MIDLANDS STATE UNIVERSITY

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

AN ANALYSIS OF THE BUOYANCY OF CORPORATE TAX IN ZIMBABWE (2009- 2018)

BY

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THIS DISSERTATION IS SUBMITTED TO THE DEPARTMENT OF ECONOMICS IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE BACHELOR OF COMMERCE ECONOMICS HONOURS DEGREE

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SUPERVISOR'S APPROVAL FORMS

The undersigned certifies that they have supervised the student, Jeketera Tanaka Kevin (R163900Z) dissertation entitled: "An Analysis of the Buoyancy of Corporate Tax in Zimbabwe (2009-2018)**."** Submitted in partial fulfilment of the requirements of Bachelor of Commerce Economics Honours Degree at the Midlands State University.

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CHAPTER 1……………………………………….

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APPROVAL FORM

The undersigned certify that they have supervised, read and recommend to the Midlands State University for acceptance a research project entitled: "An Analysis of the Buoyancy of Corporate Tax in Zimbabwe (2009-2018)**".** Submitted by Jeketera Tanaka Kevin in partial fulfilment of the requirements for the Bachelor of Commerce Honours Degree in Economics.

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(Signature of the Examiner(s)) Date

DECLARATION

I, JEKETERA TANAKA KEVIN, do hereby declare that this is a true and unpublished research which presents my own work, and has never been previously submitted for a degree at this or any other university.

.... ………………………………

Student Signature Date

DEDICATIONS

To my loving big family this piece of work is dedicated to you Mr. K. Jeketera, Mrs. T. Jeketera, Keith Jeketera, Kean Jeketera and Kelly Jeketera. Your emotional support, financial support and lively encouragement helped me sail through this prestigious Economics program.

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LIST OF ACRONYMS

ADF………………………………………………...Augmented Dickey Fuller

CIT………………………………………………... Corporate Income Tax

EXC…………………………………………………Excise Duty

GDP………………………………………………... Gross Domestic Product

OLS………………………………………………… Ordinary List Squares

PIT…………………………………………………. Personal Income Tax

RBZ………………………………………………… Reserve Bank of Zimbabwe

VAT…………………………………………………Value Added Tax

ZIMSTATS………………………………………… Zimbabwe National Statistics Agency

ABSTRACT

The study examined the buoyancy of corporate tax in Zimbabwe. The specific objectives of the study were; to establish the buoyancy of corporate income tax., identifying the weak and strong spots of corporate income tax and to draw policy recommendations. The study employed OLS approach and used quarterly time series data for the period 2009 to 2018 and buoyancy estimates were determined using a double logarithmic model. Secondary data from Zimbabwe Revenue Authority, Reserve Bank of Zimbabwe and Zimbabwe Statistical Agency was used. The study revealed that corporate tax is responsive to changes in national income in Zimbabwe and there is a positive relationship between corporate tax and gross domestic product, although the degree of buoyancy is low and less than the unitary figure one. With corporate tax not buoyant, Zimbabwean government has to re-evaluate the implementation strategies and pursue further reforms for it to fully exploit tax revenue potential in the economy.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

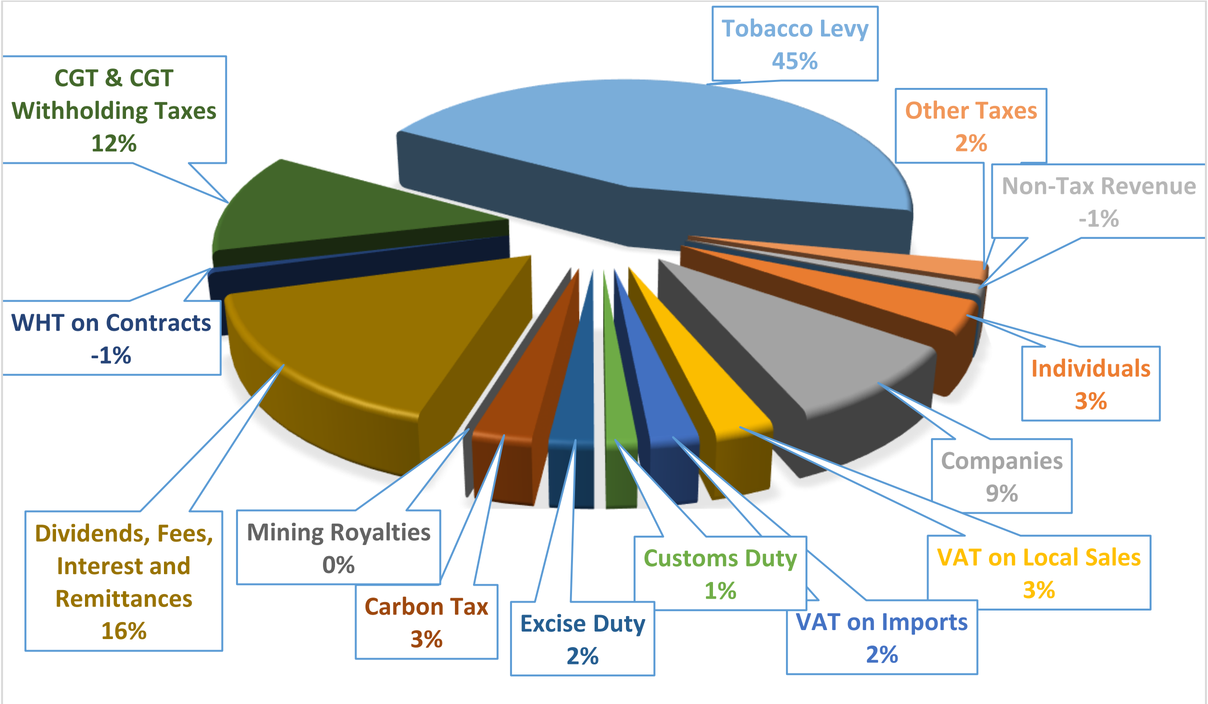
Tax revenues have remained important in OECD countries and to many governments of the world. Like many developing countries Zimbabwe has solely relied on tax revenues to tackle the country's expenditure needs. Encounters such as persistent and increasing poverty levels, deteriorating investment environment, inadequate skilled human resources, declining productivity in the real sector, dwindling infrastructure and limited access to quality social services have put exorbitant pressure on tax revenues. Azubike (2009) proposed that the need for tax revenues is to render the governments traditional functions of providing public goods, maintanance of law and order, defense against external agression, regulation of trade and business to ensure social and economic maintanance.

The extent to which a country is able to fulfil its mandate is reliant on tax revenues. The bouyancy of tax revenues is an important aspect in a fiscal policy. Tax revenue bouyancy and elasticity of a tax system have been used interchangebly in the literature. According to Parliamentary Budgetary Office (2019) buoyancy estimates show the response of tax revenue to changes in an underlying macroeconomic base, including changes that may result from policy actions. Chiefly estimates of tax revenue buoyancy capture the sensitivity of tax proceeds to changes in the economy. Acheson, (2017) expressed that buoyancy expresses pure response of revenue with respect to the changes in the macroeconomic base and they signfy automatic growth potential of tax revenues.

1.1 Background of the study

For the period under review 2009Q1 to 2018Q4, Zimbabwe's tax revenues have been unstable characterised by discrete jumps as the economy was still in transition from a hyper inflationary period to multicurrency period. The shocks in the macroeconomic environment caused uncertainty as variables such inflation reached an all-time high of 231 million percent Zimstat (2008). Tax revenues were very low that period and they stood at $956m in total, major tax heads such as Company Income Tax (CIT) contributed $45 million, Value Added Tax (VAT) $188.3 million, Personal Income Tax (PIT) $150 million and Excise duty $80.4 million, these revenues were subject to exhaustive expenditure as the economy was restructuring. Whilst African Development Bank (AfDB) (2011) suggested that growth rate also fell significantly in the same period in which the GDP growth rate figures stood at -17.7 % towards the end of 2008. The pie chart below shows total revenue performance over time of all tax heads in Zimbabwe and how much they have contributed from 2009-2018.

