AN INVESTIGATION OF THE RELATIONSHIP BETWEEN PUBLIC DEBT, GOVERNMENT EXPENDITURE AND REVENUE IN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION- FINANCE

OF

THE UNIVERSITY OF NAMIBIA

BY

HAMBELELENI TUNOMUKWATHI IIYAMBO

STUDENT NO: 201512658

APRIL 2019

SUPERVISOR: Dr T. KAULIHOWA (UNAM)

Abstract

Given the raising concerns of fiscal sustainability and increases in debt burdens, this study investigates the relationship between government expenditure, government revenue and public debt by employing the data of these variables for the period 1990 to 2016, obtained from the Ministry of Finance (MOF). Due to the existence of cointegration, the error correction model (ECM) was employed to analyse the short-run dynamics. The ordinary least square (OLS) regression revealed a positive significant relationship between government expenditure and government revenue, but public debt was found to be statistically insignificant relative to government expenditure in the long run. All independent variables were found statistically significant and positively related to government expenditure in the short run. The negative sign of the residual in the estimated ECM indicates that any disequilibrium is corrected at an annual speed of 50.28 percent. The pair-wise Granger causality tests found an unidirectional causality from government expenditure to public debt. On the contrary, there is no evidence to support any causality between government expenditure and government revenue. The study recommends policy-makers to thoroughly review the fiscal policy and incorporate in it, an effective functional finance in order to save the economy, not only from perpetual budget deficits and accumulated borrowings, but also to avoid inflation or unemployment.

Table of Contents

List of tables

List of figures

List of acronyms

ADF	Augmented Dickey-Fuller
BON	Bank of Namibia
CLRM	Classical Linear Regression Model
ECT	Error Correction Term
ECM	Error Correction Model
GDP	Gross Domestic Product
MOF	Ministry of Finance
MTEF	Medium Term Expenditure Framework
OLS	Ordinary Least Square
PP	Phillips-Perron
SACU	Southern Africa Customs Union
SADC	Southern African Development Countries
SDMS	Strategic Debt Management Strategy

Acknowledgements

First and foremost, I would like to give acknowledgment and thanks to my Almighty God for His divine strength and for granting me the wisdom to pursue this thesis and my entire studies. I am because, He is. My sincere gratitude goes to my supervisor Dr. Teresa Kaulihowa for her mentorship, enthusiastic support, discussions and corrections along with her commitment and time. I would have achieved little in this thesis without your supervision, thank you Dr Kaulihowa. Most importantly, I would love to thank my parents and siblings for their prayers, love, patience, words of encouragement and support during the time I was completing this thesis.

Special thanks go to all my friends, most specifically Felistas Shivoro, Christopher Mulunga, Veroonika Petrus and Sem Enkono. Thank you for being there without hesitation, when I needed you most. To the entire Namibia Business School staff members, thank you for your conducive and supportive learning environment. My fellow MBA classmates, it was an honour being part of an enthusiastic and vibrant knowledge sharing team. Lastly, I am grateful to my colleagues especially for allowing me some time off from my work to study and increase my knowledge base. Much appreciation goes to the expenditure management, debt management and economic policy divisions of the Ministry of Finance.

Dedication

This thesis is dedicated to my caring parents who taught me to be the person I am today. Mr. and Mrs. Iiyambo, this one is to you for being the best.

Declarations

I, Hambeleleni Tunomukwathi Iiyambo, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

…… Date……

Hambeleleni T Iiyambo

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Political debates about the future course of the fiscal policy, the need to keep government debt under control and the sustainability of public finances has been one of the most widely discussed topics in economics (Neck & Sturm, 2008). Moreover, the global crisis and the expansionary government reaction in many countries have revamped the attention of policy-makers and academics on the growth effects of large public debts and budget deficits (Presbitero, 2010) and as such, fiscal policy sustainability and public debt remain a concern to any economy, whether developed or developing. In many countries with bond markets, the largest sector is often bonds issued by the country's central government. These include sovereign or government domestic bonds issued within a government's national bond market or foreign bonds issued in the Eurobond market or foreign sector of another country's bond market (Fabozzi, 2007). Public debt therefore, refers to all finances owed by any central government through either domestically (internally) or foreign (externally) issued bonds.

The Namibia government budget mainly constitutes of government expenditures and government revenues. Total government revenues refer to all tax and non-tax revenues collected by governments including grants, while total government expenditures are all operational and development expenditures incurred by the government in a particular financial period. Tax revenues constitute all taxes on income, taxes on property, domestic taxes on goods and services, taxes on international trade and others while non-tax revenue, on the other hand, comprises of entrepreneurial and property

income, fines and forfeitures, administration fees and charges as well as return on capital from lending and equity (MoF, 2017a). Operational expenditures include personnel expenditures, expenditures on goods and other services, statutory as well as subsidised and other current transfers while capital expenditures include capital projects, transfers and equity participations (MoF, 2017a). When government expenditures and revenues are imbalanced, a budget deficit or surplus will be recorded. A budget deficit or shortfall occurs when less revenue is collected to meet the incurred expenditures.

As attested by Sherbourne, Nampila and du Preez (2002), governments generally resort to three means of financing a shortfall between government expenditure and revenue. According to Sherbourne et al. (2002), governments either borrow from the domestic financial markets, the central bank by asking it to print more money or from abroad. Although it is evident that governments rely on debt to finance their deficits which is not entirely safe, budget deficits received favour from Battaglini and Coate (2008), who argue that governments are benevolent, and government spending needs to fluctuate over time resulting in governments using budget surpluses and deficits as a shield to prevent tax rates from changing too sharply and consequently, run deficits in times of high government spending needs and surpluses when needs are low.

Labonte (2012) and Cottarelli and Schaechter (2010) further argue that reduced budget deficits may in the short run result in increased unemployment, while persistent accumulation of public debt beyond levels deemed sustainable will cause difficulties in adjusting fiscal variables especially through their effects on Gross Domestic Products (GDP).

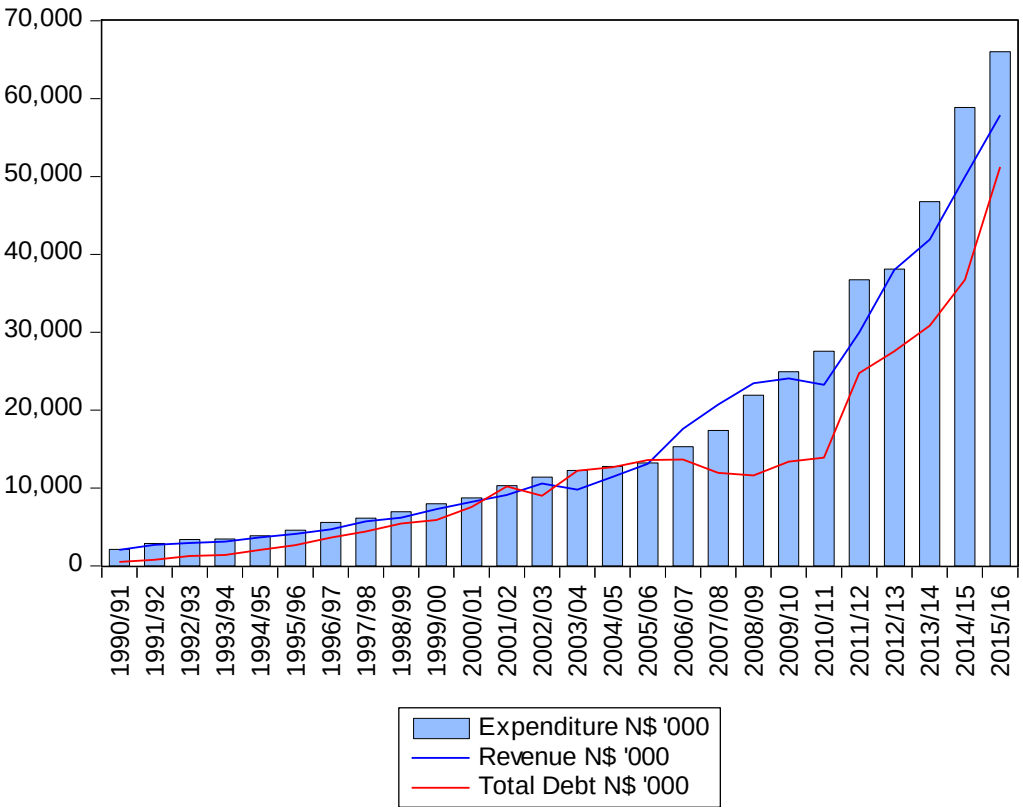
Since independence, Namibia has made efforts to maintain fiscal prudence with the objective of attaining overall macro-economic stability and laying the foundations for sustainable economic development (Ministry of Finance [MOF], 2005). However, the continuing high incidence of unemployment and poverty has required significant levels of spending on social and economic development programmes which has caused more expenditures over revenues, resulting in budget deficits and build-ups of debt (MOF, 2005). This accumulation of public debt has raised concerns about the long-term sustainability of government operations.

In examining the relationship between public debt, government expenditure and revenue, it is significant to understand the major trends and outcomes of the economy through time as they have important implications for the interactions between these variables. For every fiscal year from 1992/93 to 2000/01, expenditure has exceeded revenue and government had to borrow in order to finance budget deficits, revenue as a percentage of GDP decreased from 35.4% in 1992/93 to 34.6% in 2000/01 (Sherbourne et al., 2002). Also, for the fiscal year 2001/02 and beyond, revenue contracted due to a decrease in the Southern African Customs Union (SACU) revenue while expenditure as a percentage of GDP increased from 32.6% in 1994/95 to around 36% in 2000/01 (Sherbourne et al., 2002).

The increase in debt has largely been driven by the need to finance recurring budget deficits which resulted from excess expenditure. At the end of the 2002/03 fiscal year, the public debt stock to GDP ratio reached 25.2%, which was slightly above the 25% debt to GDP ratio benchmark adopted at the time (Zaaruka, Ndove & Tjipe, 2004).

Namibia's domestic debt increased steadily after independence from 10.2 % of GDP at the end of 1992/93 to 24.5 % of GDP in 2003/04 (MOF, 2005). By the end of 2015/2016, total expenditure, total revenue, budget deficit and public debt as a percentage of GDP stood at 43.3%, 35.3%, 8.3 and 40.1% respectively (MOF, 2017a).

Figure 1: The composition of government revenue, government expenditure and public debt in Namibia 1990-2016



Source: Author

Due to Namibia's debt increase exceeding targets, the Namibian government found it essential to formulate a comprehensive debt strategy. In 2005, Namibia developed its first Sovereign Debt Management Strategy (SDMS) with an objective to minimise the cost of government borrowing, consistent with an acceptable degree of risk. This strategy document is intended to serve as an action plan for managing the costs and

risks associated with Namibia's sovereign debt, thus ensuring an effective debt management so that sovereign debt remains affordable and low risk in the future (MOF, 2005). Consequently, the Medium Term Expenditure Framework (MTEF) which supports the debt management strategy through ceilings settings on expenditure on a three year rolling budget was introduced, to encourage fiscal discipline and limit additional borrowing needs.

However, even after the implementation of the SDMS and MTEF, the fiscal variables have been on the raise to date as indicated by the fiscal trend in figure 1. In 2016, Namibia was rated from stable to negative by Moody credit rating due to, amongst other reasons, an increase in budget deficit in 2015/2016 above target and increase in debt stock above its benchmark. (MOF, 2017b). Also, the fiscal policy in Namibia, through its objectives to stimulate employment and investment as well as alleviate poverty, has pressurised the government to increase spending, increase budget deficits and consequently raise central government debt (Zaaruka et al., 2004).

As a result, fiscal sustainability becomes an important aspect for any government, including Namibia. According to Zaaruka et al. (2004), fiscal sustainability is achieved when the ratio of the government debt to GDP is stationary and declining in the long run. This further means that the expenditure for which debt has been incurred should positively contribute to GDP growth, subsequently inducing an equivalent increase in government revenue to service the debt. Consequently, governments can influence both their expenditures and revenues to achieve their macro-economic stability, making it vital for any government, including Namibia to have a thorough fiscal policy for economic development and the maintenance of economic independence.

The increase in the country's debt further raises doubts about whether the government's current fiscal policies are sustainable. As asserted by Zaaruka et al. (2004), Namibia has been experiencing an increasing level of government debt and persistent budget deficit since independence, which has raised concerns regarding the sustainability of the fiscal policy in Namibia. The increases in the budget deficit further imply that the county's revenues have perpetually been insufficient to meet all government expenditures. Also, the fiscal policy in Namibia is aimed at stimulating employment and alleviating poverty through increased government spending and budget deficits which consequently raises central government debt. To achieve fiscal sustainability, it is necessary to understand the relationship between public debt, government expenditure and revenue to discover whether government spending leads to public debt and revenues, or if public debts and revenue are the drivers of spending in Namibia. Therefore, this study addressed the concerns regarding the sustainability of fiscal policy in Namibia by empirically examining the relationship between the aforementioned fiscal variables.

1.2 Statement of the problem

Namibia's public debt has increased faster than the GDP growth rate since independence, (Zaaruka et al., 2004). Also, in terms of the country's adopted benchmark, the government expenditure, budget deficits and public debts should be within the 40%, 5% and 35% of GDP respectively (MOF, 2017a). Despite the government's efforts to introduce the SDMS in 2005 and the MTEF, Namibia has breached its own thresholds. The total expenditure, budget deficit and public debt exceeded the targets by end of 2015/2016 while total government revenue slowed to 35%, failing to keep up with growing public spending public (MOF, 2017a).

According to Sherbourne et al. (2002), the formulation of consistent fiscal policy should consider how revenue, expenditure and debt relate to each other in order to maintain a stable debt to GDP ratio. To our knowledge, there is currently limited research in Namibia intended to address the relationship between public debt, government expenditure and revenue. Based on the raising concerns of fiscal sustainability and increase in debt burdens, expenditure and budget deficits above thresholds in Namibia, it is therefore imperative to examine and understand the underlying dynamics. This research aimed to address both the literature gap and the policy-makers' concerns of fiscal sustainability by investigating the relationship between government expenditure, revenue and public debt.

1.3 Objectives of the study

The main objective of this research was to investigate the relationship between public debt, government expenditure and government revenue in Namibia over the period of 1990 to 2016. To achieve this, the following four specific objectives were addressed:

1. To examine the relationship between government expenditure and public debt;
2. To analyse the relationship between government expenditure and government revenue;
3. To determine the direction of causality between government expenditure and public debt;
4. To determine the direction of causality between government expenditure and government revenue.

