63.87610	0.0754
At most 2	0.135917	29.85498	42.91525	0.5108
At most 3	0.121602	17.43767	25.87211	0.3830
At most 4	0.072714	6.416949	12.51798	0.4093

Trace test indicates 1 cointegrating eqn (s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rant Test (Max-EigenValue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistics	0.05 Critical Value	Prob**
None *	0.366358	100.4672	88.80380	0.0056
At most 1	0.312340	61.68414	63.87610	0.0754
At most 2	0.135917	29.85498	42.91525	0.5108
At most 3	0.121602	17.43767	25.87211	0.3830
At most 4	0.072714	6.416949	12.51798	0.4093

Max-Eigen indicates 1 cointegrating eqn (s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Sources: Author's own computation using Eview, 2012 version

Table 5 shows that the Trace test statistic indicated one co-integrating equation at a 5-significance level, and the Max-Eigen value test statistics also indicated one co-integrating equation at a 5-significance level at the first difference. The null hypothesis (H0), which states that there are no co-integrating vectors, may be securely rejected in light of the evidence above, and we can commodiously accept the alternative hypothesis, which states that there are co-integrating vectors. Thus, a long-term association between the variables TR/GDP, CIT, PPT, VAT, and PIT at first difference may be inferred. This finding suggested that the notion that tax reform and revenue success are unrelated should be disproved in the context of Ghana. The performance of Ghana's revenue and tax changes at the initial difference thus have a long-term equilibrium connection.

The final cusum test result has been presented, and it confirms the stability of the data.

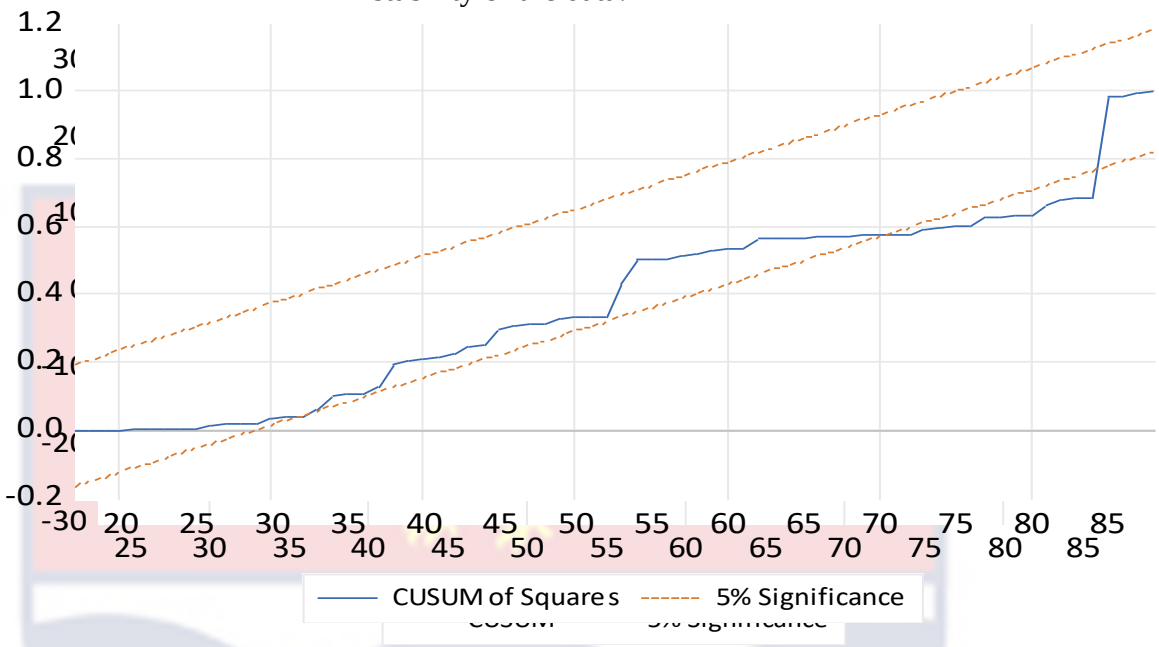


Figure 4: Stability Test Results

Source: Author's own computation (2022)

From the diagrams above, both cusum and cusum square results indicated that the data for this analysis were nearly stable; therefore, ARDL model can be estimated to establish the relationship between tax reforms and revenue performance.

Model Estimation on Tax Reform and Revenue Mobilization Performance

This study analysed the effect of tax reform on the performance of tax revenue in Ghana, as presented in Table 8. The results of the dynamic model revealed that the tax reforms of the company income tax (CIT), petroleum tax (PPT), total vat reform (VAT), and total personal income tax (PIT) are each responsible for a significant portion (98.56%) of the overall coefficient of determination (R2) of the tax revenue performance (% Δ tax to GDP ratio). The adjusted (R2) of 0.9831 showed that the tax revenue performance (%

ΔTR/GDP) was explained in the equation by 98.31% after the explanatory factors' influence was reduced. Additionally, the model specification does not contain serial autocorrelation, as evidenced by the Durbin Watson (D.W.) statistics of 2.0982, which is equal to or above 2. As a result, the linearity assumption was upheld. Additionally, the addition of AR (1) to the model strengthened the Durbin-Watson statistics and eliminated the serial autocorrelation component, confirming the existence of a favourable association between tax reform and Ghana's success in mobilising revenue. This discussion has been summarised in Table 8.

Table 8: ARDL Tax Reform and Revenue Performance Model

Dependent Variable: TAX_REV_GDP

Method: ARDL

Date: 08/18/22 Time: 07:23

Sample (adjusted): 388

Included observations: 86 after adjustments

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (4 lags, automatic): CIT PIT PPT VAT

Fix regressors: C

Number of models evaluated: 2500

Selected Model: ARDL (2, 2, 1, 2, 2)

Note: final equation sample is larger than selection sample

Variables	Coefficient	Std. Error	t-Statistic	Prob*.
TAX_REV_GDP(-1)	1.352728	0.105337	12.88192	0.0000
TAX_REV_GDP(-2)	-0.397552	0.103006	-3.859484	0.0002