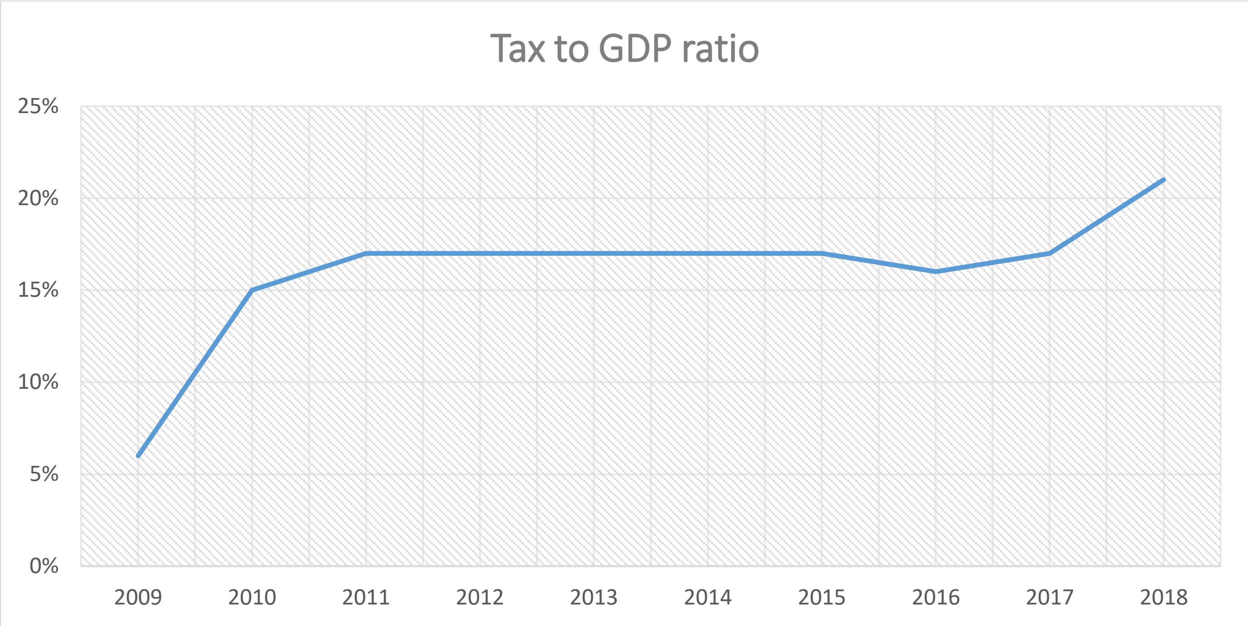
Figure 1: Total Revenue Performance.



Source: ZIMRA Annual Report (2019)

Unstable tax revenues have also induced unsteady government expenditures characterised by unproductive government expenditure. Consequently, this led to concerns of how the Zimbabwean tax system relates to national income as illustrated by tax to GDP ratio analysis relationship. The graphical representation below indicates the tax to GDP ratio for selected tax heads from 2009-2019.

Figure 2: Tax to GDP ratio



Source: ZIMRA 2019

The tax to GDP ratio has been increasing over time, indicating that aggregate tax revenues have been growing at a faster rate than GDP and suggesting that tax revenue buoyancy should be approaching the unit value. In this period the line graph indications are that the lowest tax to GDP ratio is 6% and the highest was 21%.

Developing countries are largely affected by fiscal deficits caused by fiscal imbalances which are better explained by the rapid expansion in the expenditure despite low revenue collections. Romer (1986) endogenous growth model has shown that growth is better achieved when fiscal imbalances are reduced or elimanated which he suggests that this can be realised only if governement expinditure is reduced or tax revenues are increased. As such developing countries have opted to reduce expenditure to achieve fiscal balance by reducing expenditure in Health, education and infrastructure which are contrary to the famous Rostow Musgrave theory in public sector growth which suggests expenditure on the above as prerequisites for growth.

African countries have long been characterised by perpetual tax reforms in which Omondi (2014) have considered to have a positive effect on both buoyancy and elasticity. Tax reforms are presented to be positively related on the buoyancy and elasticity , despite this relationship emprics have shown that tax reforms on its own is inadequate to provide sufficient revenue to match the cumulative government expenditure. Characterised by an unresponsive tax system,most African governments have to re-evaluate the implementation strategies and pursue further reforms for it to fully exploit the tax revenue potential in the economy.

Also in their attempt to increase growth African countries have increased public expenditure but have failed to match the increase in expenditure with revenue mobilisation which have resulted in huge fiscal deficits. Proper domestic resource mobilisation in Zimbabwe has not been an easy task for the tax collector largely because of resistance in the form of tax avoidance, tax evasion and corruption which have seriously contributed to the underdevelopment of the country Adegbie and Fakile (2011). It is clear that tax revenues are a tool for accelarated growth and development that has led government to constantly check up on the magnitude of fiscal deficits in the country. Thus tax reforms have been regularly crafted and applied nearly annually clearly detailing the structure of the tax system and composition of public expenditure. A precise estimate of the optimal level of government requires adequate knowledge of the buoyancy of tax system. This has been used to assist in the identifying sustainable revenue profile for the country and allows in determining appropriate modifications to the current tax structure and marginal tax rates as well as areas that improves tax adminmistration.

1.2 Problem Statement

The failure of a tax system in generating sufficient revenue is attributed to poor revenue forecasting. Overtime the ratio of tax to gdp been increasing over time, indicating that aggregate tax revenues have been growing at a faster rate than GDP (ZIMRA ,2018) and suggesting that tax revenue buoyancy should be approaching the unitary value, despite this studies have shown that the Zimbabwean tax system is not buoyant (Chidhakwa,1996), (Ndedza,2013) and (Bonga,2015). It is against this study background that the researcher seeks to scrutinize the magnitude to which Corporate tax is responsive to national income.

1.3 Objectives of the Study

The general objective of the study is to illustrate the role that Corporate tax revenue plays in ensuring fiscal sustainability in the long run

The objectives of the study are as follows;

- To establish the buoyancy of Corporate Income Tax.
- Identifying the weak and strong spots of Corporate Income Tax.
- To draw policy recommendations from i, ii and iii.

1.4 Research Hypothesis

The Hypothesis of the study is that Corporate Income Tax (CIT), is responsive to Real Gross Domestic Product thus it is buoyant.

1.5 Significance of the study

The core of this research is to fill a research gap, in application to Zimbabwe pertaining to Corporate tax buoyancy in its contribution and ratio to national income. More so, the study further provides answers to research questions raised by Chingoiro (2009) on how do individual taxes relates with national income in Zimbabwe. Thus solely estimating the buoyancy of Corporate tax will be the first in Zimbabwe and this study will assess whether tax reforms and policies conducted by the government since the hyper inflationary period 2009 were useful and aid in the formulation of future tax policies and administration. Consequently, the results of this research will benefit academic institutions such as Midlands State University (MSU), the government, policy makers and investors interested in doing business with Zimbabwe.

1.6 Limitations of the Study

- The study uses data from different sources particularly the National Statistics Agency, Zimstat; the Reserve Bank of Zimbabwe and Zimbabwe Revenue Authority. Data from these key sources may be inconsistent with actual data due to factors such as data smoothening and interpolation. Alleviating this issue of data researchers might opt to use databases from these organisations rather than published figures.
- More so, inadequate electricity was a limitation in this research. This research was done in odd night hours utilising the available power due to excessive load shedding. This constraint can be eased by the use of alternative electricity sources provided for by the school such as solar systems which are reliable.

1.7 Delimitations of the Study

- The buoyancy of Corporate Income Tax (CIT) only is not reflective of all the direct taxes in the Zimbabwean tax system. Although CIT is the major variable in this study this limitation can be mitigated by further exploiting the buoyancy of aggregate tax revenues in Zimbabwe.
- The buoyancy of Corporate Income Tax in this study relied on Real Gross Domestic Product (GDP) as the tax base. To amend these restriction researchers might use several

tax bases to estimate buoyancy such as Gross National Product (GNP) and Gross National Income (GNI).

1.8 Organisation of the Study

This research pursues to analyse and determine buoyancy of tax revenues in Zimbabwe with special attention placed on Corporate Income Tax, Personal Income Tax (individuals), Value Added Tax and Excise Duty. The study comprises of five chapters. Chapter 1 is the introductory part focusing mainly on the background relating to the study, the statement of the problem, significance, hypothesis, scope, limitations and organisation of the study. Chapter 2 focuses on the theoretical and empirical literature review. Chapter 3 will cover the research methodology, model specification, justification of variables and diagnostic tests to be carried out. Chapter 4 will discuss the results and presentation as well as the analysis of these results and their interpretation. The final chapter of the study will provide the summary of the whole research, conclusions obtained in the results and lastly will present recommendations for policy making.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section seeks to analyse and review literature relating to the Buoyancy of Corporate Tax thus the chapter is separated to two distinct categories namely the empirical literature and theoretical literature review.

2.1 Theoretical Literature Review

The review of theoretical literature is based entirely on scrutinizing the magnitude of theories and models developed by organised group of scholars that explain the Buoyancy of a tax system.

2.1.1 Proportionate Adjustment Method

This model was developed by Prest (1962). The model states that to obtain a series of adjusted tax revenue , actual tax revenue in each year is subtracted from the targeted estimates of the revenue impact of discretionary changes in that particular year. Thus this technique approximates historical revenue series conferring to a specific year's tax structure given that the specific or individual tax structure is maintained throughout the period under consideration. In actual buoyancy estimation this process comprises of two stages firstly, yearly tax revenue data under consideration is adjusted for discretionary changes by eliminating estimated revenue impact of discretionary changes. Secondly, the tax revenue series is converted by adjusting yearly changes by the ration of tax yield (Chelliah and Chand 1974). This method has been prevalent in many researches and has since been used by (Mansfield,1972), (Osoro,1993), (Atiyo,(1997), Wawire (2011) **a**nd Omondi (2015).