1.4 Hypotheses of the study

1. H_0 - There is no relationship between government expenditure and public debt;

   H_1 - There is a relationship between government expenditure and public debt;
2. H_0 - There is no relationship between government expenditure and government revenue;

   H_1 - There is a relationship between government expenditure and government revenue;
3. H_0 - There is no causal relation between government expenditure and public debt;

   H_1 - There is causal relation between government expenditure and public debt;
4. H_0 - There is no causal relation between government expenditure and government revenue;

   H_1 - There is causal relation between government expenditure and government revenue.

1.5 Significance of the study

Over the years, Namibia has been experiencing problems managing its public debt, government expenditure and revenues, making it significant to understand the underlying interrelationships between the relevant fiscal policy variables. Overall, the study will enhance understanding on government finance. The study will further serve as an insight for policy-makers in Namibia to improve both fiscal and debt management strategies to enhance fiscal sustainability and maintainable debt levels. Understanding the relationship between the variables, through the study findings and recommendations, will assist in implementing policies to address expenditure

overspending, insufficient revenue collection and management policies as well as public debt issues. The study will further add value and broaden the area of research in public debt, government expenditure and revenue and significantly benefit other researchers and scholars as a basis for further research and source of reference.

1.6 Limitations of the study

The major limitation of the study is the limited scope, that is, Namibia alone being the subject of study which limits the generalisation of the results. Furthermore, the study only examined the relationship between public debt, government expenditure and government revenue between 1990 and 2016. The study only collected data for 26 years since Namibia gained independence in 1990 and time series data for all variables was only available during this period. Also, the purpose of borrowing, spending and collecting revenue is similar past independence. The availability of empirical literature on the specific subject also served as a minor challenge as only limited sources were available for review.

1.7 Organisation of the study

The study has 5 chapters. This chapter gave brief background on the area of the study in the context of the Namibian economy. Chapter 2 explores all the relevant theoretical and empirical literatures around the relationship between public debt, government expenditure and revenue while the research methodology employed, including the model specification is explained in Chapter 3. The results and their interpretations are presented in Chapter 4 and lastly the findings, policy implications and recommendations of the study are summarised in Chapter 5.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Public debt, government expenditure and government revenue are important areas of study in the field of public finance and economic policy. Moreover, these areas have also gained research attraction over time. The aim of this chapter is to review both theoretical and empirical literatures related to the underlying relationship between public debt, government expenditure and revenue. The first section explores the theories on the variables while the empirical literature section dwells on studies, research methodologies as well as observations made by various researchers globally on the topic. The chapter further concludes by identifying the gaps in the reviewed literatures.

2.2 Theoretical literature

The study reviewed eight theories concerning the relationship between government expenditure, revenue and public debt. These theories include the tax smoothing, theory of public spending, taxation and debt; positive theory of public expenditure (spend-revenue hypothesis); Ricardian Equivalence theory; revenue-spend hypothesis; Lerner's theory of functional finance; classical theory on debt; and lastly, the Keynesian theory on public debt.

Budget deficits and debt accumulations can serve two purposes, namely redistribution of income over time and across generations; as well as a means of minimising the deadweight losses of taxation associated with the provision of public goods and services (Alberto & Guido, 1990). In terms of the *tax smoothing theory* mainly

postulated by Barro (1979), deficits are varied in order to maintain expected constancy in tax rates. The tax smoothing theory assumes that taxes are distorting to the economy due to their effect on labour supply which the government minimises by allocating taxes across time (Barro, 1979). This behaviour implies a positive effect of the debt issue on temporary increases in government spending such as in wartime and a countercyclical response of debt to temporary income movements. The tax smoothing theory further assumes that the government should minimise such distortion by allocating taxes across time. As a result, governments will resort to borrowing when government spending increases (Barro, 1979).

Through this theory, any increase in government spending will cause governments to run budget deficits and resorts to borrowing in order for them to maintain constant tax rates over time. Kok (2010) reinforced that the government should spend just enough to offset the marginal distortions caused by the last dollar of collected tax. The role of public debt is thus to smooth the tax distortions over time implying that the government will issue debt when revenues fall or expenditures rise and when tax revenues drop in the long run, the tax rate should instantaneously rise. Therefore, the government should spend just enough to offset the marginal distortions caused by the last dollar of collected tax (Kok, 2010). It is further argued that tax smoothing also calls for a ban on postponing unpopular policies like raising taxes or cutting expenditures, because this only leads to higher and more unpopular measures afterwards (Kok, 2010). Strazicich (1997), in the study attempting to explore the impact of tax smoothing on the Canadian government further explains that efficient governments are those which resort to unadjusted tax rates as a result of temporary expenditure and revenue changes. Conversely they minimise tax rates changes through tax smoothing, thereby allowing

room for deficits and surplus. Therefore, this theory observes that governments fix rates to minimise the costs of taxation over time.

Supporting the tax smoothing approach through the *theory of public spending, taxation and debt* is Battaglini and Coate (2008). This theory assumes that governments are rather legislature than benevolent decision makers because of their ability to distribute revenues back to their districts via pork-barrel spending (Battaglini & Coate, 2008). The theory of public spending, taxation and debt is preferred over the tax smoothing theory because it allows any government to be in perpetual debt. Furthermore, it provides predictions on the dynamics of legislative policymaking, a mix of public spending between pork and public goods, and a sharp account of how political decision making distorts public policies. Finally, it permits fiscal restraints welfare analysis (Battaglini & Coate, 2008). In general, while the tax smoothing theory predicts that governments use budget surpluses and deficits to safeguard tax rates from changing too sharply, the theory of public spending, taxation and debt mainly guarantees that governments use debt to smooth revenues, in particular taxes allowing any government to accumulate debt.

Another important theory worth noting with regards to the relationship between public debt, government expenditure and government revenue is the *positive theory of public expenditure or displacement effect* mainly propounded by Peacock and Wiseman (1961) as established in a study to determine the effect of the growth of public expenditure in the United Kingdom. Under this theory, government expenditures do not increase continuously but rather in a displacement manner. The period of social disturbances like war requires an increase in government expenditures which current

revenues are unable to meet. As a result, public expenditure is displaced from the old level, resulting in tax rates also increasing in order to sustain the increasing defensive expenditure which never returns to the old level after war. This change is referred to as the displacement effect.

In addition to the displacement effect, Peacock and Wiseman (1961) further elaborated on the inspection and concentration effect. The insufficiency of revenues to meet the increased government expenditures causes an inspection effect, while the fact that the growth rate of government expenditures is faster than the economy, leads to the concentration effect. As further explained by Uguru (2016), the displacement effect is based on the argument that governments pay taxes while providing the needs of public goods that increases in times of social and other disturbances; and which the existing level of revenue is unable to meet. According to this theory, any increase in government expenditure will lead to insufficient existing levels of revenue, causing public debt accumulation. This further assumes a positive relationship between government expenditure, government revenue and public debt. The movement from the initial and low level of expenditure to a new and higher level is known as displacement effect (Uguru, 2016). From the above, it is concluded that the positive theory of public expenditure through the displacement theory also confirms the spend-tax hypothesis.

The displacement further received support from the *Ricardian equivalence theory* by Barro (1974). The theory mainly states that the use of public borrowing or rising of taxes to meet budget deficits does not really matter. And as such, the same positive relationship between government expenditure and government revenue is expected

between government expenditure and public debt. Barro (1974) argues that taxation and public borrowing constitute essentially equivalent forms of financing public expenditures. The government is expected at some future time to redeem its debt which will usually occur through increased future taxation. This, on the basis of the rational expectations hypothesis, means that the individuals will increase their savings through the purchase of bonds issued by the government. Additionally Barro (1974), in terms of this theory argues that the increase in government expenditure leads to increases in taxes, also suggesting the spend-revenue hypothesis. The Ricardian Equivalence theory is also known as the tax discounting theory, because public debt financing of expenditures through reduced taxes leads to increased future taxes equal to the present value of the tax revenue cut. Therefore, today's debt puts a burden on the future generation, because they will be repaid by higher taxes in the future.

However, according to Kok (2010) shifting from tax to bond issues will increase consumption as more disposable income is availed to consumers. This implies that countries can increase consumption by cutting taxes and finance the increase by issuing bonds. Nonetheless, with the Ricardian theory, the above will not make a difference. Kok (2010) further criticises the Ricardian equivalence based on population turnover. Due to a limited lifespan, it is not the same population holding debt and paying taxes, and therefore, the population does not expect to pay the taxes associated with a rise in debt. Also, Ricardian equivalence could be built on the permanent-income hypothesis which implies that consumers will not spend more today after a tax cut, knowing they will be facing higher taxes in the future.

Set against the spend-revenue hypothesis is the *revenue-spend hypothesis* by Friedman (1978) and Buchanan and Wagner (1977). According to this theory, governments will first collect the money raised from taxes before spending it on government operations assuming an unidirectional causality running from government revenue to government expenditure. Friedman (1978) agrees with the revenue-spend hypothesis on certain conditions. Friedman points out that there exists a positive relationship between tax and expenditure; and any tax increases will cause an increase in expenditures. However, this is only because governments are unable to reduce budget deficits. Alternatively, reducing taxes reduces revenues available to finance government operations, forcing governments to borrow. Similarly, Buchanan and Wagner (1977) agree with the revenue-spend hypothesis, but from a negative perspective. They argue that a decrease in taxes will cause government expenditures to increase due to fiscal illusion which results from public perceptions of reduced government activities. The perceptions allow the general public to demand more from the government, increasing government expenditures and budget deficits.

Another contributor to the theories on the fiscal variables is the *Lerner's theory of functional finance* mainly by Lerner (1943) which is based on the principle of judging fiscal measures based on their function in the economy, called the functional finance. This theory suggests that the government should keep the spending rate on expenditure (aggregate demand) within the rate of aggregate supply to avoid inflation or unemployment. To ensure that the required total spending level is achieved, the government can do so through either an expansionary or restrictive fiscal policy. Lerner's theory states that any increase in government expenditure should match the

increase in government revenue. Also, the government should borrow money only if it desires the public to have less money and more government bonds.

Contrary to public debt is the *classical theory of public debt*. The classical theory on debt is drawn from the classical economic theory concept of laissez-faire, which is also known as the free-market theory. Under the laissez- faire concept, the economy is said to be self-regulatory with the market forces of demand and supply and without any government intervention. Given this context, the classical theory of public debt assumes that public debt is detrimental to the economy and bears burdens on the future generations. This theory is championed by the classical economists who shared a common principle with regards to public debt, expenditure and revenue namely Adam Smith (1937) and John Stuart Mill (1976). Among the set of principles is the idea that government expenditures satisfy useful social functions which, in general are inappropriate to be performed by the private sector.

Smith (1937) argues that the accumulation of debt due to budget deficits is considered pernicious for the nation even if all of it is owed to domestic investors, and should therefore be avoided. He further argues that payment of interest on public debt is like the right hand which pays the left because the need to redeem the debt will soon lead to increased taxation, causing the flight of domestic capital and the devaluation of the currency. As a result, Smith (1937) regards debt as a holdback to the nation's progress towards wealth and prosperity, since resources that could be used productively from the private sector of the economy are diverted by the state to finance its unproductive activities. This theory according to Tsoulfidis (2007), proposes that government expenditures financed by taxation and deficits should be justified only in crises such

as wars and natural disasters. It is further argued that the financing of government expenditure through public borrowing decreases the investible product, and therefore becomes detrimental to society's capacity to accumulate wealth.

Lastly supporting the classical theory is Mill (1976) with regards to the equivalence of financing public expenditure. Mill (1976) argues that public debt might not be pernicious to a country especially when financed from foreign savings. This means that there is no crowding out effect when government borrowings absorb domestic savings that would either be invested unproductively or invested in foreign countries. Conversely, public debt will be detrimental when the government competes with the private sector over funds that could be productively invested, resulting in rising interest rates. The increase in interest rates will lead to decreases in private capital, causing a competition between workers, paving way for decreased real wages. According to the classical economists, borrowing to fund public expenditures is detrimental to the economy.

As supported by Tsoulfidis (2007), borrowing diminishes savings ready to be invested productively under the assumption that government expenditures are unproductive. The conclusion drawn is that public borrowing undermines the economy's capacity to accumulate. In the case where these expenditures are necessary, the preferred way of financing them is through taxation. According to this theory, governments should be able to finance all their expenditures with available revenues and any deficit should only be experienced during emergencies such as wars forcing governments to resort to borrowing.

The last theory is the *Keynesian theory on public debt* derived from Keynesian economics, developed by John Maynard Keynes. Contradicting the classical theory of public debt, Keynes (1936) concurs that the growth of any economy can be stimulated by increased government expenditures and lower taxes; and that governments use fiscal policies in times of recessions to improve economic activities. According to this theory, governments would cut taxes and increase expenditure to stimulate aggregate demand in times of depression. Additionally, Keynes (1936) argues that public debt infuses no burden onto the future generations, making government expenditures essential to reduce public debt. Although the Keynesian theory on public debt acknowledged the impact of the crowding out, this theory assumes that an economy would experience full crowding out in times of slacks and a no crowding out in deep recession times (Perry, 2014). As such, governments should not aim to achieve a budget balance as they will have to increase spending and cut on taxes during recession.

The above, according to Perry (2014) is based on arguments that the savings and investment decisions are not only dependent on the rate of interest as stated by the classical theory, because the investment decision is a function of, not only the interest rates, but primarily by expectations of future profit depending on the business cycle fluctuations. Also, a positive multiplier effect, even in times of slacks, can cause increased spending, thus outweighing any loss of investment due to higher interest rates. The latter can have positive effects on investments due to profit expectations (Perry, 2014). Therefore, government spending creates more investment opportunities leading to a crowding in.

2.3 Empirical literature

Public debt, government expenditure and revenue have been attractive areas of research. As such, some of the empirical studies in this area are reviewed below.

Using the OLS regression technique at 5% level of significance, Uguru (2016) explored the relationship between public debt and government expenditure in Nigeria which revealed a significant positive relationship between the variables. Although the study used longer time series from 1980 to 2013, this study only aimed at investigating the relationship between government expenditure and public debt, excluding government revenue. The secondary data was sourced through the central Bank of Nigeria statistical bulletin for various years. The study estimated a model with public debt as the dependent variable, while the capital expenditure and recurrent expenditure were the independent variables. The study recommended the government of Nigeria to reduce its recurrent expenditure and embark more on capital expenditure. Through linking it to the theories reviewed, the study supports the positive theory of public expenditure by Peacock and Wiseman (1961) which assumes that government expenditure and taxes are positively related due to the displacement effect.