CIT	1.15E-05	8.57E-07	13.40886	0.0000
CIT (-1)	-1.57E-05	1.172E-06	-9.101162	0.0006
CIT(-2)	5.22E-06	1.45E-06	3.598368	0.0299
PIT	-1.92E-05	8.69E-06	-2.215490	0.0299
PIT(-1)	1.82E-05	8.80E-06	2.074308	0.0416
PPT	-6.60E-05	1.94E-06	-3.399372	0.0011
PPT(-1)	9.79E-05	2.98E-05	3.286626	0.0016
PPT(-2)	-4.07E-05	1.78E-05	-2.282856	0.0254
VAT	1.24E-05	3.32E-06	3.734643	0.0004
VAT(-1)	-1.41E-05	3.76E-06	-3.742280	0.0004
VAT(-2)	2.83E-06	1.62E-06	1.750189	0.0843
C	0.003740	0.001478	2.530042	0.0136
R-squared	0.985664	Mean dependent var		0.075742
Adjusted R-squared	-0.983076	S.D. dependent var		0.016009
S.E of regression	0.002083	Akaike info criterion		-9.362372
Sum squared resid	0.000312	Schwarz criterion		-8.962827
Log likelihood	416.5820	Hannan-Quinn criter.		-9.201574
F-statistics	380.7962	Durbin –Watson stat		2.098955
Prob (F-statistic)	0.000000			

*****Note: p-values and any subsequent tests do not account for model selection

Source: Authors' own Computation (2022)

It can also be noted from the above Model in Table 8 that all variables had p-values that assumed significance at lag 2 except VAT which has a p-value of 0.0843 and t-statistics of 1.750.

Short run Test Result with Least square Estimates

The size of the figures in the regression, along with the negative and positive indicators. The impact of tax reforms on the effectiveness of tax revenue mobilisation is shown in Table 9. The significance of the coefficients of all the exogenous variables indicated that revenue mobilisation performance in Ghana depends on the nature of tax reform as well as the extent of efficiency in the tax administration system of Ghana. From Table 6, the Least square regression estimates of t-statistics and p-values ($t=1.989$, $p< 0.05$) confirmed that tax reforms significantly affect revenue mobilisation performance in Ghana in the short run. These results agree with the research results of Spengel et al. (2016), Cobham, and Janský (2018). Their results concluded that tax revenue mobilisation is relatively responsive to changes in the economic variables and the nature of tax reforms in an economy in the short run. Table 9 is the summary of the Least Square Regression results:

Table 9: Least Square Regression Results

Variables	Coefficient	Std. Error	t-Statistic	Prob*.
CIT	7.91E-06	2.59E-06	3.059605	0.0030
PIT	-2.62E-05	2.99E-05	-0.875677	0.3838
PPT	3.47E-05	3.80E-05	0.913406	0.3637
VAT	2.30E-05	6.29E096	3.659977	0.0004
GDP	-3.69E-07	7.67E-07	-0.481005	0.6318
C	0.063492	0.063492	27.90595	0.0000

R-squared	0.606608	Mean dependent var	0.074920
Adjusted R-squared	-0.582621	S.D. dependent var	0.016728
S.E of regression	0.010807	Akaike info criterion	-6.151490
Sum squared resid	0.009577	Schwarz criterion	-5.982580
Log likelihood	276.6655	Hannan-Quinn criter.	-6.083440
F-statistics	25.28872	Durbin –Watson stat	0.082195
Prob (F-statistic)	0.000000		

Dependent variable=TR/GDP, regressors: CIT, PPT, TVAT, TPIT

Table 10: Long Run ARDL Test Result with bound test

ARDL Long Run Form and Bounds Test

Dependent Variable: D(TAX_REV_GDP)

Selected Model: ARDL (2, 2, 1, 2, 2)

Case 2: Restricted Constant and No Trend

Date: 08/18/22 Time: 09: 46

Sample: 188

Included observations: 86

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	0.003740	0.001478	2.530042	0.0136
TAX_REV_GDP(-1)*	-0.044823	0.022366	-2.004091	0.0488
CIT(-1)	1.05E-06	6.40E-07	1.637471	0.1059
PIT(-1)	-1.00E-06	2.59E-06	-0.386047	0.7006
PPT(-1)	-8.72E-06	7.46E-06	-1.169789	0.2459
VAT(-1)	1.16E-06	1.37E-06	0.845681	0.4005
D(TAX_REV_GDP(1-)	0.397552	0.103006	3.859484	0.0002

D(CIT)	1.15E-05	8.57E-07	13.40886	0.0000
D(CIT(01))	-5.22E-06	1.45E-06	-3.598368	0.0006
D(PIT)	-1.92E-05	8.69E-06	-2.215490	0.0299
D(PPT)	-6.60E-05	1.94E-05	-3.399372	0.0011
D(PPT(-1))	4.07E-05	1.78E-05	2.282856	0.0254
D(VAT)	1.24E-05	3.32E-06	3.734663	0.0004
D(VAT(-1))	-2.83E-06	1.62E-06	-1.750189	0.0843

*p-value incompatible with t-Bounds distribution.

Level Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistics	Prob.
CIT	2.34E-05	1.62E-05	1.444298	0.1530
PIT	-2.23E-05	5.50E-05	-0.405678	0.6862
PPT	-0.000195	0.000200	-0.973699	0.3335
VAT	2.59E-05	2.86E-05	0.907065	0.3674
C	0.083439	0.014283	5.841877	0.0000

EC= TAX_REV_GDP- (0.0000*CT – 0.0000* PIT -0.0002* PPT+0.0000* VAT+0.0834)

F-Bounds Test Null Hypothesis: No levels of relationship

Test Statistics	Value	Signif.	1(0)	1(1)
			Asymptotic: n= 1000	
F-statistics	1.574794	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Actual Sample Size	86	Finite Sample: n-80		
		10%	2.303	3.22
		5%	2.688	3.698
		1%	3.602	4.787

From Table 10, since the F- statistics value 1.574 is less than all I(0) values, I failed to reject the null hypothesis that there is no long-run relationship at levels between the various variables of tax reforms and tax revenue performance.

Chapter Summary

In this chapter, the study's findings were given, and statistical analysis was used to analyse the findings. Results were presented in tabular and graphical form, and inferences were drawn from interpreting the findings. The data were subjected to a unit root test to determine the stationarity; a descriptive analysis of the result followed this to confirm the normal distribution of the data. After this long rung relationship was established, the first difference between the data set and the stability of the data was also determined. When it was established that the assumptions of linearity of time series data were not violated, the ARDL model was deduced, and the short and long-run relationship between tax reform and tax revenue performance was established.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

This study examined the impact of tax reforms on revenue mobilisation performance in Ghana. This chapter presented the summary of the key findings of the study. The study began with the general hypothesis that various tax reforms have had no significant impact on revenue performance in Ghana. Revenue performance was measured using the IMF (2018) tax-to-GDP ratio criteria. It was thought that a nation's annual revenue should make up at least 0.5 of its annual GDP. Secondary data were collected from the databases of the Ghana statistical service and Ghana revenue authority to analyse the impact of tax reforms on revenue performance. Several preliminary tests, including descriptive statistics and diagnostic tests (Breusch-Gddfreysrial correlation LM test, Unit root test, co-integration test, and stationarity test), were conducted to proceed with the analysis.