Applying the proportionate adjustment approach in estimating tax elasticity is affected by numerous limitations that were emphasized by Ariyo (1997) and Wawire (2011). The initial critique is the unavailability of revenue receipts data which is directly attributable to discretionary changes in tax policy. While Chipeta (1998) uncovered that proportionate approach adopts the progressivity of the discretionary changes follows the underlying tax system, thus it is reliant on the assumption that changes are more or less progressive than the tax structure they modify. This method is very aggregative in comparison to other methodologies (Wawire, 2011).

2.1.2 Dummy Variable Approach (DVA)

Advanced by Singer (1968) the theory states that a dummy variable has to be introduced in place of each exogenous tax policy change. The dummy variable introduced is used a proxy for each of the Discretionary Tax Measures (DTM's) in estimating tax buoyancy in Ordinary Linear Squares (OLS) equations. This model is extended further by the introduction of lags thus usually a yearly lag in Gross Domestic Product (GDP) the base is introduced to capture potential effects on tax revenues. Ever since 1968 this model has stayed appropriate in estimating tax buoyancy and has been used extensively by Khan (1973), and Wawire (2011).

Whilst Wawire (2006) came with invaluable shortcomings in that the Dummy Variable Approach is a complex theory or method to adopt when tax policy changes are too frequent thus, there is a possible chance to commit serious multicollinearity between explanatory variables as multiple dummies enter the tax function. The use of the dummy variable approach is dependent on the number of dummy variables used in estimating the buoyancy such that researchers should use dummy variables which are equal to the discretionary measures that are prevalent.

2.1.3 Constant Rate Structure Method

This theory is used to estimate tax buoyancy and elasticity through the constant rate structure method developed by Andersen (1973) who tested the model in Denmark. This method assumes the same tax structure is applied constantly over time such that existing tax rates is applied to the preceding year's tax bases to build the adjusted revenue series. For the constant rate structure method to be effective it is essential to have the tax base series for distinct tax heads. This is not a so famous model in estimating buoyancy but several researches have used the method in literature Andersen (1973) used it in Denmark and Choudry (1975) in Malaysia.

Applying the constant rate structure method is difficult if there are multiple rates needed to mimic the immediate marginal tax structure over the preceding tax brackets in coming up with an accurate adjusted series. Such that it is time consuming and requires accuracy to construct separate tax tables for separate tax heads in a time series to obtain an adjusted series. However, this is a useful method if the compilation of data is easy, if the observations are less and there are narrow tax rates.

2.2 Empirical Literature Review

This section provides empirical findings for studies which are similar to this research of the buoyancy of Corporate Tax and the overall view of the aggregate tax.

Twerefou (2008) studied the buoyancy and elasticity of the Ghananian tax stsyem using the Ordinary Least Squares approach and the dummy variable technique to control for the effects of discretionary tax measures for the period 1970 to 2007. Research findings exposed that the overall tax system was buoyant and elastic in the long run, although the shortrun elasticity was lower than the longrun estimates. For the period 1970 to 2007 an estimate of 1.03 showed that the estimate of 1.03 was above unit figure suggesting the responsiveness of the tax system to changes in Gross Domestic Product in Ghana and Corporate tax was found also to be buoyant in that period. Insadoo (2008) however, found contradicting results from Twerefou (2008) for the studied period 1965 to 1982 using the Divisia Index Approach and the regression analysis found the overall buoyancy coefficient of 0.556. The disparities in their researches can be explained by tax reforms in Ghana for the different time periods and the differences in the methods used to estimate buoyancy.

Ndedza (2013) Assessed Zimbabwe's aggregate tax system, revenue productivity and individual taxes on the basis of tax buoyancy estimates. In a time, series stretching from 1975 to 2008 the dummy variable technique was employed in calculating tax buoyancy and discern or abstract from the tax system discretionary changes. The results showed that for the period 1975 to 2008 the overall tax system was not buoyant with a coefficient less than the unitary value (one) and also all the tax heads where not responsive except for customs duty. Of relative importance Corporate Tax was not buoyant with a coefficient of 0.895 which compared favourably to Chidakwa (1996). The research concluded that the tax system in that period was non-productive as it failed to generate sufficient revenue thus it showed the importance of discretionary tax measures in generating tax revenue. Rao (1985) conforms to the results found by Ndedza (2013) and Chidhakwa (1996) in research for buoyancy in Zimbabwe.

Omondi (2014) study on Kenya examined the effects of tax reforms and elasticity estimates. The study used regression analysis together with the Proportional Adjustment Method and the Dummy Variable Approach in an annualised time series data from 1963 to 2010 to capture the effetcs of tax reforms on tax buoyancy and discretionary changes. The research findings showed that the measurement of buoyancy was statistically significant , positive also above the unitary value of one suggesting that the Kenyan tax system was buoyant for the period that was considered. Conclusively, the research revealed that the Kenyan tax system is buoyant for the period 1963 to 2010 implying that the tax reforms had a significantly improved productivity. These results are similar to Kuyoch (2005), Okech (2011) and Mandela (2016).

Bonga *et al* (2015) researched on the tax system perfomance in regards to Zimbabwe employing traditional tax ratio trends and dynamic measures tax buoyancy and tax elasticity. This analysis used the Ordinary Least Squares (OLS) and the Dummy Variable Approach (DVA) to estimate tax buoyancy for the period 2000- 2013. The research findings showed that both the Ordinary Least Squares approach and the Dummy Variable approach yielded a tax buoyancy estimate which is greater that one 1.013 for the period 2000 to 2013. The estimate greater than one implied that the Zimbabwean tax system is responsive to national income growth. The research concluded that in Zimbabwe there is no substantial difference in tax perfomance comparing the Zim Dollar period and the Multicurrency period. This study however is not in covenant with Ndedza (2013) which found the Zimbabwean tax system not to be buoyant and productive.

Bayu (2015) estimated the buoyancy of the Ethiopian tax system for the period 1974 to 2010 and employed the Cointergration Approach and double logarithmic functions. The research revealed that direct and indirect tax revenues together with overall taxes were not buoyant in both the short and long run in Ethiopia. Within the indirect tax group corporate taxes were found to be buoyant and significant in the long run. Summarily the research posited that the tax revenues are non-buoyant in Ethiopia thus there is need for enhancing the efficiency of the revenue administration to ensure bringing more and new tax revenue payers. Birhanu (2018) study on estimated tax buoyancy and stability in Ethiopia using a panel data (fixed effect and random effect models) for 12 years in three regional states brought about the same results with Bayu (2015). This study confirmed that the overall tax system in Ethiopia is not buoyant and obtaining a coefficient of 0.78 which is far below the unit value. Also in his study he found corporate taxes in Ethiopia to be buoyant with a coefficient of 1.095 after regression and was significant. Ethiopian tax structure is not buoyant therefore measures to improve the revenue productivity are required since the authorities are not able to mobilize all the domestic revenue despite their national income figures increasing.

Dudine (2017) estimated the long run and shortrun tax buoyancies for 107 countries for the period 1980 to 2014. Employing the Fulley- Modified OLS and Mean Group Estimators countries where distributed as advanced, emerging and low income to estimate their buoyancies. The research findings revealed that in Advanced economies buoyancy estimates were not different from the unitary value one both in the short and long run. Developed countries in Europe and the United States of America had higher buoyancies compared to other advanced economies where the United States of America had a buoyancy coefficient of 2.652

the highest in the study. The emerging market economies also showed the same trend where buoyancy estimates where on average greater than one with African countries such as Angola, Algeria and South Africa showing higher buoyancy estimates.

The results also showed that in advanced economies on avaerage Corporate Income Tax buoyancy exceeds one compared to emerging economies and low income countries . Thus for advanced economies the implication was that Corporate Income tax buoyancy is larger during contractions than during times of economic expansion showing how efficient advanced economies uses the Corporate Income Tax as a procyclical measure in formulating an efficient and sustainable fiscal policy reform.

Vadika and Rami (2018) analysed the elasticity and buoyancy of Center, State and Combined Government revenues for the period 1990 to 2016 employing a log regression model in India. The estimations from the research demonstrated that the aggregate combined tax, State government tax are both buoyant with an estimate of 1.19. In order to obtain the buoyancy figures for numerous tax figures through the regression analysis the following model was employed ;

$$\boldsymbol{Ln\,TR = \beta_0 + \beta_1\, ln\,TB +}\ \mu_{\boldsymbol{i}}$$

Where TR is the Tax Revenue for a particular Tax head, TB is the tax base for the particular tax head and β_1 is the buoyancy estimate or coefficient.