Apart from the difference in the countries, a study by Alawneh (2017) differed from that of Uguru (2016) because of the additional variable - government taxes. The study intended to estimate the impact of government expenditure (capital expenditure and current expenditure) and public debt (external and internal) on taxes in Jordan during the period 2001 to 2014. It adopted the multiple linear regression method to study the impact of the independent variables on the dependant variable. The independent variables were represented by capital expenditure, current expenditure and public debt,

with taxes as the dependent variable. The analysis showed statistically significant positive relationships of all expenditures and debts on taxes. The study recommended the public sector to use non-traditional alternatives to finance capital expenditures instead of external public debt and internal sources to finance capital expenditure. However, as the study of Uguru (2016), it is also in line with the positive theory of public and failed to establish any significant causality between the variables and expenditure. Also, the study only considered tax revenues.

Mah, Petersen, Miruka & Petersen (2013) alternatively attempted to determine the impact of government expenditures and government income on government debt in Greece from 1976 to 2011. The study used the vector error correction model framework to estimate the model and the vector auto regression Granger causality to determine the direction of causation. Similarly to the study of Alawneh (2017) and Uguru (2016), the study also discovered a significant positive relationship between gross government debt and gross national expenditure but a negative relationship between gross government debt and gross national income, with causality running from gross national government expenditure and gross national income to government debt. This implied that the past values of gross national expenditure and gross national income have a predictive ability in determining the present value of gross government debt and not vice versa. This causes policy-makers to revisit their fiscal policy in order to reduce and sustain its debt.

Oladokun (2015) empirically examined the causal relationship between public expenditure and national debt using time series data. Similarly to the study of Uguru (2016), the study was also based in Nigeria using longer time series from 1981 to 2012.

However, the study further tested for causality between the variables, setting it apart. The model of the study was specified following the Solow's growth model. The E-view statistical software was used to process the data while the Granger causality test was employed to test the relationship. According to the study, public expenditure in Nigeria is financed majorly by domestic debt, while external debt is not significant in the development of infrastructural facilities. The results found that public expenditure Granger causes domestic debt. The study further suggested government expenditure to be wisely spent in order to make the country more productive and achieve meaningful development. Further reviews on various literatures and existing works regarding the effect of federal government expenditure and total external debt outstanding on the productivity and economic growth in the country, were conducted extensively.

Similarly, Idenyi, Ogonna & Ifeyinwa (2016) investigated the causal relationship between total public debt and public expenditure in Nigeria from 1980 to 2015. The study aimed to determine if government borrowings in Nigeria were based on the need to provide social services and infrastructure as provided in the budget or merely because of privileged access to financial institutions both domestically and internationally. The study applied cointegration, vector error correction model and Wald test econometric tools of analysis to public debt, government capital expenditure, and government recurrent expenditure and interest rate variables. The trace statistics in the study indicated two cointegration equations at five percent (5%) level of significance, suggesting that there is a long-run relationship among the variables tested. The findings of the test indicated that government capital and recurrent expenditure has a significant positive relationship with public debt confirming the

positive theory of public expenditure in Nigeria, while the Wald test results showed a unidirectional causality running from both expenditures to public debt. These findings are in line with the findings of Oladokun (2015) who examined the causal relationship between public expenditure and national debt. This implies that government borrowing in Nigeria is triggered by government deficit budgeting, which makes it necessary for the government to re-examine the budgeting process.

In another Nigeria study on the determinants of government expenditure growth, Okafor and Eiya (2011) aimed to ascertain the growth in government expenditure and factors responsible for such growth through an empirical analysis. Although the study examined four determinants of public expenditure growth which included public debt and tax revenue with inflation and population as additional variables, the study also failed to test for causality as Uguru (2016) and Alawneh (2017). The data was analysed through the OLS regression method to the data from 1999 to 2008. The data revealed a positive relationship between public debt and government expenditure and revenue. The study recommended that the fiscal responsibility bill should always be passed into law on time to reduce budget deficit and public debt and their effect on the economy.

The global consistently increasing government expenditures further led to concerns of understanding the reasons for such growth by public sector economists and authors like Ukwueze (2015), who studied the determinants of government expenditures in Nigeria from 1961 to 2012. The study employed the short-run ECM and long-run static equation in order to compare the influence of the variables on the size of government spending. The long-run static equation served as a test to compare short-run dynamics with the long-run relationships. The OLS estimation technique was used in the study.

The results of this study further showed that the size of revenue significantly influenced the size of public expenditure, both in the short run and long run. Total debts significantly influenced the size of government expenditure only in the short run. The study therefore recommended that the revenue base should be expanded and debt accumulation should be reduced and used for stabilisation only in the short run. It was also concluded that revenue boost public spending, while public debts might be counterproductive. Although the study merely used the OLS as an estimating technique and also failed to determine the causality between the variables, it considered a broader time series range and took into consideration all variables currently under study. Both studies by Ukwueze (2015) and Okafor and Eiya (2011) are in line with the Ricardian equivalent theory. This implies that both taxes and borrowings constitute essential equivalent forms of financing public expenditures in Nigeria.

Kaur, Mukherjee, Kumar and Ekka (2017) used a different approach in the analysis of debt sustainability in India. The study was based on empirical estimation of inter-temporal budget constraint and fiscal policy response function in a panel data framework, covering 20 Indian states for the period 1980/81 to 2015/16. The debt sustainability of state governments in India was assessed through indicator-based analysis as well as empirical exercises. The estimation results revealed the existence of a cointegrating relationship between government revenues and expenditure in India. Moreover, the estimated fiscal policy response function showed that the primary balance position of Indian states responds in a stabilising manner to the increases in debt. Thus, both the results indicate that the current debt situation at the state level is sustainable in the long run.

Kanano (2006) on the other hand also examined the determinants of public expenditure growth in Kenya using the time series data analysis technique for the period 1980 to 2004. The study intended to analyse government budgetary resource composition and examine the impact of the government budgetary resources on public expenditure growth. The determinants of the public expenditure growth model were estimated by the OLS method. The findings indicated a positive relationship between internal debt and public expenditure and a negative relationship between external debt financing and public expenditure, thus an indication of debt overhang hypothesis in Kenya. A strong positive relationship between government revenue and public expenditure was also revealed. The findings noted the importance of governments to avoid over-reliance on internal borrowing for financing public expenditure, as this has detrimental effects on economic growth due to crowding out of the private sector.

Due to substantial amounts of debt relief granted to a set of low-income countries, as an alternative aid modality, Cassimon and Campenhout (2007) analysed the aid effectiveness, debt relief and public finance response from a panel of 28 high indebted poor countries from 1991 to 2004. The study used recent advances in the fiscal response literature to study the impact of aid on fiscal variables in a vector autoregressive framework. The study investigated the linkages between debt relief and other fiscal variables such as current expenditure, government investment, taxation and domestic borrowing, in comparison to the effects of grants and concessional loans. It was found that the fiscal impact of highly indebted poor countries' debt relief reduces government investment, but the effect becomes positive after two years, well outperforming other modes of aid delivery. The empirical

research also discovered that an increase in debt relief leads to an increase in domestic government revenue collection. Also, debt relief seems to have a negative effect on the foreign component of the recipient country's revenues. Also, countries that receive debt relief are able to significantly reduce their external borrowing in the next year, which provides support for the defensive lending hypothesis.

Further expanding the literature on the variables is Kiminyei (2014), who focused on public debt, tax revenue and government expenditure in Kenya over 1960 to 2012 using the vector error correction model with correlation analysis as the data analysis tool. The study used the present value borrowing constraint to explore the relationship between the variables through a collection of annual time series data. The data from the Kenya economic surveys for total public debt, tax revenue and government expenditure was converted into their respective real values and converted from fiscal years to calendar years by splicing. Augmented Dickey-Fuller and Philips-Perron unit root tests were employed to establish the stationary properties of the series while the Johansen cointegration technique was used to determine presence of linear long-run economic relationships in the series. The study found that public debt responds to both tax revenue and government expenditure, particularly in the long run with a strong positive correlation between public debt, tax revenue and government expenditure and all correlation coefficients being statistically significant. Although based on an identical country, the study results vary slightly from those of Kanano (2006) who examined the determinants of public expenditure growth.

Alternatively, Achieng (2012) also carried out a study to determine the relationship between budget deficit and domestic debt for twenty years from 1991 to 2010 in Kenya

with domestic debt, government expenditure, and government revenue as well as budget deficit as the variables. Secondary data collected from quarterly budget economic reviews reports of the Ministry of finance, and time series reports of central Bank of Kenya was used in multiple regression analysis to investigate the relationship between the dependent and independent variables. The scatter plot analysis and bivariate correlation analysis tests were run. Both tests confirmed a linear relationship between dependent and independent variables as well as tolerable collinear relationships between independent variables. A positive relationship between the budget deficit, government expenditure, government revenue and domestic debt was found. Further, a negative relationship between inflation rates, interest rates and domestic debt was also found. Although the study's methodology differed from that of Kiminyei (2014) and Kanano (2006) also in Kenya, the findings would conform.

Shahateet, Al-Habashneh and Al-Majali (2014) examined the relationship between budget deficit and external public debt in Jordan during 1992 to 2012, testing for the existence and direction between the variables. The study provided evidence of no causality running from budget deficit to external debt or the other way round, implying that external debt is not caused by budget deficit but by other factors related to economic growth and, more likely, political factors. Also, cointegration test supports the absence of long-run relationship. This implies that fiscal decision makers may disregard external debt when setting budget constrains including taxes and non-interest spending. Additionally, budget constraints must rely on more important factors than external debt - factors such as good governance, tax reforms and lowering of government spending on certain economic activities that have little significance on total output. Saima and Uddin (2017) found converse results compared to Shahateet,

Al-Habashneh and Al-Majali (2014) with regards to the Granger causality between the budget deficit and public debt. In their study attempting to explore the relationship between budget deficit and public debt in Bangladesh over the period 1995 to 2015. They further employed the Johansen cointegration techniques to visualise the long-run relationship between the two variables and the vector error correction model to evaluate the short-run properties of the cointegrated series. The study found the presence of long-run equilibrium relationships between the two variables. The vector error correction model also provided evidence that there existed an unidirectional causality running from public debt to budget deficit but not the other way round. This implied that the budget deficit was not responsible for public debt, but public debt caused budget deficit, due to payment of interest as well as principal of debt in every year.

With a study only confined to analysing the fiscal deficit and public debt of the central government of India, Sukanya (2016) attempted analysing the trends in the volume of fiscal deficit and public debt during the period 2001 to 2017 and highlighted their implications. The study found that any excess of annual government budgeted expenditure over the total non-debt revenue resulted in fiscal budget deficit which was financed through public borrowing, either internally or externally. The study concluded that public borrowing and deficit financing, however, may have certain adverse implications for the fiscal credibility of the government and for the economy through the inflationary effects of the policy. Public borrowing and deficit financing were not always bad; and had a role in generating internal resources for capital formation and financing of developmental expenditure in the economy. It also acts as a countercyclical fiscal policy tool for bringing about economic recovery, through

compensatory public expenditure of an economically depressed economy. It is however, necessary to ensure that fiscal deficit of the government is kept within manageable limits, and public borrowing as well as its servicing is managed carefully, to minimise the impact of public debt on the financial credibility of the government.

Building onto the sustainability of public debt and ability for any government to maintain debt is a differently approached study investigating the dynamics of public debt and the appropriate measures required for achieving fiscal consolidation in Greek by Apergisa and Coorayb (2015). The empirical estimation of the study was carried out using macroeconomic data set spanning the period 1980 to 2008. The study used two econometric methodological approaches, namely the three-stage lease square technique on a theoretical model and the structural vector autoregressive methodology to perform forecast tests and calibrate the future paths of the public debt variable up to 2020. The results suggested that only a restrictive fiscal policy could permit the country to achieve debt sustainability and that debt sustainability could be achieved faster when tax revenue policies were intensified. The results of the study revealed important implications for policy-makers in designing effective macroeconomic policy to achieve sustainable levels of public debt.

The importance of sustainability further led to studies on relationships between government expenditure and government revenue. First to confirm the presence of both the revenue- spend and spend- revenue hypotheses in Iran is a study by Elyasi and Rahimi (2012) to determine the causal relationship between government revenue and government expenditure. The study used annual time series data over the period 1963 to 2007. The purpose of the study was to investigate the relationship between the

variables by applying the bounds testing approach to cointegration. The results of the causality test showed a bidirectional causal relationship between government expenditure and revenues in both the long and short run. The policy implication of results suggested that the government makes its expenditures and revenues decision simultaneously. Under this hypothesis, the fiscal authorities of Iran should try to increase revenues and decrease expenditure simultaneously to control the budget deficits.

A study in Iraq by Keivani (2013) only focused on identifying the main determinant of government expenditure without ascertaining on the causal relationship. By means of an OLS method to estimate the linear regression and relationship between the variables, the study found the oil revenue to be one of the main determinant of government expenditure in the long run using the government revenues and current expenditures covering data from 1986 to 2010. The research used the annual time series data from the website of central bank and applied the. The study further used the E-views 8 and the Statistical package for Social Science (SPSS) software for data analysis.

Using the ECM and stepwise Granger causality technique, Ghartey (2010) examined the long-run and short-term causal relationships between taxes and spending, to determine the effective way of reducing deficit and debt problems in four Caribbean countries namely Belize, Bahamas, Barbados and Jamaica. Unlike the study of Keivani (2013) in Iraq, the study applied the Granger causality test. The causality test confirmed that taxes cause spending for Belize, while the variables were found to be independent of each other for the rest of the countries. The estimates of the ECM

showed a long-run bidirectional causation in the Bahamas, Barbados and Belize, and no causality in Jamaica. Tax limitation was found to be the optimal policy for controlling deficit and debt problems over the short term for Belize, while the Bahamas, Barbados and Belize were found to be flexible in balancing their budget in the long run, due to ruling parties' budgetary controls and tax initiatives. In Jamaica, taxes and spending were found independent although all variables were controlled by the minister of finance.

In contradiction with Elyasi and Rahimi (2012) who confirmed both hypotheses in Iran, Eita and Mbazima (2008) attempted to investigate the causal relationship between government revenue and government expenditure in Namibia using Granger causality test through cointegrated vector auto regression methods for the period 1977 to 2007. The authors noted the importance of the relationship between government revenue and government expenditure, given its relevance for policy, especially with respect to the budget deficit. The study aimed at finding out whether government revenue caused government expenditure or whether the causality ran from government expenditure to government revenue. Instead, an unidirectional causality from government revenue to government expenditure was found resulting to a revenue-spend hypothesis for Namibia. It further suggested that unsustainable fiscal imbalances (deficit) could be mitigated by policies that stimulated government revenue.