While certain factors were initially changing, others were stationary at certain levels. That is, individual taxes like CIT, PPT, TPIT, and TVAT remained at the initial difference at both levels (I(0) and I) (1). The autoregressive distributive lag (ARDL) bound test was used to determine if the data series and hypothesis were normally distributed. The study first examined the connection between revenue performance and overall tax revisions before examining the link between specific taxes and revenue performance.

Summary of ARDL Bound Test for Cointegration test

ARDL bound test is usually stated in the null hypothesis that there is no cointegration or long-run relationship among the variables at levels. This is usually decided using the F-statistics, the upper and lower bound critical values. The null hypothesis is rejected if the F-statistics value is greater than the upper bound critical value. If the F-statistics is less than the lower bound critical value, do not reject the null. The result is inconclusive if the F-statistics lies between the lower and upper bound critical values.

Policy Implication

Some of the policy implications that can be drawn from the summary of the findings of this study are that: first, there was a short-run positive relationship between tax reforms and revenue performance in Ghana at first difference. However, in the long run, there was no strong relationship between the tax reforms and revenue performance at levels. This implies that in the short run, there were inefficiencies in tax revenue collection, which, if not addressed, would have a negative impact on Ghana's revenue performance. Therefore, Ghana revenue authority should formulate policies to eliminate or reduce inefficiencies in tax revenue mobilisation to enhance revenue performance. Ghana revenue authority (GRA) should roll out a policy that will broaden or widen the tax base while cutting down on tax administrative expenses. There was a need to institute a policy to minimise tax evasion and tax avoidance.

Authorities must note that a policy aimed at increasing tax rates would not improve tax performance if tax collection cost, avoidance, evasion, corruption and leakages were not addressed. For instance, personal income tax

(PIT) is made up of self-employed, and PAYE should be widened, especially the self-employed aspect, which constitutes tax from the informal sector and requires further modification and means of collection. The government decision to implement e-levy to bring more people in the informal sector on board is a step in the right direction to widen the tax net to improve tax revenue performance. However, this should be done so that it will not bring serious long-run economic hardship to the citizens. Also, the need to digitise the road toll to capture commercial and private vehicles that ply our roads and other informal tax collection to enhance tax revenue performance will greatly enhance revenue mobilisation and improve revenue performance.

Conclusions

A careful study of the trend in Revenue performance which is tax to GDP ratio suggested that tax revenue in Ghana keeps increasing annually due to good tax administrative procedures and reform policies. However, these rising tax revenues fall below the IMF (2018) recommended annual tax-to-GDP ratio of 0.5, which is required of any nation to finance its budget deficit. This means Ghana needs to increase its tax revenue as its GDP keeps rising yearly. The study's results reveal that tax reforms positively impact revenue performance in the short run. Therefore, this study concluded that various tax reforms must continue to contribute significantly to the revenue mobilisation performance in Ghana. However, some individual taxes, such as PAYE's total personal income tax (TPIT) and self-employed taxes from the informal sector, must be modified and widened to significantly impact revenue performance.

Therefore, Ghana Revenue Authority should roll out policies that bring the most self-employed on board to facilitate the collection of more taxes to

improve revenue performance. The government decision to introduce e-levy to increase the collection of taxes from the informal sector in Ghana is a step in the right direction to improve revenue performance. Notwithstanding, the e-levy implementation should be done so that it will not bring serious economic hardships to ordinary citizens. Petroleum profit tax (PPT) which directly impacts the citizens' economic and living conditions, can be reduced, while Vat (TVAT) and other indirect taxes, which are difficult to evade and do not directly impact citizens, can be increased to improve tax revenue performance. While thinking of widening the tax net to generate more revenue, the collection cost, tax evasion, and tax avoidance can be critically monitored and minimised to avoid tax revenue leakages.

Recommendations

The study has confirmed that tax reform policies positively impact a country's tax-to-GDP ratio and improve revenue performance. Notwithstanding, tax revenue performance can be achieved when the citizens are ready to pay more. Generally, because citizens do not see direct benefits from taxes, they feel reluctant to pay, evade and avoid taxes in Ghana. Therefore, the following recommendations were made:

1. The Ghana Revenue Authority should increase its efforts to enlist more people and organisations in the official tax system. This may be accomplished via active taxpayer registration campaigns, focused outreach initiatives, and streamlined tax filing procedures. Increased revenue collection will also result from taking action to stop tax evasion and illegal economic activity.

2. A comprehensive review of tax incentives and exemptions is necessary to ensure fairness and equity in the tax system. The GRA should collaborate with the Ministry of Finance to assess the effectiveness and impact of existing tax incentives and exemptions. This evaluation should focus on identifying and eliminating provisions that result in revenue leakage or disproportionately benefit specific industries or individuals. By streamlining and rationalising tax incentives, the GRA can generate additional revenue and create a more level playing field for businesses.
3. The GRA should invest in technology-driven initiatives, such as data analytics and risk-based strategies, to find tax gaps and efficiently pursue non-compliant taxpayers. The GRA staff's capacity-building programmes, which include tax law and regulatory training, may improve their ability to enforce tax compliance. To combat cross-border tax evasion, coordination with other law enforcement organisations like the police and customs should be improved.

Suggestion for Further Research

Based on the above results, future research on tax reform's effect on revenue performance can be conducted using a qualitative approach to interview the key informants on how tax reforms influence revenue mobilisation performance in Ghana. There can be research on how taxation affects the financial sustainability of firms in Ghana. In addition, further research can be conducted on how the recent COVID-19 levy and the electronic levy, popularly known as e-levy, have influenced revenue mobilisation in performance in Ghana.