The study concluded that discriminatory measures had adversely affected the productivity of tax in India. Conclusively the study postulated that there is need to cut tax rebates and exemptions for the tax system to be more succesful . Upender (2008) and Krushna (2015) also reached to the same conclusions on the buoyancy of Indian tax system.

Sheefani (2019) examined the Buoyancy of Namibia's overall tax system through the Engle – Granger approach to the error correction for the period 2001 to 2014. In line with many empirical findings the results showed that overall tax sustem of Namibia was not responsive and inelastic with a bouyancy estimate of 0.036. Consequently the value is less than the unitary value which means that the Namibian tax system does not respond ton national income. The study results conform to Ndedza (2013) who also found similar results in a developing country Zimbabwe. Finally, the Namibian economy is not productive thus it is not generating adequate tax revenue through discretionary tax measures. Also in Southern Africa Mandela (2016) applied the Error Correction Model to estimate South African tax system's short run and long run buoyancy using annual data 1974 to 2014. The research revelaled that South Africa's overall tax system is more buoyant in the Southern region with a coefficient of 1.77 and Corporate Income tax is also buoyant in the long run and short run with figures of 1.70 and 1.38 respectively. The shortrun buoyancy of Corporate tax shows that Corporate tax is the best automatic stabiliser in the shortrun as it is more repsonsive compared to other tax heads. In conclusion, Mandela (2016) and Sheefani (2019) results were different although they used the same estimation approach and this shows that the South African Tax system is more productive and revenue mobilisation is much higher compared to Namibia.

2.3 Conclusion

This section captured the theoretical and empirical background of the study in context to Corporate Tax buoyancy. The first segment dealt with the theoretical review while the other part focused on the empirical background. As showed by the empirical studies reviewed in this chapter, many researches applied the Ordinary Least Squares approach, Error Correction Models and some log linear models in estimating buoyancy through a time series. The study intends to cover this gap by adapting to some of the models in investigating the buoyancy of Corporate Income Tax in Zimbabwe.The next chapter will present the research methodology followed and the tools of analysis employed together with the specification of the model.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the methodology employed in this research and also present the adapted model in literature in concurrence with specifications of the adapted model. “Then variables used in the model are justified with the characteristics and the type of data. Lastly diagnostic tests to be carried out are detailed in this section.

3.1 Model Specification

This research framework has adopted a model used by Vadika and Rami (2018) who analysed the elasticity and buoyancy of Center, State and Government revenues for the period 1990 to 2016 employing a log regression model in India. The model adopted was a log regression function in the following form;

$$\boldsymbol{Ln\,TR} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1\,ln\,TB} + \mu_{\boldsymbol{i}} \qquad (1)$$

From the equation used above log TR is the explanatory variable which captures the total tax revenue or aggregate tax revenue and log TB is the tax base measured by Real Gross Domestic Product (RGDP). The parameter β captures the buoyancy estimate of a tax system. However, although the model did use the Ordinary Least Squares, buoyancy estimates of different tax heads were not addressed therefore this study will adapt the above model in the following form to capture the buoyancy of individual tax heads:

$$\boldsymbol{LnTR_{i,t}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1\,lnTB_t} + \mu_{\boldsymbol{i}} \qquad (2)$$

Where;

- TR is the dependent variable representing tax revenue and subscripts *i*, *t* represents different tax heads in time *t.*
- TB is Real Gross Domestic Product (RGDP) in time *t.*
- $\boldsymbol{\beta_0}$ is a constant and $\boldsymbol{\beta_1}$ is the buoyancy coefficient of tax head *i* in time *t*.
- µ represents the composite error term which captures cross sectional Effects, time effects and other factors which affects or determines the buoyancy of tax revenue.

Equation (2) is the generic model in this study which will be disaggregated in the following equations to estimate buoyancy of Corporate Tax and other tax heads in separate equations;

$$LnCIT_t = \beta_0 + \beta_1 lnRGDP_t + \mu_i \quad (3)$$

$$LnPIT_t = \propto_0 + \propto_1 lnRGDP_t + \varepsilon_i \quad (4)$$

$$LnVAT_t = \theta_0 + \theta_1 lnRGDP_t + U_i \quad (5)$$

$$LnEXC_t = \gamma_0 + \gamma_1 lnRGDP_t + Z_i \quad (6)$$

$\beta_1, \propto_1, \theta_1, \gamma_1$ are slope coefficients that measure buoyancy while $\mu_i, \varepsilon_i, U_i, Z_i$ are white noise error terms.

3.2 Measurement and Justification of Variables

3.2.1 Gross Domestic Product (GDP)

Gross Domestic Product (GDP) is the total output of goods and services produced within the geographical boundaries of Zimbabwe over a period of time. GDP will be used as a proxy for the tax base. Relying on GDP as a tax base for all buoyancy estimates is based on Acheson *et al*. (2017), Deli *et al*. (2018), (Parliamentary Budget Office, 2018) and Koster and Preismeier (2017) who proposed that among all other indicators (GDP) is the standard suite of metrics used to assess economic performance for measuring tax revenue buoyancy and as such it is good measure to proxy tax base. Therefore, the coefficient of GDP will capture buoyancy in relation to specific tax heads.

3.2.2 Corporate Income Tax (CIT)

According to ZIMRA Corporate Income Tax is the company levy legislation levied on corporate profits, private and some public. CIT is a major variable in this research as in measuring buoyancy the variable's buoyancy estimates shows the strength or weakness of a tax system and it approximates the presence or absence of tax evasion. Particularly the buoyancy of CIT gives responsiveness of corporate tax revenue to changes in national income implying the rate at which corporate tax revenue grow with respect to GDP. In the short run the figures shows the speed of adjustment thus how fast CIT buoyancy converges to its long run equilibrium value indicating how effective CIT has been used by many countries as an automatic stabilizer of a fiscal policy framework Belinga *et al* (2014) and Deli *et al* (2018). Increases in CIT revenue will lead to an increase in GDP as Sheefani *et al* (2019) confirmed after granger causality tests if CIT causes GDP growth hence the researcher presumes a positive sign from CIT.

3.2.3 Personal Income Tax (PIT)

Personal income tax is a tax levied on personal incomes and earnings of employees based on the principle of Pay as You Earn. In Zimbabwe this tax head is called Pay as You Earn and it is classified in the income tax categories which are the top bracket for top income earners, the middle tax bracket and the low tax bracket for the low income earners. Empirical studies have shown that in estimating buoyancy direct taxes are a good measure in determining the productivity of a tax system. Particularly PIT has been used in disaggregated tax models by Bayu (2015) who found that direct taxes and specifically PIT were non buoyant in the short and long run in Ethiopia. Increases in PIT revenue will lead to an increase in GDP based on findings from Bonga (2015) and Ndedzu (2013) hence the researcher anticipates a positive sign from PIT.

3.2.4 Value Added Tax (VAT)

Value Added Tax is an indirect type of consumption tax which is placed on a product whenever value is added at any production stage and at the final stage Okech and Mburu (2011). In other countries it is also named Sales tax thus generally tax levied on goods and services which covers both the retail and wholesale. VAT has become an instrumental variable or term in estimating the buoyancy of a tax system as it forms large part of revenue in the indirect havens. By introducing dummies, lags and logs to accommodate for unusual behaviours in an ordinary least squares function researchers have opted to use VAT as a variable to capture the productivity and elasticity of a direct tax system Wawire (2011). Some researches in Public finance have shown that how buoyant or non-buoyant VAT is affected by the implementation of disrecritionary policy guidelines that are meant to bolster productivity of the tax head as such poor, time implementation may render the tax head to be non-buoyant as well as in the short term it is against these findings from Wawire (2011) that the researcher anticipates VAT to be positive sign although it might not buoyant.

3.2.5 Excise Duty (EXC)

ZIMRA (2019) asserts that excise duty as a tax levied on manufacture, sale or use of goods that are locally produced. As such excise duty is a vital tool in a fiscal policy ability to as an expansionary or contractionary policy. Twerefou *et al* (2009) ascertained that the inclusion of

Excise Duty in estimating buoyancy is essential especially that revenue from excise duty is usually low and less responsive to changes in income such that the tax head is less elastic although it might be buoyant. The researcher expects the coefficient of excise duty to be positive but not buoyant based on the fact that there are a lot of economic and non-economic factors that affect the collection of excise duty and as such there a lot of variabilities in the tax head which might affect its responsiveness to GDP (Omondi, 2014).