Similarly, Ogujiuba and Abraham (2012) also found that revenue and expenditure were highly correlated in Nigeria, with causality also running from revenue to expenditure. Correlation analysis, Granger causality test, regression analysis, lag regression model, vector error correction model and impulse response analysis were

the techniques used for the analysis. The vector error correction model confirmed a significant long-run relationship between revenue and expenditure, implying that any disequilibrium in expenditure could be corrected in the long run through policies that adjusted oil and non-oil sector revenues. The lagged regression model showed that the positive relationship between revenue and expenditure reverted to negative at lag five, thereby justifying the need to use medium term expenditure framework to monitor expenditure patterns in the short to medium term.

The issue of potential links between government revenue and government expenditure also received attention from Taha and Loganathan (2008) who also found a bidirectional Granger causality running from direct tax revenues and indirect tax revenues to government spending for the sample period 1970 to 2006 in Malaysia. These findings indicated that a reduction of direct and indirect tax rates may lead to a fall in government spending in the future with non-tax revenues being a less important contributor to the effectiveness of a country's growth. This further confirms the presence of both the revenue- spend and spend- revenue hypothesis in Malaysia implying that any changes in government spending may lead to the changes in both tax revenue and vice versa. These results are in line with the findings by Elyasi and Rahimi (2012).

Another study, although in Nigeria revealed contradicting results to those of Ogujiuba and Abraham (2012). Abdulrasheed (2017) established the causality between government expenditure and government revenue with an updated annual time series analysis between 1986 and 2015, obtained from Statistical data bulletins and annual reports of central Bank of Nigeria. The study evaluated the variables, such as total

revenue and aggregate public expenditure of the federal government through cointegration statistical method and vector autoregressive techniques, comprising an ECM and Augmented Dickey-Fuller analysis. The findings showed the presence of the spend-revenue theory, indicating that changes in government expenditure triggered changes in government revenue. The cointegration tests also revealed that there was existence of long-run equilibrium relationships between government revenue and expenditure variables. The outcome of this study showed that an increase in government expenditure without a simultaneous increase in revenue could broaden the budget deficit.

Saungweme (2013) also found opposing results in the Zimbabwean government study over the period from 1975 to 2004. Using both bivariate and multivariate Granger causality models to test the tax-spend hypothesis, government expenditure was found to cause revenue; and a stable long-term relationship between total government expenditure and total revenue was found, unidirectionally running from government spending to revenue.

To tackle the problem of the fiscal deficit burden in Serbia, Luković, and Grbić (2014) studied the causal relationship between government revenue and government expenditure using quarterly data for the 2003 (Q1) to 2012 (Q4) period. The Toda-Yamamoto long-run non-causality method was used to determine whether the causal relationship between government revenue and government expenditure exists. Similarly to Saungweme (2013) and Abdulrasheed (2017), the study findings also confirm the existence of an unidirectional causality running from government

expenditure to government revenue, implying that government expenditure granger-causes government revenue.

Lastly, using a different approach, Maddah and Farahati (2014) attempted to investigate fiscal illusion in Iran by estimating two symmetric and asymmetric error correction models using quarterly data for the period 2001 to 2012. The Wald test in symmetric model found a negative causal relationship between real tax revenues and real government expenditures, confirming the presence of a fiscal illusion in the Iranian economy. Moreover, the results obtained from the asymmetric model showed that there was merely fiscal illusion in the case of tax revenues reduction and no Granger causal relationship for the positive changes of tax revenues. The study results indicated that, by a decline in tax revenues, government expenditures increased after a year, due to fiscal illusion. As such, the study recommended raising taxes as an efficient instrument to resolve the government's budget deficit.

2.4 Conclusion

Most of the existing literatures available on the relationship between public debt, government expenditure and revenue have revealed mixed results, as both government expenditure and revenue can influence public debt, either positively or negatively. From the above empirical findings, the relationships between the variables remain uncertain making it difficult to draw a conclusion regarding the relationship between the macroeconomic variables; and to generalise such relationships to Namibia. Furthermore, the causality relationship can run from both sides in different periods and nations whether developing or developed. As a result, the present study attempts to investigate such a relationship in Namibia.

The theories which attempted to confirm the relationship between government revenue, expenditure and public debt have conflicting views. They reveal the importance of constant tax rates due to their distortion nature to the economy under the tax smoothing theory. Public debt is also a strategic variable used by individual policy-makers. However, public debt is viewed as detrimental to the economy under the classical theory, while the Keynesian argues that borrowing increases expenditure and reduces tax stimulate the economy. Some theories assume that causality runs from revenue to spending, while others urge that government spending increases or decreases government revenue, such as the displacement effect. The reviewed empirical literature concurred with the rising of concern in the areas of public debt, government expenditure and revenues.

Although there has been numerous studies on the individual research variables, studies on the relationship between public debt, government expenditure and revenue remain limited globally, and most especially in Namibia. Also, most the studies either focused on the relationship of domestic or external debt alone and on tax revenue, instead of the total government revenue. Overall, most studies mainly focused on establishing the relationship between government expenditure and revenue. As a result, this study tends to differ through its attempt to establish the relationship between the total government expenditure, total government revenue and total public debt, making it one of the very few studies in Namibia.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

In the previous chapter, the literature reviewed on the relationship between government expenditure, government revenue and public debt revealed that the relationship can run either way. In this chapter, the various tools needed to gather the relevant information on the relationship between the variables are outlined. Firstly, the research design that informed the research is discussed, followed by a description of the data sources and type, procedure used to collect the data, analysis technique, model specification, estimation procedures and finally, the ethical consideration.

3.1 Research design

The study employed a quantitative research design of time series analysis. This design is appropriate as it enabled the researcher to quantify the relationship between the government expenditure, revenue and public debt through a multiple regression analysis; and determine the causality between variables through granger causality testing. The quantitative design is therefore the most appropriate because it allows the researcher to determine impact of the underlying relationship, as well as the causal directions.

3.2 Data sources and description

The study made use of time series secondary data. The government financial operations actual data on public debt, government expenditure and revenue for the period of 1990 to 2016 was sourced from the MOF annual budget reports. Other sources such as the World Bank data portal contained no relevant data related to central

government debts for the years under study, while the International Monetary Fund (IMF) had incomplete data with regards to public debt. As such, the study restrained from using the original source of data from MOF as all data pertaining to the study variables was readily available over the same fiscal periods.

3.3 Model specification

The main objective of the study was to investigate the relationship between public debts, government expenditure and government revenue in Namibia. The study adapted a similar multiple linear regression method to that of Abdulrasheed (2017) with public debt as an additional variable, as well as that used in the study for Uguru (2016) in testing the relationship between government tax, government expenditure and public debt from the reviewed literature. The regression analysis was done to analyse the relationship between the dependent and independent variables. As a result, the basic model of this study is presented as follow:

$$GVTEX_t = \int (PD_t, GVTRV_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

GVTEX= Government expenditure (total operational and development expenditure)

PD= Total public debt (domestic and external debt)

GVTRV= Government Revenue (tax revenue, non-tax revenue and grants)

In order to determine the relationship between the variables, the multiple regression model is expressed below:

$$GVTEX_t = \alpha + \beta_1 PD_t + \beta_2 GVTRV_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

In the above model, GVTEX is the dependent variable whereas PD and GVTRV are the independent variables. β_1, & β_2 are regression parameters. α is the constant while ε is the stochastic error term. Each β's indicates how on average, a unit change in the independent variable affects the dependent variable. To solve the problem of autocorrelation, the raw data was transformed into logarithms forms. The regression equation expressed in natural logarithms is as follows:

$$LnGVTEX_t = \alpha + \beta_1 LnPD_t + \beta_2 LnGVTRV_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

3.4 Data procedure and analysis

The E-views "Econometric views" statistical software package was used to analyse the data and estimate the regression. Time series properties (unit root and cointegration) of the data are first examined to determine the best fitting model. A descriptive statistics analysis on the mean, median, standard deviations as well as the minimum and maximum values was further performed to describe the nature of the time series data. The empirical estimation of the parameters was done within a framework of classical linear regression model (CLRM) using the OLS technique. Granger causality was further employed to examine the direction of causality between public debt, government revenue and government expenditure.

3.4.1 Stationarity test

Testing for stationarity is an important aspect as time series data are regarded as non-stationary in nature. Mahadeva and Robinson (2004) indicate that many economics theories posit causal relationship between economics variables that increase over time and such variables are non-stationary. Furthermore, the use of regression techniques,

such as the straight forward OLS with trending or non-stationary data, can lead to the problem of spurious results (Gaomab, 1998). A time series data is said to be stationary if the mean and variance are constant through time; and the value of the covariance between the two time periods depends only on the distance or lag between the two periods and the actual time at which the covariance is computed (Gujarati, 2004).

In order to avoid spurious result problems, stationarity test to check the existence of a unit root was firstly examined. Literature provides numerous unit root testing tools, however, the study made use of the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) procedures in testing for unit roots, due to their advantages. The two methods are simple and popular in time series studies (Love & Chandra, 2004). Also, an agreement in results for both test yields much more reliable results compared to when only one test is performed. The null hypothesis that the series are non-stationary (i.e. has a unit root) was tested against the alternative that they are stationary.

3.4.2 Cointegration test

Once the unit root tests results confirm the non-stationarity of variables at levels, cointegration analysis was considered. In time series studies, cointegration implies the existence of long-run equilibrium relationship among the variables that have been incorporated in a model (Gujarati 2004). With cointegration, the short-run and long-run relationship among variables can be separated and used to improve long-run forecast accuracy (Gujarati, 2004). Cointegration is also important, due to its ability to improve the accuracy of long-run forecasts as well as to separate short and long-run relationships among variables (Shifotoka, 2015).

Hence, the study tested for cointegration to determine whether public debt, government expenditure and government revenue do converge in the long run and whether an empirically meaningful relationship exists. Cointegration can be tested by two tests namely, the Engle and Granger and Johansen cointegration tests. Although the Engle and Granger test is advantaged for its simplicity to test for the existence of long-run equilibrium relationships, the Johansen approach is also favourable. As a result, the study used both the Johansen and Engle and Granger cointegration tests.

3.4.2.1 Johansen cointegration

Due to its ability to test multiple variables, the study employed the Johansen cointegration method to test for the existence of cointegrating relations among the variables in the model. The two Johansen tests namely, the trace test and maximum eigen value test were used. The trace test tests for joint hypothesis while the maximum eigen value test focuses on individual eigenvalues. The study tested for the hypothesis that there are at most "r" cointegrating equations, where "r" is the number of cointegrated equations under the null hypothesis. The null hypothesis is rejected if the probability value (p-value) under both trace and maximum eigenvalue tests are less than 5% (0.05) significance level and the statistics for both tests are greater than the critical value at 5% level of significance, concluding that the variables are cointegrated.

In order to measure the existence of long-run relationships amongst the variables using the Johansen technique, the optimal lag length was determined. Gonzalo and Pitarakis (2002) state that the appropriate lag length must be determined by allowing a different lag length for each equation at each time and choosing the model with the lowest

Akaike Information Criterion (AIC) or Schwarz Information Criterion (SC) values and that which is selected by most criteria. If the lag length is too small, the model will be misspecified, if it is too large, the degrees of freedom will be lost. Hence, it is vital to determine the optimal lags length to avoid multicollinearity, serial correlation in the error terms and misspecification errors.

3.4.2.2 Engle and Granger cointegration

The Engle and Granger test used the long-run relationship for the log transformed variables as indicated equation 3. Cointegration is confirmed by testing the stationarity of the residuals from the cointegration regression (Engle & Granger, 1987). Therefore, the residuals (Ut) obtained from OLS multiple regression between LnGVTEX, LnPD and LnGVTRV (equation 3) are saved and further tested through the ADF tests for a unit root.

3.4.3 Error correction model

For this study, the short-run ECM to estimate the speed at which the disequilibrium in the model is corrected was specified, indicating the changes in the dependant variable as a function of the disequilibrium error and the changes in the independent variables. The error correction model is specified below:

$$\Delta LnGVTEX_t = \alpha + \beta_1 \Delta LnPD_t + \beta_2 \Delta LnGVTRV_t + \beta_3 U_{t-1} + V_t \ \ldots\ldots\ldots\ldots \ (4)$$

Where α is the constant, ΔLnGVTEX, ΔLnPD and ΔLnGVTRV are the differenced log variables for government expenditure, public debt and government revenue respectively. β_1 and β_2 are the short-run coefficients, U is the residual of the regression model, while U_{t-1} is the one period lagged residual of equation (4) or the

disequilibrium corrector. The coefficient of the U_{t-1} in this case β_3, measures the speed or rate at which the ECT adjusts the previous period disequilibrium and the sign of the residual lag must be negative and significant to indicate a long-run equilibrium relationship. The V_t is the white noise error term.

The Granger representation theory states that, if two variables X and Y are cointergrated, they can be expressed as an ECM. The great advantage of using the ECM is the possibility of modelling both the short and long run relationships jointly provided the variables are cointegrated. After confirming the presence of cointergration through the Johansen and Eagle and Granger procedures discussed above, the study further estimated the short-run error correction model. The coefficient in the ECM estimates the percentage speed at which the dependent variable returned to equilibrium after a change in the independent variables, i.e. the speed of adjustment (Banerjee, Donaldo, Galbraith & Hendry, 1993). This model combines both the short and long run relationships of variables under a single equation. Furthermore, the ECM treats the error correction term (ECT) as the equilibrating error term that corrects the deviations of variables from their equilibrating values given by the cointegrating regression, since the previous period deviations from the long-run equilibrium may influence short-run dynamics. The greater the coefficient of the ECT, the faster the speed of adjustment of the model from the short run to the long run (Granger, 1969).

As a result, it becomes significant to determine whether the long-run relationship established in the regression equation (3) will still hold, considering the short-run disturbances.

3.4.4 Granger causality

Since the dependence of one variable on other variables does not necessarily imply causation (Gujarati, 2004), Granger causality was further employed to examine the direction of causality between the variables. The Granger causality test is a technique for determining whether one time series is significant in forecasting another (Ray, 2012). The study conducted a causality test to determine the causal relationship between government spending and public debt, as well as between government revenue and government expenditure. Granger (1969) is of the opinion that Y "Granger causes" X if X is only best predicted by using the lag values of Y on assumptions that the future cannot cause the past, but the past can cause the present or the future; and that a cause contains unique information about an effect not available anywhere else.