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APPENDICES

APPENDIX

Null Hypothesis: D(TR_GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.198810	0.0000
Test critical values:	1% level	-3.516676	
	5% level	-2.899115	
	10% level	-2.586866	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TR_GDP,2)
Method: Least Squares
Date: 04/27/22 Time: 05:21
Sample (adjusted): 2000Q3 2019Q4
Included observations: 78 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TR_GDP(-1))	-1.053656	0.114543	-9.198810	0.0000
C	0.000926	0.000446	2.075825	0.0413

R-squared	0.526828	Mean dependent var	0.000000
Adjusted R-squared	0.520602	S.D. dependent var	0.005542
S.E. of regression	0.003837	Akaike info criterion	-8.262743
Sum squared resid	0.001119	Schwarz criterion	-8.202315
Log likelihood	324.2470	Hannan-Quinn criter.	-8.238552
F-statistic	84.61810	Durbin-Watson stat	2.006084
Prob(F-statistic)	0.000000		

Date: 04/27/22 Time: 05:33
Sample (adjusted): 2000Q4 2019Q4
Included observations: 77 after adjustments
Trend assumption: Linear deterministic trend
Series: TR_GDP CIT GDP PPT TPIT TVAT
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.423451	115.2692	95.75366	0.0012
At most 1 *	0.324095	72.86573	69.81889	0.0280
At most 2	0.232064	42.70456	47.85613	0.1399
At most 3	0.146890	22.37280	29.79707	0.2782
At most 4	0.070263	10.14007	15.49471	0.2701
At most 5 *	0.057139	4.530378	3.841465	0.0333

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.423451	42.40345	40.07757	0.0269
At most 1	0.324095	30.16117	33.87687	0.1304
At most 2	0.232064	20.33176	27.58434	0.3186
At most 3	0.146890	12.23273	21.13162	0.5249
At most 4	0.070263	5.609696	14.26460	0.6636
At most 5 *	0.057139	4.530378	3.841465	0.0333

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

TR_GDP	CIT	GDP	PPT	TPIT	TVAT
78.12628	0.003472	-0.000156	-0.008149	-0.002183	0.004106
-44.40363	0.000158	4.66E-05	0.001621	-0.001064	-0.001224
-24.45515	8.31E-05	0.000269	-0.007947	-0.010883	0.000149
91.45392	0.000656	0.000112	-0.000545	-0.005904	-0.000646
57.27432	-0.000397	0.000129	-0.006851	-0.001623	-0.002229
69.27075	0.003998	0.000106	-0.007960	-0.009363	0.000425

Unrestricted Adjustment Coefficients (alpha):

D(TR_GDP)	0.000106	0.000379	0.001575	-0.000409	0.000218	-0.000257
D(CIT)	-174.2927	-206.0806	32.68833	-51.78132	-11.83642	32.71587
D(GDP)	-2521.610	-5247.595	835.2164	-602.7280	-73.39363	-307.3880
D(PPT)	17.93411	-30.96282	2.148056	-16.39342	11.60591	2.918242
D(TPIT)	-83.21474	-113.7561	41.75505	1.862398	-10.77267	1.197961
D(TVAT)	-110.9059	-93.85104	32.51187	7.573806	33.92807	-33.46629

1 Cointegrating Equation(s): Log likelihood -2360.821

Normalized cointegrating coefficients (standard error in parentheses)

TR_GDP	CIT	GDP	PPT	TPIT	TVAT
1.000000	4.44E-05	-2.00E-06	-0.000104	-2.79E-05	5.26E-05
	(7.4E-06)	(7.0E-07)	(2.3E-05)	(2.6E-05)	(8.8E-06)

Adjustment coefficients (standard error in parentheses)

D(TR_GDP)	0.008291
	(0.03698)
D(CIT)	-13616.84
	(4574.44)
D(GDP)	-197004.0
	(98839.2)
D(PPT)	1401.125
	(841.649)
D(TPIT)	-6501.258
	(2382.12)
D(TVAT)	-8664.666
	(2867.24)

2 Cointegrating Equation(s): Log likelihood -2345.740

Dependent Variable: TR_GDP
Method: ARDL
Date: 04/27/22 Time: 05:36
Sample (adjusted): 2001Q3 2019Q4
Included observations: 74 after adjustments
Dependent lags: 6 (Fixed)
Dynamic regressors (6 lags, fixed): CIT GDP PPT TPIT TVAT
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
TR_GDP(-1)	0.767681	0.171940	4.464820	0.0001
TR_GDP(-2)	-0.055836	0.197534	-0.282667	0.7793
TR_GDP(-3)	-1.54E-12	0.157297	-9.81E-12	1.0000
TR_GDP(-4)	0.175343	0.184938	0.948118	0.3502
TR_GDP(-5)	-0.119294	0.198025	-0.602418	0.5511
TR_GDP(-6)	0.102230	0.162825	0.627852	0.5346
CIT	-5.62E-06	7.74E-06	-0.726104	0.4731
CIT(-1)	4.39E-06	9.71E-06	0.452548	0.6539
CIT(-2)	-8.55E-06	8.07E-06	-1.059352	0.2974
CIT(-3)	-8.58E-18	2.74E-06	-3.14E-12	1.0000
CIT(-4)	-1.43E-05	1.69E-05	-0.843863	0.4050
CIT(-5)	1.03E-05	2.11E-05	0.488926	0.6282
CIT(-6)	1.41E-05	1.72E-05	0.819343	0.4187
GDP	-7.70E-07	2.75E-07	-2.801428	0.0086
GDP(-1)	6.45E-07	3.71E-07	1.738170	0.0918
GDP(-2)	-1.83E-07	3.45E-07	-0.532397	0.5981
GDP(-3)	-4.41E-18	2.41E-07	-1.83E-11	1.0000
GDP(-4)	1.49E-06	5.96E-07	2.491663	0.0181
GDP(-5)	-1.06E-06	7.41E-07	-1.423701	0.1642
GDP(-6)	6.90E-07	5.94E-07	1.160785	0.2543
PPT	2.62E-05	1.24E-05	2.117889	0.0420
PPT(-1)	-2.18E-05	1.57E-05	-1.389073	0.1744
PPT(-2)	9.59E-06	1.44E-05	0.665736	0.5104
PPT(-3)	1.36E-16	1.03E-05	1.32E-11	1.0000
PPT(-4)	-1.20E-05	1.88E-05	-0.640685	0.5263
PPT(-5)	9.34E-06	2.24E-05	0.417243	0.6793
PPT(-6)	-1.72E-05	1.86E-05	-0.923683	0.3626
TPIT	1.35E-05	1.54E-05	0.873512	0.3889
TPIT(-1)	-1.34E-05	1.92E-05	-0.696416	0.4912
TPIT(-2)	1.03E-05	1.65E-05	0.621633	0.5386
TPIT(-3)	1.58E-16	9.78E-06	1.61E-11	1.0000
TPIT(-4)	-9.01E-06	2.25E-05	-0.400126	0.6917
TPIT(-5)	5.99E-06	2.73E-05	0.219731	0.8275
TPIT(-6)	-2.69E-05	2.25E-05	-1.193180	0.2416
TVAT	3.50E-06	4.32E-06	0.810674	0.4235
TVAT(-1)	-3.12E-06	5.12E-06	-0.608614	0.5471
TVAT(-2)	-2.67E-06	4.47E-06	-0.597739	0.5542
TVAT(-3)	2.45E-17	2.68E-06	9.14E-12	1.0000
TVAT(-4)	-6.76E-06	5.63E-06	-1.201460	0.2384
TVAT(-5)	4.77E-06	6.55E-06	0.727816	0.4720
TVAT(-6)	-4.18E-06	5.42E-06	-0.771451	0.4461
C	0.007728	0.006867	1.125287	0.2688