3.3 Data Sources and Characteristics

The research study aims to establish the buoyancy of Corporate Income tax in Zimbabwe Centered on a quarterly time series data for the period 2009 to 2018. Quarterly times series data on tax revenues was collected from the Zimbabwe Revenue Authority data base and gross domestic product (GDP) data was collected from the RBZ and Zimstats all these units are measured in United States Dollars (US$). Using secondary data has an advantage of using readily available statistics representing the true values and being relatively easy to access on the internet. Also secondary data is reliable and less biased towards the researcher's interest as compared to primary data. However, secondary data has a major disadvantage in that it is usually prone to data smoothing processes so that the data fits the researcher's interests. Of interest GDP data was collected in annual frequency to convert the annual frequency to quarterly frequency the researcher employed a Denton, (1971) econometric approach to determine quarterly estimates. This process interpolates low frequency data by using a related high frequency indicator time series with the assistance of a statistical package Eviews (Abdul and Zanib, 2013). The research purely employs the OLS estimation approach and data is estimated and analysed on Eviews 9.

3.4 Diagnostic Tests

Diagnostic tests form an essential part of the research as data reliability and relevance are key attributes that determines the binding econometric procedures that avoids spurious and biased results. This subsection will also test for econometric problems in line with the use of time series data.

3.4.1 Unit Root Test

Stationarity and non-stationarity of a time series forms an important base for a research which renders the study's results admissible or nonsensical. Gujarati and Porter (2008) posits that a series is stationary if the means and the variance are constant and has an independent covariance this is normally called a reverting series. This study assumes a crossectional independence of variables and therefore the stationarity tests are based on the *p* values of the Augmented Dickey Fuller (ADF), Chi Square and Phillips Peron (PP). To test for Stationarity, it follows the following hypothesis;

H_0: Series is non stationary ***(ρ** = 1)*

H_1: Series is stationary (**ρ** < 1)

Decision Rule: Reject H_0 if ***ρ*** is greater than 1 otherwise do not reject

Decision Rule: if $ADF_{stat} > ADF_{crit}$ Reject H_0 and conclude the series is stationary.

3.4.2 Heteroscedasticity Test

Gujarati and Porter (2008) defined heteroscedasticity as a condition where the error variance is non constant violating the important assumption of the Classical Linear Regression Model (4) of homoscedasticity. The common test for heteroscedasticity in Econometrics is the Breusch Pagan Chi Square test which will employed in this research study. The hypothesis test procedure is as follows:

H_0: Homoscedasticity

H_1: Heteroscedasticity

Decision Rule: If χ^2 cal > χ^2 crit reject H_0 and conclude the model is homoscedastic.

3.4.3 Normality Test

Validity of this statistical test depends on the normality of the error terms. The test for normality will be done through the Jarque Bera which according to (Gujarati, 2004) if the error terms follow a normal distribution the normal probability plot will be a straight line and if not normal the plots may show a marked deviation from the origin and the x-axis. The hypothesis procedure follows that:

H_0: Residuals are normally distributed

H_1: Residuals are not normally distributed

3.4.4 Cointergration Test

Engle and Granger (1987) recommended a procedure for Cointergration analysis of the model. Assuming that the variables are in disequilibrium in the short run, and then an error term is used to tie the short run behaviour to the long run values. If the variables become cointergrated, an Error Correction Model (ECM) and the Johansen Cointegration test is employed to determine the relationship of variables. Therefore, if the trace statistic is exceeding the values of the t critical values then the decision rule follows that variables are cointergrated in the long run and therefore we don't reject H0.

3.4.5 Model Specification Test

The test for model specification is designed to determine whether the variables used in the model and the whole model itself is correctly specified (Gujarati, 2008). The decision criteria under this test follows that if the probability value of the Ramsey Reset test is less than 0.05 then we reject the null hypothesis and conclude that the model is mispecified, entailing that they might be over specifies or under specified. If the model is correctly specified the Ramsey Reset probability value will be greater than 0.05 therefore, it means the model is correctly specified so we accept the specific hypothesis.

3.5 Conclusion

The chapter has established the methodology that would be used in this research emphasizing the procedures the researcher will adopt to carry out the above mentioned diagnostic tests. The next chapter presents and analyses the findings from the study.

CHAPTER FOUR

RESULTS PRESENTATION AND INTEPRETATION

4.0 Introduction

This chapter intends to present the results from the regression using a model that was detailed in chapter 3 and also continues to carry out the diagnostic tests. The study uses Ordinary Least Squares approach to determine the Buoyancy of Corporate Tax from 2009Q1 to 2018Q4 by the means of E-views 9 package.

4.1 Summary Statistics

The descriptive statistics gives a summary of data that was analysed through software. The summary statistics highlights the number of observations, mean , standard deviation , minimum value and maximum values of variables recorded. The statistics are presented below and also in appendix 2.

Table 4.1 Summary of Descriptive Statistics

	CIT	PIT	VAT	EXCISE	RGDP
Mean	97.13643	163.86545	140.9287	122.9128	11913.03
Median	93.23379	177.8264	143.9690	130.2695	13394.38
Maximum	256.3343	244.4694	219.4286	241.5097	19143.00
Minimum	1.723975	5.609460	11.08592	3.951029	450.0000
Std. Dev	52.74200	56.27196	44.08480	63.81052	4406.285
Observations	40	40	40	40	40

Source: Author's Calculations, See appendix 2 for full Results

The mean value of corporate income tax is US$97.1364 million and this shows that income from corporate tax from 2009 to 2018 is moderate also indicated by a standard deviation of US$52.724 million which shows that corporate taxes did not deviate or highly fluctuated from the median and mean. Also the highest income received from the 40 observations is US$256.33 million with the lowest income received at US$1.72 million. The whole table of descriptive statistics are presented in Appendix 2

4.2 Diagnostic Tests Results

4.2.1 Unit Root Test

To establish the stationarity of variables used in the model, the Augmented-Dickey Fuller Test was employed and the following results were obtained.

Table 4. 2: Summary of Unit Root Test

Variable	ADF Statistic	Critical Value	Trend	Intercept	Order of Integration	Prob.
CIT	-12.42062***	1% -4.219126 5% -3.533083 10% -3.198312	NO	NO	I(0)	0.0000
PIT	-6.073271***	1% -4.226815 5% -3.536601 10% -3.200320	NO	NO	I(1)	0.0001
VAT	-3.091514**	1% -3.610453 5% -2.938987 10% -2.607932	NO	YES	I(0)	0.0355
EXCISE	-9.573854***	1% -4.219126 5% -3.533083 10% -3.198312	NO	NO	I(0)	0.0000
RGDP	-4.257099***	1% -4.219126 5% -3.533083 10% -3.198312	YES	YES	I(1)	0.0096

**Means significant at 10% **means significant at 5% and ***means significant at 1% and all level of significant.*

Table 4.2 shows that CIT, VAT and EXCISE are stationary at level I (0) thus integrated of the order zero at 1%, 5% and 10% level of significance with the exception of VAT which is significant at only 5%. PIT and RGDP are stationary at first difference thus they are integrated at I (1). Therefore, H_0 of non-stationarity is rejected and we accept H_1 since the data is free from the unit root problem and the variables can be used for model estimation.

4.2.2 Heteroscedasticity Test

The test for Heteroscedasticity was carried out to determine if the variables used in the model followed the Classical Linear Regression Model (CLRM) assumption of homoscedasticity which assumes constant variance among variables through the Breusch-Pagan/ Cook- Weisberg Test for Heteroscedasticity.

Table 4. 3: Heteroscedasticity Tests Results

F-Statistic	23.78417	Prob. F (1.38)	0.0000
Observed*R-	15.39823	Prob .Chi-Square (1)	0.0001
Scaled Explained SS	26.91451	Prob. Chi-Square (1)	0.0000

Using the Bruech –Pagan Godfrey test the series was found to be suffering from heteroscedasticity therefore we rejected the null hypothesis as the probability value was less 0.05. The researcher found that the major reason for an inconstant mean variance emanated from the fact all the models used 1 explanatory variable. To avoid biased estimates, the researcher employed the cluster- robust estimators for standard errors which can be used to supress the effects of heteroscedasticity in regression analysis (Nicholas, 2007). Refer to Appendix 3.

4.2.3 Test for Normality

Residuals generated from the regression were tested for normality using the Jarque-Bera Test method as follows:

Table 4. 4: Test for Normality Results

Mean	Skewness	Kurtosis	Jarque-Bera Statistic	Probability
-1.38e-15	0.095863	4.873455	5.911988	0.056005

The Jarque – Bera test was employed to test if residuals were normally distributed or not. The probability value of the Jarque-Bera statistic of 0.056005 which is greater than 0.05 revealed that the null hypothesis is not rejected implying that the residuals follow a normal distribution. The asymmetric dispersion around the mean is measured by the skewness in a time series and as such the results show that the distribution is positively skewed as shown by 0.095863. Further to that we compare the kurtosis value to 3 as shown by the results the value 4.873455 suggests that the peakedness of the dispersion is slightly high. However, in support of this De Carlo (1997) highlighted that despite the distribution being normal excess kurtosis can be influenced by the presence of outliers which is not a major point that can deter to reject the null hypothesis of normality. Refer to Appendix 3

4.2.4 Cointergration Test

To establish if the variables are cointergrated or not, the Johansen Cointegration methodology was employed and the results are as follows:

Table 4. 5: Summary of Cointergration Test Results

Hypothesized No of CE (s)	Eigen value	Trace statistic	Critical value	Probability
None *	0.738271	90.91095	69.81889	0.0004
At most 1 *	0.530256	59.97407	47.85613	0.0000
At most 2 *	0.458281	31.59645	29.79707	0.0422
At most 3	0.173366	7.242625	15.49471	0.5496
At most 4	0.000202	0.007660	3.841466	0.9298

**indicates number of cointegrating equations at 5%. See appendix 3 for full results.*

The Johansen Cointergration test was done to determine if there is a long run relationship between the variables of the estimated model. Basing on the null hypothesis that if there is Cointegration the t statistic values will be greater than the t critical values. As such the null hypothesis of Cointegration was not rejected as the results show that there are 3 Cointergrated equations and their t statistics are greater than the critical values, which implied that the variables have a long run relationship and this dismisses any chance of spurious results.