There are three cases of causality, namely unidirectional causality whereby causality runs from either one variable to another, bidirectional causality of which all variables are mutually reinforcing and lastly independence, by which there is no causality between the variables. Based on the above, the study will employ the pair-wise Granger causality test as proposed by Granger (1969) to test the causal relationship between the public debt (PD), government expenditure (GVTEX) and government revenue (GVTRV). The test determines whether the causality runs from GVTEX to PD or rather from PD to GVTEX, implying an unidirectional causality; whether both the PD and GVTEX simultaneously Granger cause each other, implying a bidirectional causality; or whether the causality between PD and GVTEX is non-existent. Similarly, the test also determines whether the causality runs from GVTRV to GVTEX, or rather

from GVTEX to GVREV; or if both GVTEX and GVTRV mutually cause each other and lastly; whether there is no causality between GVTEX and GVTRV.

A simple Granger causality test involving the variables, government expenditure and public debt is written in equations 5 and 6, while that involving government expenditure and government revenue is written in equation 7 and 8 as:

$$LnPD_t = \sum_{i=1}^{n} \lambda_i \ LnPD_{t-i} + \sum_{j=1}^{n} \delta_j \, LnGVTEX_{t-j} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (5)$$

$$LnGVTEX_t = \sum_{i=1}^{n} \alpha_i \ LnPD_{t-i} + \sum_{j=1}^{n} \beta_j \, LnGVTEX_{t-j} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots \ (6)$$

$$LnGVTRV_t = \sum_{i=1}^{n} \lambda_i \ LnGVTRV_{t-i} + \sum_{j=1}^{n} \delta_j \, LnGVTEX_{t-j} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots \ (7)$$

$$LnGVTEX_t = \sum_{i=1}^{n} \alpha_i \ LnGVTRV_{t-i} + \sum_{j=1}^{n} \beta_j \, LnGVTEX_{t-j} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots \ (8)$$

where LnGVTEX refers to government expenditure and LnPD and LnGVTRV refer to public debt and government revenue respectively. Also, ε_{1t} and ε_{2t} are the stochastic error terms that are not correlated with each other; and α_i, β_j, λ_i, δ_j are the coefficients of the variables. From the above equations, the null hypotheses to be tested are then: H_0: $\sum_{i=1}^{n} \alpha_i = 0$ for i = 1… n, which implies that LnPD does not Granger cause LnGVTEX and that LnGVTRV does not Granger cause LnGVTEX; and $\sum_{j=1}^{n} \delta_j = 0$ for j = 1… n, implying that LnGVTEX does not Granger cause LnPD and that LnGVTEX does not Granger cause LnGVTRV. If none of the hypotheses are rejected, it means that LnPD does not Granger cause LnGVTEX nor does LnGVTEX Granger cause LnPD, implying that the two variables are independent of each other. Rejecting the first hypothesis while accepting the second hypothesis shows that LnPD Granger causes LnGVTEX, but LnGVTEX does not Granger cause LnPD. Similarly, accepting the first hypothesis while rejecting the second hypothesis indicates that the causality

runs from LnGVTEX to LnPD. Lastly, if all the hypotheses in the above equations are simultaneously rejected, there is bidirectional causality between the two variables. The above interpretations will apply with regards to causality between government expenditure and government revenue.

3.4.5 Diagnostic tests

A number of diagnostic tests was administered in the study to ensure that the estimates are robust. These tests involved testing for heteroscedasticity, autocorrelation and normality in the model. The white heteroscedasticity test was performed under the null hypothesis that there is no heteroscedasticity with the decision criteria of rejecting the null hypothesis, if the calculated F-statistic is greater than the critical F-statistic. The autocorrelation test, which tests for the inconsistency of the error term used the Breusch-Godfrey serial correlation LM test to test the null hypothesis that there is no serial correlation. As part of the diagnostic tests, the study also performed a normality test to ensure that the model used in the study is normally distributed, where the null hypothesis of normality was tested against the alternative of no normality as well as a stability test to ensure the model's suitability for analysis. The model is stable when the blue line is located within two red lines.

3.5 Research ethics

According to Saunders, Lewis and Thornhil (2009), concerns about the ethics of research practice have grown dramatically and researchers, whether using secondary data or collecting primary data, have to carefully consider all possible ethical issues that could arise, including gaining access to information to undertake the research.

Welman, Kruger and Mitchell (2005) further attest that ethical behaviour is important in research, as in any other field of human activity and involves issues of honesty and respect for the rights of individuals.

Although the study was based on secondary data, the researcher observed research ethics. A letter granting permission to conduct the research was firstly obtained by the researcher from the Namibia Business School. Thereafter, the letter was presented to the Ministry of Finance from which the data relating to the variables was obtained to acknowledge informed consent. Although the Ministry of Finance acts as a custodian for civilians, making all information relating to the variables available to the general public, the data obtained was also treated with all due diligence and for research purposes only. Additionally, all staff within the departments from which the budget reports were collected were kept anonymous and the researcher ensured that the data was relevant and adequate in achieving all research objectives and to the benefit of the organisation and the country at large.

3.6 Conclusion

This chapter covered the methodology employed in this research. The research design was described as a quantitative research design of time series data. This chapter also described the data source and procedure used in collecting and analysing the data. Lastly, the chapter highlighted the methods used to analyse the data and the need for ethical consideration.

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Introduction

The previous chapter described the methodology and estimation models of the study. This chapter presents and discusses the empirical results and findings of the study. The time series data for the period 1990 to 2016 was analysed using E-views 10. The results with interpretations from the descriptive statistics, ADF and PP unit root tests, optimal lag length, cointegration tests, ECM model estimation, and various diagnostic tests including stability, are presented. The chapter concludes with the Granger causality tests indicating the direction of causality between the variables

4.2 Descriptive statistics analysis

The time series consisted of 26 observations from 1990 to 2016 for public debt, government expenditure and government revenue. The studies commenced by generating the time series descriptive statistics for all individual variables. The descriptive statistics were performed on the raw data before log form transformation. Table 4.1 below shows the series descriptive statistics in billions of Namibian dollars.

Table 4.1: Description statistics in billions of Namibian dollars

	GVTEX	GVTRV	PD
Mean	18034.03	16583.59	12638.15
Median	11821.95	10164.85	10905.09
Maximum	65996.03	57844.84	51212.00
Minimum	2103.400	2031.700	501.0070
Std. Dev.	17659.53	15568.84	12367.06
Skewness	1.412733	1.248352	1.548211
Kurtosis	4.024651	3.589005	5.060806
Jarque-Bera	9.785930	7.128829	14.98765
Probability	0.007499	0.028314	0.000557

Sum	468884.8	431173.4	328592.0
Sum Sq. Dev.	7.80E+09	6.06E+09	3.82E+09
Observations	26	26	26

Source: Author

As indicated in table 4.1 above, the study considered 26 positive observations for all variables. On average, GVTEX, GVTRV and PD are N$ 18 034.03, N$ 16 583.29 and N$ 12 638.15 billion respectively. The values for GVTEX and GVTRV remain higher than PD over the years with a lead from government expenditure which ranges from N$ 2 103.40 to N$ 65 996.03 billion, government revenue from N$ 2 031 to N$ 57 844.84 billion while the values of the public debt are between N$ 501 and N$ 21 212.00 billion.

The highest amount of government expenditure, government revenue and public debt are observed in the 2015/2016 financial year whereas the lowest values of all variables are observed in the 1990/1991 financial year. This implies that all variables have been on the rise since independence. Overall, government expenditure remains higher in magnitude than the rest of the variables, implying that the Namibia government has been experiencing a budget deficit over the years, while public debt remains lower than the other variables throughout the years. The standard deviations indicating how far the observations are from the sample mean of GVTEX, GVTRV and PD are 17 659.53, 15 568.84 and 12 367.06 respectively. All the standard deviations for the variables are below their respective means, implying a lower variance. The standard deviation lower that the means also further implies that the series do not have outliers.

4.3 Stationarity testing

To check whether the variables are stationary over the time series, the study firstly tested for the unit root in order to establish the order of integration using both the ADF and PP tests. The time series were tested at levels, first differencing as well as second differencing. A variable is said to be integrated of order one, or I (1), if it is stationary after differencing it once, or order two, I (2) if differenced twice. If the variable is stationary without differencing, then it is integrated of order zero, I (0). The null hypothesis to be tested is that there is a unit root, implying that the time series is non-stationary while the alternate is that there is no unit root within the time series, suggesting that the data is indeed stationary.

When the probability value (p-value) is less that the 5% (0.05) level of significance, the null hypothesis that there exists a unit root is rejected and vice versa. Also, if ADF and PP t-statistics are greater than the t-critical values, the null hypothesis is then rejected. The unit root test results for the log forms of public debt, government expenditure and government revenue for the ADF and PP at levels are presented in tables 4.2 and 4.3 whereas tables 4 and 5 depicts the ADF and PP test at first differencing.

Table 4.2: Unit root test results at levels-ADF

Variables	Deterministic terms	ADF – Levels				P-values
		t-statistic	t-critical values			
			1%	5%	10%	
	Intercept	-2.339919	-3.724070	-2.986225	-2.632604	0.1681

ΔLNPD	***Intercept and constant***	-2.787134	-4.374307	-3.603202	-3.238054	0.2143
ΔLNGVTEX	***Intercept***	-0.054149	-3.724070	-2.986225	-2.632604	0.9443
	Intercept and constant	-1.938752	-4.374307	-3.603202	-3.238054	0.6048
ΔLNGVTRV	***Intercept***	-0.157163	-3.724070	-2.986225	-2.632604	0.9321
	Intercept and constant	-3.330508	-4.394309	-3.612199	-3.243079	0.0853

Source: Authors' compilation and values from E-views 10.

Table 4.3: Unit root test results at levels-PP

Variables	**Deterministic terms**	**PP- Levels**				**P-values**
		t-statistic	**t-critical values**			
			1%	**5%**	**10%**	
ΔLNPD	***Intercept***	-2.389943	-3.724070	-2.986225	-2.632604	0.1544
	Intercept and constant	-2.767380	- 4.374307	-3.603202	-3.238054	0.2210
ΔLNGVTEX	***Intercept***	-0.027760	-3.724070	-2.986225	-2.632604	0.9472
	Intercept and constant	-2.073990	- 4.374307	-3.603202	-3.238054	0.5345
ΔLNGVTRV	***Intercept***	-0.033976	-3.724070	-2.986225	-2.632604	0.9465
	Intercept and constant	-3.220365	-4.374307	-3.603202	-3.238054	0.1032

Source: Authors' compilation and values from E-views 10.

Both the ADF and PP unit root tests as per tables above show that at levels, with intercept and with trend and intercept, the study fails to reject the null hypothesis for

all the variables, implying that they are non-stationary. This is because all the p- values for both tests are greater than 0.05. Also, all the absolute t-statistics under all determinist terms are less than the t-critical values. Using data that is non-stationary may cause spurious regressions. As a result, the study further tested the stationarity of the variables at first difference under both ADF and PP. The results involving the intercept and trend, and intercept for each variable, including the probability values are shown in tables 4 and 5 below:

Table 4.4: Unit root test results at first differencing-ADF

Variables	Deterministic terms	ADF-1st Differencing				P-Values
		t-statistic	t-critical values			
			1%	5%	10%	
ΔLNPD	***Intercept***	-4.496611	-3.737853	-2.991878	-2.635542	0.0017
	Intercept and constant	-4.526126	-4.394309	-3.612199	-3.243079	0.0075
ΔLNGVTEX	***Intercept***	-5.538608	-3.737853	-2.991878	-2.635542	0.0001
	Intercept and constant	-5.604954	-4.394309	-3.612199	-3.243079	0.0007
ΔLNGVTRV	***Intercept***	-5.179574	-3.737853	-2.991878	-2.635542	0.0003
	Intercept and constant	-5.116156	-4.394309	-3.612199	-3.243079	0.0021

Source: Authors' compilation and values from E-views 10

As indicated in Table 4.4, at 5% level of significance, public debt, government expenditure and government revenue become stationary at first difference with an intercept and a with intercept and constant in the ADF unit root test. This is indicated

by the absolute t-statistic for all variables being greater that the critical values at 5% level of significance at all deterministic terms. With an intercept, the ADF t-statistic values for public debt, government expenditure and government revenue are 4.496611, 5.538608 and 5.179574 respectively and are all greater that the critical values at 5% level of significance. Also, the probability values for the ADF tests with intercept and intercept, and constant are all below 0.05, leading the researcher to reject the null hypothesis that the series for all variables contain a unit root; and to accept that the series are stationary after first differencing.

Table 4.5: Unit root test results at first differencing-PP

Variables	**Deterministic term**	**PP -1st Differencing**				**P-Values**
		t-statistic	**t- values**			
			1%	**5%**	**10%**	
ΔLNPD	***Intercept***	-4.497562	-3.737853	-2.991878	-2.635542	0.0017
	Intercept and constant	-4.541772	-4.394309	-3.612199	-3.243079	0.0073
ΔLNGVTEX	***Intercept***	-5.538608	-3.737853	-2.991878	-2.635542	0.0001
	Intercept and constant	-5.808443	-4.394309	-3.612199	-3.243079	0.0004
ΔLNGVTRV	***Intercept***	-5.369767	-3.737853	-2.991878	-2.635542	0.0002
	Intercept and constant	-5.352196	-4.394309	-3.612199	-3.243079	0.0012

Source: Authors' compilation and values from E-views 7.

Stationarity at first difference was also asserted by the PP unit root test as indicated in table 4.5. Under all deterministic terms, public debt, government expenditure and government revenue also become stationary at first difference. This is indicated by the

absolute t-statistic values of all variables being greater that the critical values at 5% level of significance. With intercept, at 0.05 level of significance, the PP t-statistic values for public debt, government expenditure and government revenue are 4.497562, 5.538608 and 5.369767 respectively, all greater than the t- critical value at 5% level of significance. Also, the probabilities are all below 0.05, which led the researcher to reject the null hypothesis that the series for all variables contain a unit root, implying that the series are stationary at first difference.

Both the ADF and PP tests indicate that all the variables under investigation are stationary at the same order, that is at first differencing, meaning they are all integrated of order one I(1). This further implies that the estimation from such data does not create spurious modeling problems which arise when variables in the model are non-stationary. From the above, since the variables are stationary at the same order I(1), the study continued further to test for cointegration, using both the Johansen and Engle and Granger cointegration tests.