R-squared	0.989636	Mean dependent var	0.103520
Adjusted R-squared	0.976357	S.D. dependent var	0.018583
S.E. of regression	0.002857	Akaike info criterion	-8.581065
Sum squared resid	0.000261	Schwarz criterion	-7.273352
Log likelihood	359.4994	Hannan-Quinn criter.	-8.059402
F-statistic	74.52649	Durbin-Watson stat	2.159141
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: TR_GDP
Method: ARDL
Date: 04/27/22 Time: 05:51
Sample (adjusted): 2000Q2 2019Q4
Included observations: 79 after adjustments
Maximum dependent lags: 6 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (6 lags, automatic): CIT GDP PPT TPIT TVAT
Fixed regressors: C
Number of models evaluated: 100842
Selected Model: ARDL(1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
TR_GDP(-1)	0.901938	0.045213	19.94863	0.0000
CIT	-6.52E-06	1.99E-06	-3.281553	0.0016
CIT(-1)	5.82E-06	2.11E-06	2.765292	0.0073
GDP	-7.13E-07	1.60E-07	-4.452862	0.0000
GDP(-1)	7.69E-07	1.63E-07	4.716885	0.0000
PPT	3.42E-05	6.67E-06	5.128109	0.0000
PPT(-1)	-3.48E-05	6.64E-06	-5.235232	0.0000
TPIT	3.24E-05	6.35E-06	5.099646	0.0000
TPIT(-1)	-3.34E-05	6.46E-06	-5.170767	0.0000
TVAT	6.14E-06	1.90E-06	3.224016	0.0020
TVAT(-1)	-6.06E-06	1.93E-06	-3.149173	0.0024
C	0.008293	0.003372	2.459609	0.0165

R-squared	0.983597	Mean dependent var	0.100752
Adjusted R-squared	0.980904	S.D. dependent var	0.020982
S.E. of regression	0.002899	Akaike info criterion	-8.709594
Sum squared resid	0.000563	Schwarz criterion	-8.349678
Log likelihood	356.0290	Hannan-Quinn criter.	-8.565401
F-statistic	365.2458	Durbin-Watson stat	2.132296
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

	TR_GDP	CIT	GDP	PPT	TPIT	TVAT
TR_GDP	1	0.75963398...	0.84087731...	0.84665480...	0.83114271...	0.86718862...
CIT	0.75963398...	1	0.98041589...	0.94035752...	0.98414427...	0.94925711...
GDP	0.84087731...	0.98041589...	1	0.95586461...	0.99827818...	0.99005840...
PPT	0.84665480...	0.94035752...	0.95586461...	1	0.94396239...	0.94991606...
TPIT	0.83114271...	0.98414427...	0.99827818...	0.94396239...	1	0.98458253...
TVAT	0.86718862...	0.94925711...	0.99005840...	0.94991606...	0.98458253...	1