4.2.5 Ramsey Reset Test

Table 4.6: Model Specification Test

Probability	DW Statistic	R-Squared	Adjusted R-Squared	F-Statistic
0.4267	1.293916	0.641317	0.631933	2.643154

The probability value of the Ramsey RESET is 0.4267 which is greater than 0.05, thus we do not reject the null hypothesis that the model is correctly specified. Likewise, the DW statistic of 1.293916 is greater than the R^2 and Adjusted R^2 which further validates that the model is correctly specified therefore, dismissing any chance or likelihood of spurious regression. This is also supported by the DW statistic which is greater than the R^2 Adjusted R^2

4.3 Presentation of Regression Results

Therefore, the regression results obtained after running the Ordinary Least Squares (OLS) specified the models as:

Buoyancy of Corporate Income Tax equation;

$$LnCIT = -2.5818 + 0.7563LnGDP \quad (1)$$

$$R^2 = 0.78 \quad Pvalue = 0.0000 \quad and\ DW\ 1.7267$$

Buoyancy of Personal Income Tax equation;

$$LnPIT = 0.1866 + 0.5233LnGDP \quad (2)$$

$$R^2 = 0.70 \quad Pvalue = 0.0000 \quad and\ DW = 1.62$$

Buoyancy of Value Added Tax equation;

$$LnVAT = 1.2169 + 0.3987LnGDP \quad (3)$$

$$R^2 = 0.69 \quad Pvalue = 0.0000 \quad and\ DW = 1.56$$

Buoyancy of Excise Duty equation;

$$LnEXC = -2.071 + 0.7256LnGDP \quad (4)$$

$$R^2 = 0.74 \quad Pvalue = 0.0000 \quad and\ DW = 1.075$$

Appendix 3 shows the full results

4.4 Interpretation of Results

All variables in the 4 models were significant which is explained by the p values which were less than 0.05. The inference therefore is that buoyancy as measured by the changes in GDP is influenced by all the tax heads included in the generic and disaggregated model.

As shown from the results above gross domestic product in the generic model (equation 1) explains 78.4% of the tax revenue, while the other 21.6% is explained by other factors outside of this model. After correcting for the degrees of freedom as shown by adjusted R^2 still 77.8% validated the superiority of GDP in explaining the changes in tax revenue (Osoro,1991 and Mishra 2005). The table also shows that the model was correctly specified and it was far from a spurious regression validated by the Durbin Watson (DW) statistic of 1.726705 which is close to 2 and it is higher than the R^2. Also the higher DW statistic dismisses any chance of serial correlation among the variables. Therefore, the results obtained in this regression can be used for policy formulation.

4.4.1 Corporate Income Tax (CIT)

The buoyancy of corporate income tax is shown by the coefficient of *lnGDP* which is 0.7562 which significant at 5% level of significance and with a probability value of 0.0000 as shown in equation 1. A positive sign reflected on the coefficient of *lnGDP* in the first equation is consistent with theory which states that there is a positive relationship between tax revenue and national income. Thus it means a percent increase in GDP will increase corporate tax by 0.762 percent. (Mondi, 2014) validated the use of logarithms in determining buoyancy and elasticity and productivity of a tax which is benchmarked with the unitary value 1 in Kenya. Using the same approach Corporate income tax is less buoyant since 0.7562 is less than one therefore corporate income tax in Zimbabwe is less responsive to changes in gross domestic product thus corporate income tax is not productive in Zimbabwe. The results compare favourably to Ndedza (2013), Chidakwa (1996) and Rao (1995) who found corporate tax not buoyant in Zimbabwe.

4.4.2 Personal Income Tax (PIT

The buoyancy estimate of Personal income tax is shown in equation 2 which was positive and significant at 5% level of significance validated by the probability value of 0.0001. PIT was found to be responsive to changes in national income although the degree of buoyancy was average as shown by the PIT coefficient of 0.5233 which is below the unitary value of 1.

Therefore, it means that a percent increase in GDP will increase personal tax by 0.52 percent thus personal tax is less or not responsive to national income specifying that this direct tax head is not productive. This study conforms to a study done by Bayu (2015) and Birhanu (2018) in Ethiopia which also showed that direct taxes were not buoyant in the long and short for the Ethiopian tax system.

4.4.3 Value Added Tax (Vat)

Value added tax was found to be not buoyant for the study period with an estimate of 0.3987 although positive shown in equation 3 and it was significant at 1% ,5% and 10% level of significance validated by the probability value of 0.0000. Comparing with the unitary value of one which shows buoyancy VAT was far inferior to buoyancy estimate which means that a unit change in GDP will reflect to a positive change in value added tax by 0.40 percent. As such value added tax is not productive this result is similar to what Sheefani (2019) found in Namibia although the approaches were different and also in a panel study done Dudine (2017) the results compares favourably to the discoveries that on average the Southern African countries tax system are not buoyant.

4.4.4 Excise Duty (Exc)

Buoyancy of excise duty is shown in equation 4. Excise duty had a positive coefficient of 0.7256 and is significant at 5% level of significance and also the results were as expected by the researcher which was that the variable would be positive but the degree of buoyancy is moderate. Since the buoyancy estimate of excise duty is less than one the tax head was found not to be buoyant. Thus a unit increase in GDP is associated with a 0.72 percent increase in excise duty. These results conform to Vadika and Rami 2018 who found precisely that excise duty was not buoyant in their disaggregated models that explained buoyancy in India.

4.5 Conclusion

This chapter reported the findings of the study. The methodology that was outlined in chapter three was employed to process data together with the use of Eviews. The obtained results were in line with the formulated hypothesis. Corporate tax and all other tax heads included in the equations were responsive to changes in gross domestic product although the degree of buoyancy was low. All tax heads were found to be significant which matched the researcher's expectations as all probability values were less than 0.05. Chapter five will therefore give insights on policy recommendations to the stakeholders and also give the conclusions and further study recommendations for future studies.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.0 Introduction

This section brings the outcome established from the whole study. Centred on these outcomes, evaluations of the aims made in the first chapter are highlighted together with policy recommendations are presented. Furthermore, this part concludes the whole study and also points out the areas to explore for further study.

5.1 Summary of the Study

The study intended to determine and analyse buoyancy of corporate tax in Zimbabwe. Employing a logarithmic function to estimate buoyancy in a quarterly time series stretching from 2009Q1 – 2018Q4 the ordinary least squares method was estimated. Empirical conclusions from the research determined that corporate tax is responsive too changes in national income for the period 2009 – 2018 and a progressive association between variables was established although the degree of buoyancy is low also less than unitary figure one. All other tax heads included in the study also showed that they are responsive to changes in national income although their buoyancy estimates are fairly low except excise duty which was fairly high.

5.2 Conclusions

Chief of this analysis was to establish buoyancy of corporate income tax and identifying the weak and strong spots of corporate income tax in Zimbabwe using a quarterly time series from 2009Q1 – 2018Q4. Although corporate tax and national income had a positive association and responsive, the tax head (corporate tax) is not buoyant thus corporate tax in Zimbabwe is not fully productive so the government should aim on maximising revenues through the tax head to increase national income. Therefore, the assertion that corporate tax is buoyant is rejected and hence reaching to the conclusion that corporate tax in Zimbabwe tax system is not buoyant.

5.3 Policy Implications and Recommendations

Corporate income tax in Zimbabwe is generally responsive to GDP in the period studied although the degree of buoyancy was generally low. While Zimbabwe's prospects to duple corporate tax efforts at ZIMRA and other revenue collection agencies its thrust should be focused more on the growth side. Thus, implementation of policies that will widen the tax base, tax compliance should be strengthened in each and every sector lastly tax exemptions should be eliminated together distortionary tax concessions.

Zimbabwe's main sources of revenue the indirect taxes (corporate tax and value added tax), had a buoyancy estimate below one, this might be owing to large exemptions and tax evasions within the tax system. Therefore, the authority should enforce tax compliance, tax payer education, tax audits and prevent tax evasion as their immediate policy solutions. The tax guidelines stated above are paramount to develop an improved revenue collection technique which will prevail as tax payers now adhere to tax procedures with a deeper understanding of their tax requirements.