4.5 Cointegration tests

The unit root tests in the previous section indicated that the values of all three variables are stationary after second differencing or integrated of order I(1), making cointegration testing necessary to establish the long-run relation. The results aimed to establish whether a long-run relationship exists between these variables by employing the Johansen's cointegration technique and Engle and Granger cointegration tests. These results of the tests are discussed below.

4.5.1 The Johansen cointegration test

The Johansen cointegration requires that an optimal lag length is first determined as described in the methodology chapter. The series optimum lag length from the AIC is 2 because the lowest value of all criteria is observed there as indicated by "*". The results from the optimal lag length test are presented in table 4.6 below.

Table 4.6: Lag length selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10.86209	NA	0.000637	1.155174	1.302431	1.194242
1	85.03304	159.8252*	4.61e-07	-6.086087	-5.497060*	-5.929818*
2	94.57173	13.51315	4.60e-07*	-6.130978*	-5.100181	-5.857507

*Indicates the lag order selected by criterion, AIC

After establishing the optimal lag length, the study tested for cointegration with the Johansen trace and the maximum eigenvalue test. The null hypothesis of no cointegration is tested against the alternative that the variables are cointegrated. The decision rule on whether to accept the null hypothesis depended on the probability value in comparison to the 5% (0.05) level of significance. The null hypothesis is rejected when the p-value is less than 0.05, implying that there is a cointegrating relationship between the two variables. Also, if the calculated values for both the trace and maximum eigenvalue tests are greater than the critical values, the null hypothesis is rejected, implying that the variables are cointegrated, or else the study will fail to reject the null hypothesis. Tables 4.7 and 4.8 below represent the outcome of both tests of cointegration on all the variables.

Table 4.7: Johansen cointegrating tests (Trace)

Unrestricted cointegration rank test (Trace)				
Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	P-value
None *	0.827484	52.59090	29.79707	0.0000
At most 1	0.330254	12.17374	15.49471	0.1488
At most 2	0.120531	2.954045	3.841466	0.0857

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

The results from the Johansen cointegration trace test are shown above. The trace test results at none indicate a p-value of 0.0000 which is less than the 5% significance level. As a result, the null hypothesis of no cointegration is rejected, and the alternative that there exist cointegrating equations is accepted. Also, the trace statistic of 52.59090, greater than the critical value of 29.79707, supports the rejection of the null hypothesis at 5% level of significance. However, the study failed to reject the null hypothesis that there exist at most 1 or 2 cointegrating equations as the p-values 0.1488 and 0.0857 are all greater than the 0.05. Also, the t-statistics are all less than their critical values. As a result, the researcher failed to reject the null hypothesis that there is at most 2 cointegrating equations. This analysis indicates that there exists 1 cointegrating equation at 5% level of significance.

Table 4.8: Johansen cointegrating tests (Maximum eigenvalue)

Unrestricted cointegration rank test (Maximum eigenvalue)				
Hypothesised No. of CE(s)	Eigenvalue	Max-eigen Statistic	0.05 Critical Value	P-value
None *	0.827484	40.41716	21.13162	0.0000
At most 1	0.330254	9.219692	14.26460	0.2683
At most 2	0.120531	2.954045	3.841466	0.0857

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

The maximum eigenvalue test in table 4.8 indicates similar results. These tests indicate that the null hypothesis of no cointegrating equation is also rejected at 5% level of significance. This is because the p-value of 0.0000 is less than 0.05 while the max-eigen statistic of 40.41719 is greater than the critical value of 21.13162. However, the test also fails to reject the null hypothesis that there exist at most 1 and 2 cointegrating equations. This is because of the p-values under each null hypothesis that are greater than 0.05. Also, just like the trace test, the max-eigen statistics are less than their critical values. This analysis also indicates that there exists 1 cointegrating equation at 5% level of significance. Johansen cointegration tests all indicate the existence of cointegrating equations at 5% level of significance. This implies that the public debt, government expenditure and government revenue of Namibia are associated and move together in the long-run during the period under study.

4.5.2 Engle and Granger cointegration test

Engle and Granger cointegration approach required an OLS regression between government expenditure as the dependant variable, and public debt and government revenue as independent variables to obtain the residual values. Residuals obtained from the model of GVTEX, PD and GVTRV log values were tested for the unit root using the ADF tests as indicated by table 9.

Table 4.9: LnPD, LnGVTEX and LnGVTRV residuals unit root test result

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.435558	0.0171
Test critical values: 1% level	-2.660720	
5% level	-1.955020	
10% level	-1.609070	

Table 4.9 above indicates that the p-value of 0.0171 is below the 5% level of significance. Also, the ADF t-statistic absolute value of 2.161928, at 5% level of significance is greater that the critical value of 1.955020. Hence, the study rejected the null hypotheses that the residual value (U_t) has a unit root and accepted the alternative hypothesis. The absence of a unit root in the residual implies that there exists a cointegrating relationship between public debt, government expenditure and government revenue. Also, all variables are stationary after first differencing. Given these cointegration tests results, the study adopted the ECM to investigate both the short- and long-run dynamics among the variables.

4.6 Model estimation

4.6.1 Error correction model

Based on the cointegration property, the study estimated the ECM model. The results are reported in table 10. The coefficients LnPD and LnGVTRV are significant to explain LnGVTEX when the probability values are less than 0.05, otherwise, they become insignificant variables to explain the dependant variable. The coefficient of the ECT measures the speed of adjustment in current public debt from its previous equilibrium value. Most importantly, the sign of the ECT must be negative and significant to indicate a long-run equilibrium relationship. The outputs from equation 4 indicating the ECM or short-run relations are specified in table 10 below.

Table 4.10: ECM estimates (dependant variable: first differenced LnGVTEX)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.035326	0.024126	1.464179	0.1580
D(LNGVTRV)	0.360934	0.129112	2.795518	0.0108
D(LNPD)	0.284756	0.068655	4.147666	0.0005
U(-1)	-0.502892	0.139997	-3.592166	0.0017
R-squared	0.561556	Mean dependent var		0.137842
Adjusted R-squared	0.498922	S.D. dependent var		0.075614
S.E. of regression	0.053524	Akaike info criterion		-2.871709
Sum squared resid	0.060162	Schwarz criterion		-2.676689
Log likelihood	39.89636	Hannan-Quinn criter.		-2.817619
F-statistic	8.965566	Durbin-Watson stat		1.725916
Prob(F-statistic)	0.000509			

Table 4.10 indicates the results obtained from estimating the ECM (4). From the results, the ECM indicates a negative coefficient for the lagged residual U_{t-1} of -0.502892. Also, the ECT coefficient is statistically significant because its p-value of 0.0017 is below 0.05 significance level. This implies that that there is a long-run relationship and any shocks in the short run will be adjusted back to the long-run equilibrium by the ECT coefficient. The coefficient for the error term β_3 -0.502892 shows that the speed of adjustment at which the ECT corrects the disequilibrium in the model is 50.2892 % annually. In other words, the speed at which the system corrected its previous disequilibrium period due varied shocks is 50.30 % annually.

A positive significant relationship between government expenditure and public debt is represented by the p-value 0.0108 less than 0.05, while a positive significant relationship between government revenue and government expenditure is confirmed by a p-value of 0.0005. All of the above mean that, a 1 percent increase in government revenue will increase government expenditure by 0.36%. Similarly, a 1 percent

increase in government debt will increase government expenditure by 0.28%. These findings support the study of Ukwueze (2015).

Additionally, the model's R square of 0.561556 is found to be less than the Durbin Watson statistics of 1.725916 concluding the absence of spurious regression. The Durbin Watson is closer to 2 indicating the absence of autocorrelation. The F-statistics is also significant, indicating that the independent variables are jointly significant in explaining the variations in the dependent variable. The coefficients substituted in the ECM equation specified in equation (5) under the methodology chapter are indicated below:

$$\Delta LnGVTEX_t = 0.035326 + 0.284756\Delta LnPD_t + 0.360934\Delta LnGVTRV_t - 0.502892\, U_{t-1} + 0.053524_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{(9)}$$

The positive significant relationship of public debt to government expenditure was expected, as well as that of government revenue. Any increase in government revenues will increase government expenditures. However, in terms of the magnitude, government expenditure is more responsive to government revenue (0.36%) when compared with public debt (0.26%). The positive relationship between government expenditure and revenue will force the government to run a budget deficit (increase tax rates) when revenues are insufficient to meet the increase in expenditures (to meet the increase in expenditures). Consequently, the country will be forced to resort to borrowing, thus increasing public debt.

The findings are similar to those of Idenyi, Ogonna & Ifeyinwa (2016) on the causal relationship between total public debt and public expenditure in Nigeria and to that of

Okafor and Eiya (2011). From the theoretical perspective, these findings support the positive theory of public expenditure for Peacock and Wiseman (1961) which states that government expenditure and taxes are positively related due to the displacement effect. The findings further support Friedman (1978) who points out any tax increases will cause an increase in expenditures but only when governments are unwilling to reduce budget deficits. The above findings are also in line with the Ricardian equivalent theory which states that both taxes and borrowings constitute essential equivalent forms of financing public expenditures.

4.7 Granger causality

The study employed the pair-wise Granger causality test to test the causal relationship between public debts (LnPD), government expenditure (LnGVTEX) and government revenue (LnGVTRV). The study used 2 lags as the optimal lag length obtained by the criterions. According to Engel and Granger (1987), cointegration between two variables in the long-run indicates either an unidirectional, or bidirectional Granger causality between these two variables. The null hypothesis of no Granger causality is tested against the alternative of Granger causality between variables. The null hypothesis is rejected if the probability obtained is less than 5% (0.05) and failed to be rejected when the probability is greater than 0.05.

Table 4.11: Pair-wise Granger causality tests

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
LNGVTRV does not Granger Cause LNGVTEX	24	1.77287	0.1968
LNGVTEX does not Granger Cause LNGVTRV		0.96700	0.3982
LNPD does not Granger Cause LNGVTEX	24	2.06618	0.1542
LNGVTEX does not Granger Cause LNPD		3.67094	0.0449

As highlighted in table 4.11, the study rejected the null hypothesis that government expenditure does not Granger cause public debt at 5% level of significance, because the probability of 0.0449 is less than 0.05. As a result, an unidirectional causality was found running from LnGVTEX to LnPD. This further means that LnGVTEX can be considered as a useful tool to stimulate public debt in Namibia because of its ability to predict the price of borrowing. The findings are similar to those of Mah et al. (2013), Oladokun (2015) as well as Odenyi, Ogoma and Ifeyinwa (2016). Nonetheless, the researcher failed to reject the null hypothesis that LnPD does not granger cause LnGVTEX, concluding that the past values of public debt cannot help to predict the future values of government expenditure 5% level of significance because the p-value of 0.1542 is greater than 0.05. This further implies that public debt does not stimulate government spending in Namibia.

Similarly, the study failed to reject the null hypotheses of no causality from GVTEX to GVTRV, as well as that of no causality from GVTRV to GVTEX, implying that the variables are independent of each other with p-values of 0.3982 and 0.1968 respectively. The causality between government expenditure and government revenue was tested to serve in devising an optimal strategy to reduce the budget deficit and further reduce public debt. The results above failed to support Barro's hypothesis which states that government expenditure causes government revenue, indicating the absence of the spend-revenue hypothesis theory and the revenue- spend hypothesis theory of Buchanan and Wagner (1977) in Namibia as indicated in the reviewed theoretical literatures. Increasing taxes does not induce government spending and the budget deficit cannot merely be eliminated through policies implementations that stimulate government revenue. Also, the above results are contrary to the findings of

Saungwene (2013) who found causality running from government expenditure to revenue, while Ogujiuba and Abraham (2012) found an unidirectional causality running from government revenue.

4.8 Diagnostic tests

The study performed several diagnostic tests to ensure the absence of autocorrelation, heteroscedasticity and abnormality. Diagnostic tests ensure that the model is robust, from an econometric standpoint. Stability test was also performed. The results for each tests are discussed below.

4.8.1 Heteroscedasticity

The white heteroscedasticity test was performed under the null hypothesis that there is no heteroscedasticity against the alternative that there exists heteroscedasticity with the decision criteria of rejecting the null hypothesis, if the calculated F-statistic is greater than the critical F-statistic.

Table 4.12: Heteroscedasticity test: Breusch-Pagan-Godfrey

F-statistic	0.250385	Prob. F(3,21)	0.8601
Obs*R-squared	0.863352	Prob. Chi-Square(3)	0.8343
Scaled explained SS	0.396120	Prob. Chi-Square(3)	0.9410

As indicated above, the study failed to reject the null hypothesis that there is no heteroscedasticity in the model against the alternative that there is heteroscedasticity in the ECM model. This is because the p value for the Chi-square is also greater than the 0.05.

4.8.2 Autocorrelation

The autocorrelation test, which tests for the inconsistency of the error term, used the Breusch-Godfrey serial correlation LM test to test the null hypothesis that there is no serial correlation. The researcher failed to reject the null hypothesis that the model is not serially correlated against the alternative that there is autocorrelation in the ECM mode. This is because the p-value for the Chi-square is greater than the 0.05, implying that our model is good.

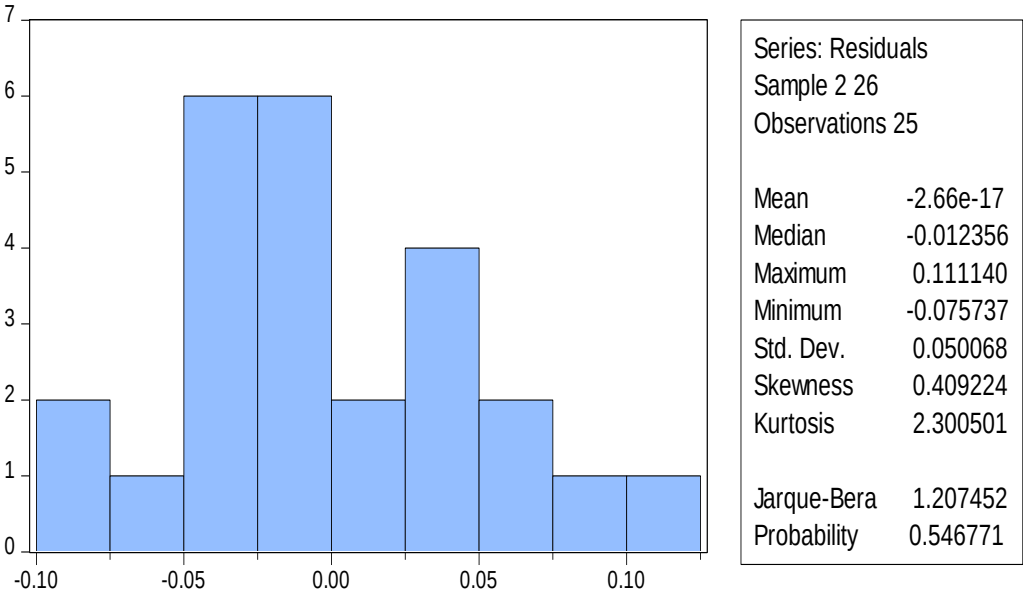
Table 4.13: Breusch-Godfrey serial correlation LM Test

F-statistic	0.261772	Prob. F(2,19)	0.7724
Obs*R-squared	0.670402	Prob. Chi-Square(2)	0.7152

4.8.3 Normality

The normality test results where the null hypothesis of normality was tested against the alternative of abnormality are presented below. From the histogram, the study failed to reject the null hypothesis that the model is normally distributed, because the Jarque-Bera probability of 0.546771 is greater than the 0.05 level of significance.