Vector Autoregression Estimates
Date: 04/27/22 Time: 06:02
Sample (adjusted): 2000Q3 2019Q4
Included observations: 78 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	TR_GDP	CIT	GDP	PPT	TPIT	TVAT
TR_GDP(-1)	0.791916	-2702.545	-59675.70	-365.1385	-1988.140	-2898.344
	(0.16011)	(20828.8)	(443551.)	(3726.15)	(10830.4)	(13514.0)
	[4.94594]	[-0.12975]	[-0.13454]	[-0.09799]	[-0.18357]	[-0.21447]
TR_GDP(-2)	0.142220	-3957.015	15369.26	1772.505	182.3234	324.6715
	(0.15623)	(20323.7)	(432795.)	(3635.80)	(10567.8)	(13186.2)
	[0.91031]	[-0.19470]	[0.03551]	[0.48751]	[0.01725]	[0.02462]
CIT(-1)	1.35E-07	0.840849	0.280318	0.036454	-0.015017	-0.067928
	(2.8E-06)	(0.36549)	(7.78323)	(0.06538)	(0.19005)	(0.23714)
	[0.04792]	[2.30058]	[0.03602]	[0.55752]	[-0.07901]	[-0.28645]
CIT(-2)	-3.14E-07	-0.256202	-8.256540	-0.006320	-0.185879	-0.294034
	(3.0E-06)	(0.39156)	(8.33822)	(0.07005)	(0.20360)	(0.25405)
	[-0.10434]	[-0.65432]	[-0.99020]	[-0.09023]	[-0.91296]	[-1.15740]
GDP(-1)	-1.51E-08	-0.008826	0.681212	-0.002528	-0.003536	-0.003649
	(2.4E-07)	(0.03107)	(0.66166)	(0.00556)	(0.01616)	(0.02016)
	[-0.06325]	[-0.28407]	[1.02954]	[-0.45484]	[-0.21886]	[-0.18100]
GDP(-2)	3.15E-07	0.023388	0.461972	-0.000157	0.016101	0.020339
	(2.5E-07)	(0.03209)	(0.68341)	(0.00574)	(0.01669)	(0.02082)
	[1.27864]	[0.72875]	[0.67598]	[-0.02729]	[0.96488]	[0.97680]
PPT(-1)	1.81E-07	0.334463	1.211497	0.850604	0.081237	0.214896
	(1.0E-05)	(1.34138)	(28.5648)	(0.23997)	(0.69748)	(0.87030)
	[0.01751]	[0.24934]	[0.04241]	[3.54470]	[0.11647]	[0.24692]
PPT(-2)	-1.03E-05	0.197315	5.880750	-0.075351	0.077069	0.101590
	(1.0E-05)	(1.34801)	(28.7061)	(0.24115)	(0.70093)	(0.87461)
	[-0.99021]	[0.14637]	[0.20486]	[-0.31246]	[0.10995]	[0.11615]
TPIT(-1)	-8.79E-07	0.151863	-0.273832	-0.016859	0.886764	0.042250
	(9.8E-06)	(1.27639)	(27.1809)	(0.22834)	(0.66369)	(0.82814)
	[-0.08963]	[0.11898]	[-0.01007]	[-0.07383]	[1.33611]	[0.05102]
TPIT(-2)	-1.01E-05	0.118453	7.858360	0.052491	-0.018512	0.083070
	(1.0E-05)	(1.30791)	(27.8522)	(0.23398)	(0.68008)	(0.84859)
	[-1.00458]	[0.09057]	[0.28215]	[0.22434]	[-0.02722]	[0.09789]
TVAT(-1)	6.54E-07	-0.098455	-0.410160	0.033308	-0.039740	0.867351
	(2.7E-06)	(0.34900)	(7.43191)	(0.06243)	(0.18147)	(0.22643)
	[0.24382]	[-0.28211]	[-0.05519]	[0.53349]	[-0.21899]	[3.83050]
TVAT(-2)	-8.06E-07	-0.158259	-1.740389	0.031532	-0.072572	-0.184461
	(2.7E-06)	(0.35170)	(7.48939)	(0.06292)	(0.18287)	(0.22818)
	[-0.29810]	[-0.44999]	[-0.23238]	[0.50117]	[-0.39684]	[-0.80839]
C	0.006023	302.5068	1825.999	-50.61511	28.29407	75.71146
	(0.00464)	(603.206)	(12845.3)	(107.910)	(313.652)	(391.368)
	[1.29897]	[0.50150]	[0.14215]	[-0.46905]	[0.09021]	[0.19345]
R-squared	0.970869	0.979843	0.991335	0.968639	0.989491	0.990124
Adj. R-squared	0.965491	0.976122	0.989735	0.962850	0.987551	0.988301
Sum sq. resids	0.000938	15881634	7.20E+09	508264.4	4293985.	6685493.
S.E. equation	0.003800	494.3003	10526.18	88.42767	257.0239	320.7082
F-statistic	180.5248	263.3091	619.6830	167.3048	510.0042	543.0729
Log likelihood	331.1128	-587.4118	-825.9731	-453.1771	-536.4019	-553.6681
Akaike AIC	-8.156737	15.39518	21.51213	11.95326	14.08723	14.52995
Schwarz SC	-7.763953	15.78796	21.90492	12.34604	14.48001	14.92274
Mean dependent	0.101339	2536.836	105402.6	576.6021	2121.121	3023.441
S.D. dependent	0.020455	3198.828	103894.1	458.7822	2303.562	2965.101

Determinant resid covariance (dof adj.)	3.31E+19
Determinant resid covariance	1.11E+19
Log likelihood	-2374.318
Akaike information criterion	62.87996
Schwarz criterion	65.23666
Number of coefficients	78

	TR_GDP	CIT	GDP	PPT	TPIT	TVAT
Mean	0.100180	2475.157	102968.3	563.5165	2069.489	2951.572
Median	0.098745	880.9500	54503.00	421.3350	966.9000	1489.050
Maximum	0.131000	11913.30	349480.0	1618.500	7682.000	8930.200
Minimum	0.054983	69.67000	8029.000	53.18000	55.86000	148.6700
Std. Dev.	0.021467	3181.775	103705.1	460.3423	2297.246	2961.965
Skewness	-0.338830	1.609242	1.044106	1.100913	1.078990	0.874215
Kurtosis	2.348736	4.837571	2.855200	2.951625	3.001554	2.262266
Jarque-Bera	2.944557	45.78434	14.60531	16.16794	15.52293	12.00421
Probability	0.229402	0.000000	0.000674	0.000308	0.000426	0.002474
Sum	8.014386	198012.6	8237464.	45081.32	165559.1	236125.8
Sum Sq. Dev.	0.036406	8.00E+08	8.50E+11	16741289	4.17E+08	6.93E+08
Observations	80	80	80	80	80	80

	TR GDP	CIT	GDP	PPT	TPIT	TVAT
Mean	0.100180	2475.157	102968.3	563.5165	2069.489	2951.572
Median	0.098745	880.9500	54503.00	421.3350	966.9000	1489.050
Maximum	0.131000	11913.30	349480.0	1618.500	7682.000	8930.200
Minimum	0.054983	69.67000	8029.000	53.18000	55.86000	148.6700
Std. Dev.	0.021467	3181.775	103705.1	460.3423	2297.246	2961.965
Skewness	-0.338830	1.609242	1.044106	1.100913	1.078990	0.874215
Kurtosis	2.348736	4.837571	2.855200	2.951625	3.001554	2.262266
Jarque-Bera	2.944557	45.78434	14.60531	16.16794	15.52293	12.00421
Probability	0.229402	0.000000	0.000674	0.000308	0.000426	0.002474
Sum	8.014386	198012.6	8237464.	45081.32	165559.1	236125.8
Sum Sq. Dev.	0.036406	8.00E+08	8.50E+11	16741289	4.17E+08	6.93E+08
Observations	80	80	80	80	80	80

Dependent Variable: TR_GDP
Method: ARDL
Date: 06/25/22 Time: 10:09
Sample (adjusted): 2001Q1 2019Q4
Included observations: 76 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): CIT PPT TPIT TVAT
Fixed regressors: C
Number of models evaluated: 2500
Selected Model: ARDL(1, 4, 1, 1, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
TR_GDP(-1)	0.751852	0.062649	12.00102	0.0000
CIT	-3.80E-06	2.52E-06	-1.504424	0.1374
CIT(-1)	5.96E-06	2.24E-06	2.659134	0.0099
CIT(-2)	-1.20E-19	9.55E-07	-1.26E-13	1.0000
CIT(-3)	-1.78E-19	9.55E-07	-1.86E-13	1.0000
CIT(-4)	-7.50E-06	2.70E-06	-2.782413	0.0071
PPT	1.85E-05	5.55E-06	3.325325	0.0015
PPT(-1)	-1.34E-05	5.12E-06	-2.610908	0.0112
TPIT	1.35E-05	4.14E-06	3.272184	0.0017
TPIT(-1)	-1.06E-05	3.80E-06	-2.789637	0.0069
TVAT	1.91E-06	1.24E-06	1.538386	0.1289
C	0.019596	0.004549	4.307624	0.0001