For other developed nations reduction of tax rates has consequently had revenue yield increase and a progressive effect has been observed Laffer (2004). As such it is worthwhile for Zimbabwe to reduce some tax rates on some intermediate goods such that these reductions in taxes will induce more investments while promoting domestic resource mobilisation. The tax buoyancy will gradually increase as the tax system breeds substantial revenue volume. Generally, the total tax. revenue of the government will invariably depend upon the size of the tax base, the levels of tax rates adopted within the tax system, administrative efficiency, and the compliance rate. The taxes introduced should be appropriate. and sufficient to finance the expenditure needs of the government over time. In other words, revenues should rise with national. income, and the entire tax system should evolve to enhance the revenue yield over time.

Tax compliance should be enforced. It is also worth to note that some revenue being collected in the current years are as a result of operations taken by Authority to recover unpaid taxes and hence include penalty figures, which may not happen in the future as increased compliance is expected. In conclusion, it is desirable to have a tax system with buoyancy coefficients greater than one. This indicates that during times of economic growth tax revenues would be increasing at a faster rate than GDP. This can facilitate increases in savings or growth in expenditure without the need for increases in the tax rate. Conversely a tax buoyancy or elasticity coefficient that is lower than one may point towards issues related to the structure of the tax, administration or compliance.

5.4 Recommendations for further studies

Future researchers should explore buoyancy of corporate income tax in Zimbabwe employing other approaches specifically the error correction model (ECM) to estimate the short term and the long term buoyancy and to also show the speed of adjustment regarding how corporate income tax may be used to correct shocks in the economy. This requires , however, more detailed information about underlying tax reforms and their revenue impacts. Future researchers may explore this model in determining the buoyancy of the Zimbabwean tax system since it was not involved in this model.

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APPENDICES

Appendix 1

Data set used in the regression model

Year	Corporate Income Tax ($m)	Value Added Tax ($m)	Excise Duty ($m)	Personal Income Tax ($m)	Gross Domestic Product ($m)
2009Q1	1.72	11.09	3.95	5.61	450.00
2009Q2	5.84	45.39	4.65	36.90	135.00
2009Q3	10.94	43.53	28.93	40.50	225.00
2009Q4	26.40	88.72	42.87	67.30	7,467.00
2010Q1	42.42	97.22	34.53	67.86	7,769.75
2010Q2	57.78	100.21	42.71	99.85	8,072.50
2010Q3	51.42	128.88	32.31	120.77	8,375.25
2010Q4	103.36	133.76	56.45	138.25	8,678.00
2011Q1	54.77	144.10	62.44	129.69	9,107.50
2011Q2	76.41	145.34	78.72	134.83	9,537.00
2011Q3	67.86	136.11	81.14	148.63	9,966.50
2011Q4	91.94	172.07	84.16	170.08	10,396.00
2012Q1	75.22	162.68	88.89	145.29	10,876.25
2012Q2	104.13	154.98	71.68	156.31	11,356.50
2012Q3	117.21	143.29	101.82	163.03	11,836.75
2012Q4	147.96	179.48	117.21	195.95	12,317.00
2013Q1	85.96	145.64	111.82	174.27	12,569.50
2013Q2	99.48	135.02	130.63	174.29	12,822.00
2013Q3	102.36	155.23	129.90	211.33	13,074.50
2013Q4	116.45	143.84	138.10	184.47	13,327.00
2014Q1	104.59	102.96	104.67	192.88	13,461.75
2014Q2	91.87	128.93	131.68	236.65	13,596.50
2014Q3	92.20	125.39	122.90	225.41	13,731.25
2014Q4	100.31	146.50	153.07	244.47	13,866.00
2015Q1	71.60	107.82	165.40	200.18	13,918.00
2015Q2	95.88	105.06	180.84	179.35	13,970.00
2015Q3	86.54	138.27	176.08	196.59	14,022.00
2015Q4	167.54	184.21	191.90	187.49	14,074.00
2016Q1	52.03	132.85	160.45	166.31	14,192.25
2016Q2	90.93	153.43	154.81	184.56	14,310.50
2016Q3	100.02	169.28	178.33	214.27	14,428.75
2016Q4	93.06	168.44	168.71	176.30	14,547.00
2017Q1	93.41	187.31	150.29	166.11	14,733.50
2017Q2	121.84	136.49	173.40	180.83	14,920.00
2017Q3	124.54	175.11	187.97	193.35	15,106.50
2017Q4	157.75	185.64	164.25	188.76	15,293.00
2018Q1	128.11	207.52	236.20	193.87	16,255.50
2018Q2	226.34	219.43	215.48	217.90	17,218.00
2018Q3	190.96	194.17	215.68	211.32	18,180.50
2018Q4	256.33	201.78	241.51	232.79	19,143.00

Appendix 2

Descriptive Statistics

	CIT	PIT	VAT	EXCISE	RGDP
Mean	97.13643	163.8645	140.9287	122.9128	11913.03
Median	93.23379	177.8264	143.9690	130.2695	13394.38
Maximum	256.3343	244.4694	219.4286	241.5097	19143.00
Minimum	1.723975	5.609460	11.08592	3.951029	0.450000
Std. Dev.	52.74200	56.27196	44.08480	63.81052	4406.285
Skewness	0.818726	-1.149146	-0.851413	-0.121046	-1.308927
Kurtosis	4.427370	3.811899	3.996481	2.119340	4.726815
Jarque-Bera	7.864392	9.902202	6.487653	1.390284	16.39174
Probability	0.019601	0.007076	0.039014	0.499004	0.000276
Sum	3885.457	6554.581	5637.148	4916.513	476521.1
Sum Sq. Dev.	108487.0	123494.8	75795.32	158799.5	7.57E+08
Observations	40	40	40	40	40

Appendix 3: Diagnostic Tests

3.1 Results of Unit Root Tests

3.1.1 CIT unit root test results

Null Hypothesis: D(CIT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.42062	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CIT,2)
Method: Least Squares
Date: 03/14/20 Time: 12:55
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CIT(-1))	-1.661994	0.133809	-12.42062	0.0000
C	3.995802	10.26952	0.389093	0.6996
@TREND("2009Q1")	0.287452	0.441013	0.651798	0.5188

R-squared	0.815372	Mean dependent var	1.612127
Adjusted R-squared	0.804822	S.D. dependent var	67.47675
S.E. of regression	29.81056	Akaike info criterion	9.703259

Sum squared resid	31103.43	Schwarz criterion	9.832542
Log likelihood	-181.3619	Hannan-Quinn criter.	9.749257
F-statistic	77.28505	Durbin-Watson stat	2.014536
Prob(F-statistic)	0.000000		

3.1.2 **PIT unit root test results**

Null Hypothesis: D(PIT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.073271	0.0001
Test critical values:	1% level	-4.226815	
	5% level	-3.536601	
	10% level	-3.200320	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PIT,2)
Method: Least Squares
Date: 03/14/20 Time: 12:58
Sample (adjusted): 2009Q4 2018Q4
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PIT(-1))	-1.614795	0.265886	-6.073271	0.0000
D(PIT(-1),2)	0.293291	0.167415	1.751881	0.0891
C	20.24802	8.319570	2.433783	0.0205
@TREND("2009Q1")	-0.564405	0.334900	-1.685295	0.1014

R-squared	0.649448	Mean dependent var	0.482948
Adjusted R-squared	0.617580	S.D. dependent var	33.24633
S.E. of regression	20.55958	Akaike info criterion	8.986337
Sum squared resid	13948.98	Schwarz criterion	9.160491
Log likelihood	-162.2472	Hannan-Quinn criter.	9.047735
F-statistic	20.37908	Durbin-Watson stat	1.898134
Prob(F-statistic)	0.000000		

3.1.3 **VAT unit root results**

Null Hypothesis: VAT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.091514	0.0355
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VAT)
Method: Least Squares
Date: 03/14/20 Time: 12:59
Sample (adjusted): 2009Q2 2018Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VAT(-1)	-0.265849	0.085993	-3.091514	0.0038
C	41.94062	12.54134	3.344190	0.0019

R-squared	0.205283	Mean dependent var	4.889663
Adjusted R-squared	0.183804	S.D. dependent var	25.54022
S.E. of regression	23.07394	Akaike info criterion	9.165205
Sum squared resid	19699.04	Schwarz criterion	9.250516
Log likelihood	-176.7215	Hannan-Quinn criter.	9.195814
F-statistic	9.557460	Durbin-Watson stat	2.497954
Prob(F-statistic)	0.003774		