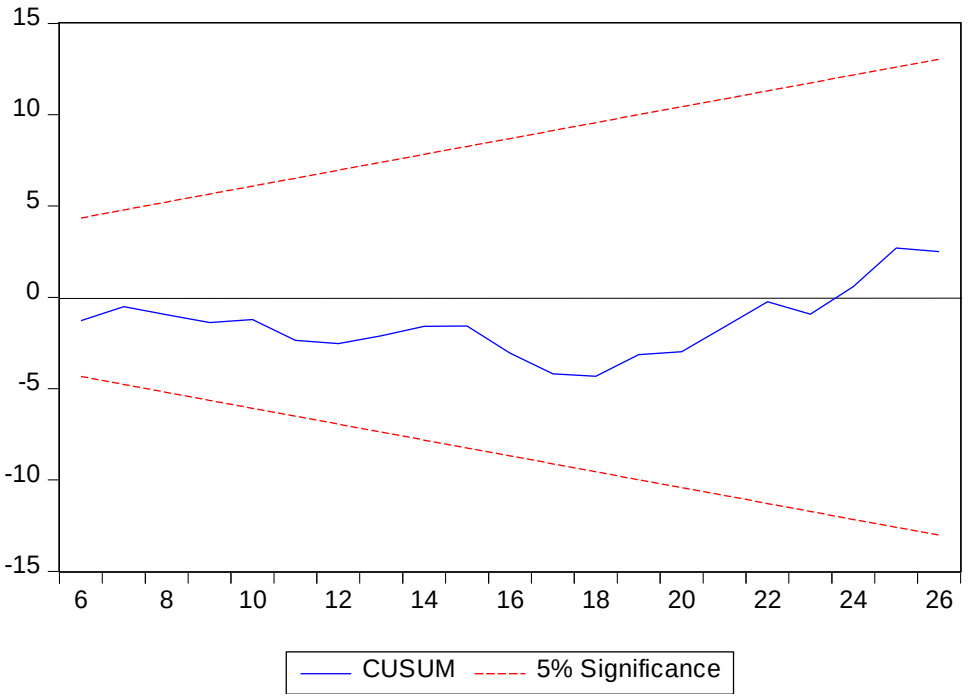
Figure 2: Histogram normality test



4.8.3 Stability

The stability test to ensure the model is suitable for analysis was also analysed, as indicated by figure 3. As indicated by the CUSUM test, the model is stable because the blue line is located within two red lines. This means that there are no structural breaks in the estimated residual.

Figure 3: CUSMUS stability test



4.9 Conclusion

The study employed annual datasets stretching from 1990 to 2016 to investigate the relationship between the variables. The results indicate a significant long-run relationship amongst government expenditure and revenue while public debt was proved to be statistically insignificant. Moreover, there is a positive significant short-run relationship between government expenditure, government revenue and public debt. Nevertheless, the study found only one directional causality from government expenditure to public debt.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This last chapter of the research provides a final outlook by outlining the study findings and conclusions based on the results obtained from the previous chapter. Also, the policy implications and recommendations as well as the areas of further research are presented.

5.2 Summary of study and conclusions

The raising concerns of fiscal sustainability and increases in debt burdens, expenditure and budget deficits above thresholds in Namibia, made it imperative to examine and understand the dynamics of government expenditure, revenue and public debt. This research aimed to address both the literature gap and the policy-makers concerns in terms of fiscal sustainability by investigating the relationship between the variables, as such an understanding is crucial to achieving fiscal sustainability.

The study started off with a brief introduction of the variables under study and review of historic trends. Thereafter an overview of the empirical and theoretical literature on related subject matters was given. The methodology applied was then discussed and lastly the analysis and interpretation of the data were presented. Most of the existing literatures on the relationship between public debt, government expenditure and revenue revealed mixed results. The theories which attempted to confirm the relationship between the variables have conflicting views, as some assume causality runs from revenue to spending, while others urge that government spending causes revenue. The empirical findings regarding the relationships and causalities between

the variables remain inconclusive, making it difficult to draw a conclusion regarding the relationships between the macroeconomic variables and to generalise such relationships to Namibia.

As a result, by addressing the first and second objective, the study rejected the research null hypotheses that there is no relationship between government expenditure and public debt; as well as that of no relationship between government expenditure and revenue as the cointegration results indicated long-run relations between the variables. The ECM model revealed a positive significant relationship between government expenditure and government revenue and public debt. In addition, the ECT from the study was negative and statistically significant confirming that all previous disequilibrium in the three variables is removed in the following period. The results of the ECT revealed an average speed of 50.28% for variables to adjust from any disequilibrium back to the long-run equilibrium annually. Therefore, the study concludes that there exist positive long-run relationships between government expenditure, public debt government revenue.

Another study objective was to determine the direction of causality between government and public debt, as well as between government expenditure and revenue in Namibia. To address the third and last objective, the Granger causality test was employed to determine the direction of causation between government expenditure and public debt, as well as between government expenditure and public debt.

The Granger causality testing confirmed the existence of a causal relationship running from government expenditure to public debt but not the other way around, implying

an unidirectional causality from government expenditure to public debt. This caused the researcher to reject the third research null hypothesis as the study found causality relations between the variables. This indicated that the past values of government expenditure can help predict the government debts, but public debt is not a useful tool in determining government expenditure. Such a relationship indicates that policy-makers have the ability to control the country's borrowings through government spending. Increasing government expenditures leads the country into more debts. Further, the implication of these results for the Namibia government and policy makers is for policies to be implemented targeting government expenditure first as it will directly affect government debt

Though the study expected to find causality between government expenditure and revenue, the researcher failed to reject the fourth research hypothesis, namely, that there is no causal relation between government expenditure and government revenue. This means that the study found no causal relations, implying that the variables are independent of each other. This provides evidence of no tax-spend or spend-tax hypothesis in Namibia. Increasing taxes does not leads to more government spending and neither does the government spend due to the increase in government revenue. N Lastly, the study performed several diagnostic tests to ensure that the model is robust. The tests confirmed the absence of autocorrelation, heteroscedasticity and abnormality.

5.3 Policy recommendations

The results from the study shows that the Namibian government can efficiently use fiscal variables of government expenditure, revenue and public debt to achieve fiscal

sustainability; and reduce debt burdens and budget deficits. The study recommends policy-makers to thoroughly review the fiscal policy in order to reduce overspending; and improve revenue collections, resulting in reduced budget deficits and sustainable if not reduced debt. In so doing, the government should efficiently adopt the functional finance as suggested by the Lerner's theory into its restrictive or expansionary fiscal policies, thus judging all fiscal measures based on their functions in the economy. Aligning the functional finance into the fiscal policy will ensure that the aggregate demand (spending rate) is within the rate of aggregate supply.

Fiscal imbalances can also be eliminated through sufficient prolonged revenue collections. Therefore, the government should implement long-term policies that stimulate government revenue, while still attempting to mitigate their expenditures to stabilise borrowings in the short run. However, precautions should be taken as increase in revenues will also increase government expenditure due to the positive relationship. Moreover, since both government revenues and public debt directly influence expenditure, the Namibian government should learn an art of spending within their means (prioritising income collected from revenues over borrowing).

Although the findings indicated no causality between government expenditure and revenue, revenues still indirectly trigger public debt through budget deficits and as such, the study advises policy-makers to revisit their budgeting process. From the inception of the budget process, the government should avoid overstated revenues and understated expenditures estimates and ensure that the budgeted expenditures are always below the budgeted revenues. In the long run, the government should aim to expand their revenue collections while minimising the reliance on borrowing.

Lastly, since Namibia's government expenditure was found to cause public debt, the borrowed funds should productively be spent on development/capital expenditures in order to regenerate more revenue and achieve growth. However, government should ensure that it invests in successful capital projects. Such investments require proper planning and implementing to avoid the misuse of borrowed funds. Conversely, this might serve as a challenge to Namibia since its biggest portion of expenditure is operational, most specifically administration.

5.4 Further research

An expansion on the variables is suggested for further research. Since the study found unidirectional causality from government expenditure to public debt, future research, to investigate the relationship between public debt and individual operational and development expenditures is recommended in order to determine the discrete impact that expenditure has on borrowing. Similarly, future research could also focus on the relationship between public expenditure and domestic and foreign debt, as well as individual government revenues as split variables to further improve policy recommendations. Finally, further research is suggested on the improving the data once they become available.

References

Alawneh, A. (2017). The impact of public expenditure and public debt on taxes: A case study of Jordan. *Accounting and Finance Research, 6*(3), 10-23. Retrieved from https://doi.org/10.5430/afr.v6n3p10

Abdulrasheed, B. (2017). Causality between government expenditure and revenue in Nigeria. *Asian Journal of Economics and Empirical Research, 4*(2), 91-98. doi: 10.20448/journal.501.2017.42.91.98

Achieng, W. J. (2012). *The relationship between government budget deficit and domestic debt in Kenya*. (Master's Thesis). University of Nairobi, Nairobi, Kenya. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/95918

Alberto, A. & Guido, T. (1990). A positive theory of fiscal deficits and government debt. *The Review of Economic Studies, 57*(3), 403-41. doi:10.2307/2298021

Apergisa, N., & Coorayb, A. (2015). The dynamics of Greek public debt – Evidence from simultaneous and structural VAR models. *A Department of Banking and Financial Management, 47*(10). 967-980. Retrieved from http://dx.doi.org/10.1080/00036846.2014.985372

Banerjee, A., Dolado, J.J., Galbraith, J.W., & Hendry, D. (1993). *Co-integration, error correction, and the econometric analysis of non-stationary data*. United Kingdom: Oxford University Press.

Barro, R. J. (1974). Are government bonds net wealth? *Journal of Political Economy, 82* (6), 1095-1117. Retrieved from http://www.jstor.org/stable/1830663

Barro, R. J. (1979). On the determination of the public debt. *Journal of Political Economy, 87*(5), 940-971. Retrieved from http://www.jstor.org/

Battaglini, M., & Coate, S. (2008). A dynamic theory of public spending, taxation, and debt. *The American Economic Review*, *98*(1), 201-236. Retrieved from http://www.jstor.org/

Buchanan, J.M., & Wagner, R.W. (1977). *Democracy in deficit*. New York: Academic Press. Retrieved from https://trove.nla.gov.au/work/10974774

Cassimon, D., & Campenhout, B. (2007). Aid effectiveness, debt relief and public finance response: Evidence from a panel of HIPC countries. *Review of World Economics, 143*(4), 742-763.

Cottarelli, C., & Schaechter, A. (2010). *Long term trends in public finances in the G-7 economies*. Retrieved from https://www.researchgate.net/publication/228822015

Eita, J.H. & Mbazima, D. (2008). *The Causal relationship between government revenue and expenditure in Namibia.* MPRA Paper No. 9154. Retrieved from https://www.researchgate.net/publication/24116340

Elyasi, Y., & Rahimi, M. (2012). The Causality between government revenue and government expenditure in Iran. *International Journal of Economic Sciences and Applied Research, 5*(1), 129-145. doi: 10.2139/ssrn.1977987

Engle, R. F., & Granger, C, W. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrics, 55*(14), 251-276. Retrieved from http://www.jstor.org/

Fabozzi, F. J. (2007). *Fixed income analysis (2nd ed.).* Hoboken, NJ: John Wiley & Sons.

Friedman, M. (1978). The Limitations of Tax Limitations. *Policy Review*, 7-14. Retrieved from http://www.unz.com/print/PolicyRev-1978q3-00007

Gaomab, M. (1998). *Modelling inflation in Namibia.* Bank of Namibia Research Department Occasional, No. 1. Retrieved from https://www.bon.com.na/CMSTemplates/Bon/Files/bon.com.na/2f/2ffbcc0d-76fc-4228-a0d6-5bb7d9a989bc.pdf

Ghartey, E. E. (2010). Government expenditures and revenues causation: Some Caribbean empirical evidence. *Applied Econometrics and International Development, 10*(2), 149-165. Retrieved from http://www.usc.es/econo met/journals1/aeid/aeid10212.pdf

Gonzalo, J., & Pitarakis, J. (2002). Estimation and Model Selection Based Inference in Single and Multiple Threshold Models. *Journal of Econometrics, 110*(2), 319-352. https://doi.org/10.1016/S0304-4076(02)00098-2

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-pectral methods. *Econometrica, 37*(3), 424-438. Retrieved from https://www.jstor.org/stable/1912791

Gujarati, D. (2004). *Basic econometrics*. (5th ed). London: McGraw Hill.

Idenyi, O. S., Ogonna, I. C., & Ifeyinwa, A. C. (2016). Public debt and public expenditure in Nigeria: A causality analysis. *Research Journal of Finance and Accounting, 7*(10), 27-38. Retrieved from https://iiste.org/Journals/index.php/RJFA/article/viewFile/30368/31224

Kanano, A. G. (2006). *Determinants of public expenditure growth in Kenya.* (Master's Thesis). University of Nairobi, Nairobi, Kenya. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/6272

Kaur, B., Mukherjee, A., Kumar, N., & Ekka, A.P. (2014). *Debt sustainability of states in India.* Reserve Bank of India Working Paper Series, No. 81929. Retrieved from https://mpra.ub.uni-muenchen.de/81929/

Keivani, F. S. (2013). The Relationship between the Government Expenditures and Revenues in the Long Run a Case Study of Iran. *Journal of Business and Management, 14*(6), 83-87. Retrieved from http://www.iosrjournals.org/iosr-jbm/papers/Vol14-issue6/L01468387.pdf

Keynes, J. M. (1936). *The general theory of employment, interest and money.* New York: Cambridge University Press.