R-squared	0.977103	Mean dependent var	0.102559
Adjusted R-squared	0.973168	S.D. dependent var	0.019255
S.E. of regression	0.003154	Akaike info criterion	-8.536361
Sum squared resid	0.000637	Schwarz criterion	-8.168350
Log likelihood	336.3817	Hannan-Quinn criter.	-8.389286
F-statistic	248.2889	Durbin-Watson stat	1.745175
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: TR_GDP
Method: Least Squares
Date: 06/25/22 Time: 10:18
Sample: 2000Q1 2019Q4
Included observations: 80

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CIT	-1.87E-05	2.49E-06	-7.518054	0.0000
PPT	4.78E-05	7.64E-06	6.254712	0.0000
TPIT	3.23E-05	5.77E-06	5.595969	0.0000
TVAT	-6.35E-06	2.84E-06	-2.232574	0.0286
C	0.071481	0.001811	39.46082	0.0000

R-squared	0.873327	Mean dependent var	0.100180
Adjusted R-squared	0.866571	S.D. dependent var	0.021467
S.E. of regression	0.007842	Akaike info criterion	-6.798310
Sum squared resid	0.004612	Schwarz criterion	-6.649433
Log likelihood	276.9324	Hannan-Quinn criter.	-6.738621
F-statistic	129.2693	Durbin-Watson stat	0.330989
Prob(F-statistic)	0.000000		

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: TR_GDP CIT PPT TPIT TVAT C

	Value	df	Probability
t-statistic	9.279729	74	0.0000
F-statistic	86.11337	(1, 74)	0.0000
Likelihood ratio	61.74536	1	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.002480	1	0.002480
Restricted SSR	0.004612	75	6.15E-05
Unrestricted SSR	0.002131	74	2.88E-05

LR test summary:

	Value
Restricted LogL	276.9324
Unrestricted LogL	307.8051

Unrestricted Test Equation:
Dependent Variable: TR_GDP
Method: Least Squares
Date: 06/25/22 Time: 10:21
Sample: 2000Q1 2019Q4
Included observations: 80

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CIT	-7.45E-05	6.25E-06	-11.92313	0.0000
PPT	0.000198	1.70E-05	11.64040	0.0000
TPIT	0.000126	1.08E-05	11.62199	0.0000
TVAT	-2.30E-05	2.65E-06	-8.686754	0.0000
C	0.137821	0.007256	18.99507	0.0000
FITTED^2	-15.09299	1.626447	-9.279729	0.0000

R-squared	0.941455	Mean dependent var	0.100180
Adjusted R-squared	0.937500	S.D. dependent var	0.021467
S.E. of regression	0.005367	Akaike info criterion	-7.545127
Sum squared resid	0.002131	Schwarz criterion	-7.366475
Log likelihood	307.8051	Hannan-Quinn criter.	-7.473500
F-statistic	237.9986	Durbin-Watson stat	0.450173
Prob(F-statistic)	0.000000		

YEAR	VAT	CIT	PPT	PIT	TOTAL TAX REV	GDP	TAX REV/GDP
200Q1	26.18008	12.55313	9.938281	10.0015625	58.67304688	1499.492	0.039129
200Q2	34.2918	16.24063	12.61047	12.9834375	76.12632813	1903.32	0.039997
2000Q3	41.22336	19.26125	14.63109	15.4559375	90.57164063	2209.164	0.040998
200Q4	46.97477	21.615	16.00016	17.4190625	102.0089844	2417.023	0.042204
2001Q1	49.61555	21.49953	13.84422	17.37085938	102.3301563	2233.539	0.045815
2001Q2	53.77883	23.24047	15.05953	18.91601563	110.9948438	2362.773	0.046977
2001Q3	57.53563	25.03617	16.77319	20.55313673	119.8981176	2511.447	0.047741
200Q4	60.88148	26.88453	18.98359	22.28054688	129.0301563	2679.32	0.048158
2002Q1	60.1607	28.06734	22.18492	23.289375	133.7023438	2915.266	0.045863
2002Q2	60.1607	28.06734	25.19445	25.524375	138.946875	3102.484	0.044786
2002Q3	60.1607	28.06734	28.50541	28.1757912	144.9092503	3289.707	0.044049
2002Q4	60.1607	28.06734	32.11586	31.24125	151.5851563	3476.641	0.043601
2003Q1	83.98148	39.20016	34.14023	36.14929688	193.4711719	3682.641	0.052536
2003Q2	91.60039	42.77484	39.10789	39.47632813	212.9594531	3861.859	0.055144
2003Q3	99.67714	46.65361	45.13241	42.64959793	234.1127624	4033.487	0.058042
2003Q4	108.2037	50.83266	52.21055	45.66585938	256.9127344	4197.141	0.061211
2004Q1	120.0978	56.27984	65.1182	47.97132813	289.4671875	4280.352	0.067627

2004Q2	128.3734	60.68016	72.39992	50.90179688	312.3553125	4457.836	0.070069
2004Q3	135.9441	64.99945	78.83007	53.90187378	333.675537	4656.9	0.071652
2004Q4	142.7984	69.23234	84.40352	56.96664063	353.4009375	4877.07	0.072462
2005Q1	146.3834	75.86	88.425	58.67015625	369.3385156	5172.922	0.071398
2005Q2	152.8498	78.93875	92.57375	62.44484375	386.8071094	5414.453	0.07144
2005Q3	159.6385	80.94689	96.15238	66.86194115	403.5996858	5655.948	0.071358
2005Q4	166.7337	81.87688	99.15188	71.91515625	419.6775781	5896.859	0.07117
2006Q1	169.5348	74.7468	100.0742	80.16234375	424.5180859	6106.25	0.069522
2006Q2	179.1159	76.32883	102.5333	85.47765625	443.4556016	6359.5	0.069731
2006Q3	190.8668	79.63669	105.0258	90.41525515	465.9445519	6625.346	0.070328
2006Q4	204.7688	84.66086	107.5405	94.96734375	491.9375547	6903.125	0.071263
2007Q1	225.747	94.79484	114.0757	94.59054688	529.2080469	6941.703	0.076236
2007Q2	242.0237	101.9139	115.0587	100.2050781	559.2013281	7345.172	0.076132
2007Q3	258.5108	109.4052	114.4806	107.2632758	589.659899	7861.994	0.075001
2007Q4	275.186	117.2592	112.3291	115.7546094	620.5289844	8491.391	0.073077
2008Q1	290.5068	124.4214	106.7975	124.6095313	646.3352344	9749.961	0.066291
2008Q2	308.2213	133.4423	102.2475	136.4167188	680.3278906	10399.48	0.065419
2008Q3	326.7748	143.2622	96.86456	150.1002719	717.0018139	10956.06	0.065443
2008Q4	346.1371	153.8683	90.635	165.6476563	756.2880469	11418.8	0.066232