3.1.4 **EXCISE unit root results**

Null Hypothesis: D(EXCISE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.573854	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCISE,2)
Method: Least Squares
Date: 03/14/20 Time: 13:01
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXCISE(-1))	-1.460532	0.152554	-9.573854	0.0000
C	10.11351	6.532468	1.548191	0.1306
@TREND("2009Q1")	-0.064117	0.277143	-0.231350	0.8184

R-squared	0.723773	Mean dependent var	0.661179
Adjusted R-squared	0.707989	S.D. dependent var	34.63014
S.E. of regression	18.71345	Akaike info criterion	8.772018
Sum squared resid	12256.76	Schwarz criterion	8.901301
Log likelihood	-163.6683	Hannan-Quinn criter.	8.818016
F-statistic	45.85380	Durbin-Watson stat	2.151852
Prob(F-statistic)	0.000000		

3.1.5 **RGP unit root results**

Null Hypothesis: RGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.257099	0.0091
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 03/14/20 Time: 13:02
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	-0.380874	0.089468	-4.257099	0.0002
D(RGDP(-1))	-0.007965	0.138987	-0.057304	0.9546
C	3131.113	609.4012	5.138016	0.0000
@TREND("2009Q1")	95.64495	31.81601	3.006189	0.0049

R-squared	0.380353	Mean dependent var	503.7276
Adjusted R-squared	0.325678	S.D. dependent var	1189.442
S.E. of regression	976.7349	Akaike info criterion	16.70561
Sum squared resid	32436377	Schwarz criterion	16.87799
Log likelihood	-313.4066	Hannan-Quinn criter.	16.76694
F-statistic	6.956651	Durbin-Watson stat	2.287793
Prob(F-statistic)	0.000896		

3.2 **Cointergration Test**

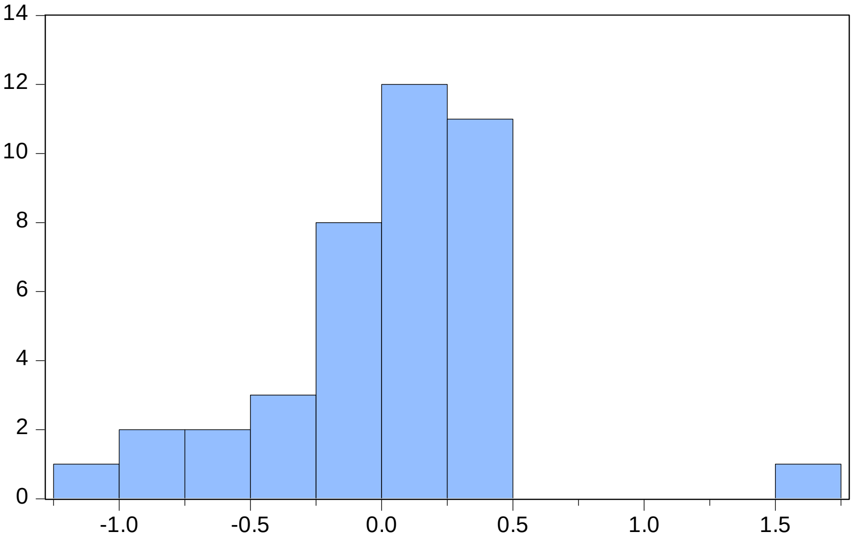
Date: 06/14/20 Time: 14:25
Sample (adjusted): 2009Q3 2018Q4
Included observations: 38 after adjustments
Trend assumption: Linear deterministic trend
Series: CIT PIT VAT EXC GDP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.738271	90.91095	69.81889	0.0004
At most 1*	0.530256	59.97407	47.85613	0.0234
At most 2*	0.458281	31.59645	29.79707	0.0422
At most 3	0.173366	7.242625	15.49471	0.5496
At most 4	0.000202	0.007660	3.841466	0.9298

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

3.3 **Normality test results**



Series: Residuals
Sample 2009Q1 2018Q4
Observations 40

Mean	-1.38e-15
Median	0.069967
Maximum	1.505848
Minimum	-1.008123
Std. Dev.	0.462618
Skewness	0.095863
Kurtosis	4.873455
Jarque-Bera	5.910988
Probability	0.052053

3.4 **Model Specification test results**

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(CIT) LOG(RGDP)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.801969	38	0.4276
F-statistic	2.643154	(1, 38)	0.4276
Likelihood ratio	0.671339	1	0.4126

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.205030	1	0.205030
Restricted SSR	12.31901	39	0.315872
Unrestricted SSR	12.11398	38	0.318789
Unrestricted SSR	12.11398	38	0.318789

LR test summary:

	Value	df
Restricted LogL	-33.20283	39
Unrestricted LogL	-32.86716	38

Unrestricted Test Equation:
Dependent Variable: LOG(CIT)
Method: Least Squares
Date: 03/14/20 Time: 13:52
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RGDP)	0.237253	0.307404	0.771797	0.4450
FITTED^2	0.111529	0.139069	0.801969	0.4276

R-squared	0.641371	Mean dependent var	4.330497
Adjusted R-squared	0.631933	S.D. dependent var	0.930654
S.E. of regression	0.564614	Akaike info criterion	1.743358
Sum squared resid	12.11398	Schwarz criterion	1.827802
Log likelihood	-32.86716	Hannan-Quinn criter.	1.773890
Durbin-Watson stat	1.293916		

3.5 Heteroscedasticity test results

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	23.78417	Prob. F(1,38)	0.0000
Obs*R-squared	15.39823	Prob. Chi-Square(1)	0.0001
Scaled explained SS	26.91451	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/18/20 Time: 21:59
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.373067	0.446872	5.310401	0.0000
LOG(GROSS_DOMESTIC_PRODUCT__)	-0.236808	0.048557	-4.876902	0.0000

R-squared	0.384956	Mean dependent var	0.208665
Adjusted R-squared	0.368770	S.D. dependent var	0.415907
S.E. of regression	0.330438	Akaike info criterion	0.671912
Sum squared resid	4.149196	Schwarz criterion	0.756356
Log likelihood	-11.43824	Hannan-Quinn criter.	0.702444
F-statistic	23.78417	Durbin-Watson stat	2.321063
Prob(F-statistic)	0.000019		

3.6 CIT regression results

Dependent Variable: LOG(CIT)
Method: Least Squares
Date: 03/30/20 Time: 12:01
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	0.756277	0.064369	11.74911	0.0000
C	-2.581787	0.592387	-4.358278	0.0001

R-squared	0.784142	Mean dependent var	4.330497
Adjusted R-squared	0.778461	S.D. dependent var	0.930654
S.E. of regression	0.438039	Akaike info criterion	1.235690
Sum squared resid	7.291379	Schwarz criterion	1.320134
Log likelihood	-22.71381	Hannan-Quinn criter.	1.266223
F-statistic	138.0415	Durbin-Watson stat	1.726705
Prob(F-statistic)	0.000000		

3.7 PIT regression results

Dependent Variable: LOG(PIT)
Method: Least Squares
Date: 03/30/20 Time: 12:05
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	0.523292	0.055170	9.485101	0.0000
C	0.186643	0.507728	0.367603	0.7152

R-squared	0.703049	Mean dependent var	4.969466
Adjusted R-squared	0.695234	S.D. dependent var	0.680073
S.E. of regression	0.375438	Akaike info criterion	0.927262
Sum squared resid	5.356252	Schwarz criterion	1.011706
Log likelihood	-16.54524	Hannan-Quinn criter.	0.957794
F-statistic	89.96713	Durbin-Watson stat	1.619036
Prob(F-statistic)	0.000000		

3.8 VAT regression results

Dependent Variable: LOG(VAT)
Method: Least Squares
Date: 03/30/20 Time: 12:06
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	0.398686	0.043268	9.214343	0.0000
C	1.216893	0.398195	3.056020	0.0041

R-squared	0.690816	Mean dependent var	4.860836
Adjusted R-squared	0.682679	S.D. dependent var	0.522702
S.E. of regression	0.294445	Akaike info criterion	0.441255
Sum squared resid	3.294509	Schwarz criterion	0.525699
Log likelihood	-6.825095	Hannan-Quinn criter.	0.471787
F-statistic	84.90412	Durbin-Watson stat	1.561175
Prob(F-statistic)	0.000000		

3.9 EXCISE regression results

Dependent Variable: LOG(EXC)
Method: Least Squares
Date: 03/30/20 Time: 12:07
Sample: 2009Q1 2018Q4
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GDP)	0.725616	0.068869	10.53613	0.0000
C	-2.070985	0.633805	-3.267543	0.0023

R-squared	0.744983	Mean dependent var	4.561063
Adjusted R-squared	0.738273	S.D. dependent var	0.916090
S.E. of regression	0.468665	Akaike info criterion	1.370852
Sum squared resid	8.346598	Schwarz criterion	1.455296
Log likelihood	-25.41703	Hannan-Quinn criter.	1.401384
F-statistic	111.0100	Durbin-Watson stat	1.075321
Prob(F-statistic)	0.000000		

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