2009Q1	364.693	163.9823	77.39047	189.945625	796.0114063	11313.07	0.070362
2009Q2	386.3813	176.6984	71.96328	206.491875	841.5348438	11779.87	0.071438
2009Q3	409.5694	190.7311	68.17537	222.1663927	890.6422181	12344.07	0.072151
2009Q4	434.219	206.0638	66.01484	236.951875	943.2495313	13004.41	0.072533
2010Q1	451.3738	209.2804	63.30531	243.5800781	967.5396094	13688.8	0.070681
2010Q2	482.618	232.614	65.29469	259.5305469	1040.057266	14572.88	0.071369
2010Q3	518.9481	262.6392	69.79752	277.5262899	1128.911038	15583.77	0.072441
2010Q4	560.316	299.3338	76.80531	297.5416406	1233.996797	16720.02	0.073804
2011Q1	621.0838	309.1737	94.45547	300.2526563	1324.965625	18246.09	0.072616
2011Q2	666.8818	395.282	103.2358	332.0898438	1497.489375	19530.28	0.076675
2011Q3	712.0441	467.6551	111.2779	373.7143755	1664.69155	20836.2	0.079894
2011Q4	756.5104	526.2902	118.5736	425.0939063	1826.468125	22162.03	0.082414
2012Q1	808.6656	555.6695	125.3655	541.8900781	2031.590703	23572.02	0.086187
2012Q2	848.5106	593.0417	131.087	590.5817969	2163.221172	24915.73	0.086821
2012Q3	884.3976	622.9031	135.9776	626.8126708	2270.09087	26256.42	0.086459
2012Q4	916.2438	645.2027	140.0242	650.5397656	2352.010391	27591.64	0.085244
2013Q1	890.6245	624.8555	142.5254	611.793125	2269.798438	28505.31	0.079627
2013Q2	935.9299	646.1708	145.1915	630.589375	2357.881563	30001.06	0.078593
2013Q3	998.6873	674.0368	147.3134	656.9397231	2476.977231	31661.4	0.078233

2013Q4	1078.793	708.3811	148.8751	690.771875	2626.820938	33483.25	0.078452
2014Q1	1172.78	761.7788	145.4836	754.6241406	2834.666641	36144.88	0.078425
2014Q2	1289.183	804.1993	147.7152	794.5539844	3035.651484	38024.8	0.079833
2014Q3	1424.471	848.1718	151.1666	833.0533226	3256.862236	39799.45	0.081832
2014Q4	1578.525	893.6166	155.8205	870.0444531	3498.006953	41465.1	0.08436
2015Q1	2099.843	934.037	142.17	909.2859375	4085.335391	42379.81	0.096398
2015Q2	2277.276	985.1899	157.0675	941.7678125	4361.301484	44091.94	0.098914
2015Q3	2396.759	1040.532	180.9948	971.57852	4589.864358	45957.37	0.099872
2015Q4	2458.127	1099.964	213.9338	998.6203125	4770.645078	47971.44	0.099448
2016Q1	2243.364	1164.798	309.042	987.4616406	4704.665156	50248.03	0.093629
2016Q2	2276.047	1232.09	338.7787	1023.340234	4870.256094	52523.47	0.092725
2016Q3	2338.089	1303.094	356.2903	1070.765009	5068.238539	54908.77	0.092303
2016Q4	2429.212	1377.689	361.556	1129.621328	5298.078281	57398.53	0.092303
2017Q1	2667.698	1433.877	314.0259	1227.39375	5642.995469	60177.26	0.093773
2017Q2	2770.245	1524.702	311.0628	1298.35625	5904.365781	62813.3	0.093999
2017Q3	2854.949	1628.096	312.1096	1369.920862	6165.074567	65487.92	0.094141
2017Q4	2921.531	1743.906	317.1253	1441.96125	6424.523594	68194.66	0.094209
2018Q1	2888.252	1845.979	333.1994	1515.229922	6582.660703	70837.32	0.092926
2018Q2	2951.864	1997.399	343.4019	1588.181953	6880.847422	73660.12	0.093413

2018Q3	3030.461	2171.923	354.7938	1661.496892	7218.674727	76562.97	0.094284
2018Q4	3123.705	2369.362	367.3375	1735.014609	7595.418516	79538.16	0.095494
2019Q1	3311.322	276.5012	380.0671	1841.313984	5809.204453	83038.02	0.069958
2019Q2	3402.667	105.1957	395.3785	1902.536641	5805.777422	85992.91	0.067515
2019Q3	3477.247	212.2511	412.2822	1951.166327	6052.946758	88850.45	0.068125
2019Q4	3534.704	597.4159	430.7362	1987.008047	6549.864141	91601.62	0.071504
2020Q1	3311.322	2266.965	454.4254	1908.725938	7941.438047	93038.55	0.085356
2020Q2	3402.667	2806.358	474.5927	1959.929063	8643.546328	96078.76	0.089963
2021Q3	3477.247	3221.631	494.8974	2039.163382	9232.938999	99508.85	0.092785
2021Q4	3534.704	3512.748	515.2907	2146.198438	9708.941484	103318.3	0.093971
2021Q1	5147.227	4039.399	637.537	2834.590469	12658.7532	129043.1	0.098097
2021Q2	5054.775	3938.402	617.5024	2776.280781	12386.95992	125018.7	0.099081
2021Q3	4605.64	3569.53	556.9221	2524.675696	11256.76764	112774.5	0.099817
2021Q4	3799.392	2932.428	455.7379	2079.533594	9267.091016	92298.63	0.100403