Kiminyei, F. K. (2014). *Public debt, tax revenue and government expenditure in Kenya: 1960- 2012*. (Master of Economics Thesis). University of Nairobi, Nairobi, Kenya. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/76540

Kok, R. J. (2010). *Using political economic theories to budget deficits and stabilization in 29 countries: An empirical investigation*. (Master's Thesis). Erasmus University Rotterdam, Rotterdam. Retrieved from https://thesis.eur.nl/pub/7899

Labonte, M. (2012). *Reducing the budget deficit: Policy issues*. Congressional research service report for progress. Retrieved from https://fas.org/sgp/crs/misc/R41778.pdf

Lerner, A. P. (1943). Functional finance and the federal debt. *Social Research*, *10*(1) 38-51. Retrieved from http://www.jstor.org/

Love, J., & Chandra, R. (2004), Testing export-led growth in India, Pakistan and Sri Lanka using a multivariate framework. *The Manchester School, 72* (4): 483-496.

Luković, S., & Grbić, M. (2014). The causal relationship between government revenue and expenditure in Serbia. *Economic themes, 52* (2), 127-138. doi:10.1515/ethemes-2014-0009

Maddah, M., & Farahati, M. (2014). The asymmetric effects of tax revenues on government expenditures in Iran. *Iranian Journal of Economic Studies, 3*(2), 43-62. Retrieved from http://ijes.shirazu.ac.ir/article_3669_56d44e38914d08972054ba950fbab5b4.pdf

Mah, G., Petersen, J. M., Miruka, C., & Petersen, M. A. (2013). The impact of government expenditure on the Greek government debt: An econometric analysis. *Mediterranean Journal of Social Sciences, 4*(3). doi:10.5901/mjss.2013.v4n3p323

Mahadeva, L., & Robinsin, P. (2004). Unit root testing to help model building. London, Bank of London: Centre of Central Banking Studies.

Mill, J.S. (1979). *Principles of Political Economy*. Fairfield, NJ: Augustus M. Kelley.

Ministry of Finance. (2001-2020). *Medium term expenditure framework* 2001/02 to 2019/20. Windhoek: Author.

Ministry of Finance. (2005). *Sovereign debt management strategy*. Windhoek: Author.

Ministry of Finance (2017a). *Fiscal strategy for the 2017/18- 2019/20 MTEF*. Windhoek: Author.

Ministry of Finance. (2017b). *Media statement on Moody's investor service downgrading of Namibia's credit rating*. Windhoek: Author.

Neck, R., & Sturm, J. (2008). *Sustainability of public debt*. London, England: The MIT Press Cambridge.

Ogujiuba, K., & Abraham, T.W. (2012). Testing the relationship between government revenue and expenditure: Evidence from Nigeria. *International Journal of Economics and Finance, 4*(11), 172-182. doi:10.5539/ijef.v4n11p172

Okafor, C., & Eiya, O. (2011). Determinants of growth in government expenditure: An empirical analysis of Nigeria. *Research Journal of Business Management*, *5*(1): 44-50. doi:10.3923/rjbm.2011.44.50

Oladokun, O. O. (2015). Causal relationship between public debts and public expenditure in Nigeria. *International Journal of Management and Applied Science*, *1*(8), 68-79. Retrieved from http://www.iraj.in/journal/journal_file/journal_pdf/14-186-144178134468-79.pdf

Peacock, A. T., & Wiseman, J. (1961). *The growth of public expenditure in the United Kingdom.* London: Oxford University Press. Retrieved from https://www.nber.org/chapters/c2302.pdf

Perry, N. (2014). *Debt and deficits: Economic and political issues*. Tufts University: Global Development and Environment Institute. Retrieved from http://ase.tufts.edu/gdae

Presbitero, A. F. (2010). *Total public debt and growth in developing countries.* Development Studies Working Paper No. 300. Retrieved from http://ssrn.com/abstract=1804958

Ray, S. (2012). Testing granger causal relationship between macroeconomic variables and stock price behaviour: evidence from India. *Advances in Applied Economics and Finance*, *3*(1), 470-481. Retrieved from https://pdfs.semanticscholar.org/9dee/47ca56680dcc579bb1861dc86fc2946954dc.pdf

Saima, U., & Uddin, M. K. (2017). The relationship between budget deficit and public debt in Bangladesh: A vector error correction model approach. *Imperial Journal of Interdisciplinary Research, 3*(7), 623- 628. Retrieved from http://www.onlinejournal.in

Saunders, M., Lewis, P., & Thornhil, A. (2009). *Research Methods for Business Students* (5th ed.). England, United Kingdom: Pearson Education Limited.

Saungweme, T. (2013). Causality between government expenditures and revenues: The Zimbabwean case 1980-2004. *International Journal of Economic Research, 4*(6), 28-40. doi:10.5430/afr.v6n2p114

Shahateet, M. I., Al-Habashneh, F., & Al-Majali, K. A. (2014). Budget deficit and external debt in Jordan: Causality and co-integration analysis. *International Journal of Economics and Finance, 6*(8), 268- 277. doi:10.5539/ijef.v6n8p268

Sherbourne, R., Nampila, T., & du Preez, R. (2002). *Maintaining economic independence: government debt and fiscal sustainability.* IPPR Briefing Paper No. 13. Retrieved from http://ippr.org.na/wp-content/uploads/2010/06/BP13.PDF

Shifotoka, H. (2015). *Investigating the relationship between the bank rate, unemployment and inflation: The Phillips curve in Namibia.* (Master's Thesis). University of Namibia, Windhoek, Namibia. Retrieved from http://repository.unam.na/handle/11070/1679

Smith, A. (1937). *The Wealth of Nations*. New York: Random House.

Strazicich, M. C. (1997). Does tax smoothing differ by the level of government? Time series evidence from Canada and the United States. *Journal of Macroeconomics*, *19*(2), 305-326. Retrieved from https://doi.org/10.1016/S0164-0704(97)00017-7

Sukanya, N. (2016). Fiscal deficit and public debt in India- The trends and implications. *Journal of Commerce & Management Thought*, *7*(4), 781-794. doi:10.5958/0976-478X.2016.00042

Taha, R., & Loganathan, N. (2008), Causality between tax revenue and government spending in Malaysia. *The International Journal of Business and Finance Research, 2*(2), 67-73.

Tsoulfidis, L. (2007). Classical economists and public debt. *International Review of Economics*, *54* (1). Retrieved from https://doi.org/10.1007/s12232-007-0003-8

Uguru, L. C. (2016). The link between public debt and government expenditure pattern: The Nigeria experience. *Journal of Business and Management*, *18*(1), 37-41. Retrieved from www.iosrtjournals.org/

Ukwueze, E. R. (2015). Determinants of the size of public expenditure in Nigeria. *SAGE Open*, 1-8. doi:10.1177/2158244015621346

Welman, C., Kruger, F., & Mitchell, B. (2005). Research methodology. (3rd ed.). South Africa, Cape Town: Oxford University Press.

Zaaruka, B. B., Ndove, T., & Tjipe, T. (2004). *Central government debt sustainability*. Bank of Namibia Working Paper Series 1/2004. Windhoek: Bank of Namibia Research Department. Retrieved from https://www.bon.com.na

Appendices

1. Raw data used (measured in N$ 000 000')

FIN YEAR	GVTEX	GVTRV	PD
1990/91	2103.4	2031.7	501.007
1991/92	2862.5	2673.5	786.232
1992/93	3379.50	2944.5	1249.22
1993/94	3439.2	3106.1	1375.44
1994/95	3856.7	3661.4	2038.473
1995/96	4556.8	4080.7	2648.043
1996/97	5566.90	4675.8	3597.643
1997/98	6129	5689.6	4414.092
1998/99	6935.6	6186.4	5415.792
1999/00	7952.7	7271.5 5	872.632
2000/01	8708.299	8199.978592	7546.1712
2001/02	10302.386902	9097.8523339	10200.91
2002/03	11398.68680525	10562.086216	8986.7796
2003/04	12245.21899809	9767.604430709	12198.9976
2004/05	12770.50121822	11424.53545912	12642.398
2005/06	13192.60658789	13107.71179712	13586.0972
2006/07	15279.183	17593	13635.991
2007/08	17383.295	20688	11925.628
2008/09	21911.848	23446.82	11609.274
2009/10	24908.926	24046.562	13389.143
2010/11	27552.721	23243.585	13893.437267
2011/12	36742.708	29962.126	24734
2012/13	38113.591	37996.95209579	27549.17
2013/14	46751.07738847002	41909.89117535	30852
2014/15	58845.451	49960.606	36731.405
2015/16	65996.032000	57844.839	51212

Source: Ministry of Finance (2001 - 2020)

2. Log transformed data

FIN YEAR	LNGVTEX	LNGVTRV	LNPD
1990/91	7.651310362085928	7.616628160003565	6.216620073043145
1991/92	7.959450647862495	7.891143754388786	6.667251914270874
1992/93	8.125483048540409	7.987694302384625	7.130274635527319
1993/94	8.142994165182072	8.041123198940521	7.226528958911592
1994/95	8.257567174524614	8.205600866916914	7.61995627713848
1995/96	8.424375901777601	8.314023821309444	7.881576155595748
1996/97	8.624593625025942	8.45015555007757	8.188034187797788
1997/98	8.720786883485731	8.64639522587953	8.392557429372469
1998/99	8.844422846670519	8.730108613294826	8.597074409127895
1999/00	8.981266772631171	8.891717876617765	8.678058193930512
2000/01	9.07203187284048	9.01188682251723	8.928795587783464
2001/02	9.240130885428864	9.1157936573981	9.230232210979156
2002/03	9.34125343522549	9.265026096081508	9.103509843044752
2003/04	9.412890853921316	9.186826518523978	9.40910906341128
2004/05	9.454893197921176	9.343518554902504	9.44481136489707
2005/06	9.487411844677922	9.480956022784194	9.516802284149326
2006/07	9.634246592704628	9.775256374639046	9.520467973239976
2007/08	9.763264966581005	9.937309101011639	9.386444976843718
2008/09	9.994782774080592	10.06249015700297	9.359559540436969
2009/10	10.12298149211196	10.08774731313232	9.502199433649636
2010/11	10.22385657558425	10.05378445896574	9.539171868561292
2011/12	10.51169506318407	10.30768939639523	10.115934094302
2012/13	10.54832621666574	10.54526122748616	10.22372768708549
2013/14	10.75259258019396	10.64327714428845	10.33695685705389
2014/15	10.98266981148496	10.81899009386971	10.51138739019211
2015/16	11.09734989798909	10.96551951515892	10.84372915856607

3. Unit root tests results (ADF and PP)

Null Hypothesis: D(LNGVTEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.538608	0.0001
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGVTEX,2)
Method: Least Squares
Date: 10/26/18 Time: 02:34
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTEX(-1))	-1.043636	0.188429	-5.538608	0.0000
C	0.136803	0.029770	4.595280	0.0001

R-squared	0.582354	Mean dependent var	-0.008061
Adjusted R-squared	0.563370	S.D. dependent var	0.105417
S.E. of regression	0.069657	Akaike info criterion	-2.410799
Sum squared resid	0.106747	Schwarz criterion	-2.312628
Log likelihood	30.92959	Hannan-Quinn criter.	-2.384754
F-statistic	30.67618	Durbin-Watson stat	2.138930
Prob(F-statistic)	0.000014		

Null Hypothesis: D(LNGVTEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.604954	0.0007
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGVTEX,2)
Method: Least Squares
Date: 10/26/18 Time: 02:36
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTEX(-1))	-1.054066	0.188060	-5.604954	0.0000
C	0.108623	0.039665	2.738486	0.0123
@TREND("1")	0.002195	0.002050	1.070512	0.2965

R-squared	0.603966	Mean dependent var	-0.008061
Adjusted R-squared	0.566248	S.D. dependent var	0.105417
S.E. of regression	0.069427	Akaike info criterion	-2.380600
Sum squared resid	0.101224	Schwarz criterion	-2.233343
Log likelihood	31.56720	Hannan-Quinn criter.	-2.341533
F-statistic	16.01288	Durbin-Watson stat	2.240132
Prob(F-statistic)	0.000060		

Null Hypothesis: D(LNPD) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.496611	0.0017
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNPD,2)
Method: Least Squares
Date: 10/26/18 Time: 02:38
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPD(-1))	-0.923252	0.205322	-4.496611	0.0002
C	0.160286	0.051869	3.090190	0.0053

R-squared	0.478914	Mean dependent var	-0.004929
Adjusted R-squared	0.455228	S.D. dependent var	0.243009
S.E. of regression	0.179362	Akaike info criterion	-0.519167
Sum squared resid	0.707755	Schwarz criterion	-0.420996
Log likelihood	8.230001	Hannan-Quinn criter.	-0.493122
F-statistic	20.21951	Durbin-Watson stat	2.108430
Prob(F-statistic)	0.000179		

Null Hypothesis: D(LNPD) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.526126	0.0075
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNPD,2)
Method: Least Squares
Date: 10/26/18 Time: 02:39
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPD(-1))	-1.010557	0.223272	-4.526126	0.0002
C	0.253266	0.106776	2.371929	0.0273
@TREND("1")	-0.005730	0.005751	-0.996284	0.3305

R-squared	0.502432	Mean dependent var	-0.004929
Adjusted R-squared	0.455044	S.D. dependent var	0.243009
S.E. of regression	0.179392	Akaike info criterion	-0.482016
Sum squared resid	0.675813	Schwarz criterion	-0.334759
Log likelihood	8.784195	Hannan-Quinn criter.	-0.442949
F-statistic	10.60264	Durbin-Watson stat	1.983890
Prob(F-statistic)	0.000656		

Null Hypothesis: D(LNGVTRV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.179574	0.0003
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGVTRV,2)
Method: Least Squares
Date: 10/26/18 Time: 02:40
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTRV(-1))	-1.038179	0.200437	-5.179574	0.0000
C	0.133193	0.031832	4.184312	0.0004

R-squared	0.549439	Mean dependent var	-0.005333
Adjusted R-squared	0.528959	S.D. dependent var	0.123215
S.E. of regression	0.084566	Akaike info criterion	-2.022924
Sum squared resid	0.157329	Schwarz criterion	-1.924753
Log likelihood	26.27509	Hannan-Quinn criter.	-1.996879
F-statistic	26.82799	Durbin-Watson stat	1.961572
Prob(F-statistic)	0.000034		

Null Hypothesis: D(LNGVTRV) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.116156	0.0021
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGVTRV,2)
Method: Least Squares
Date: 10/26/18 Time: 02:41
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTRV(-1))	-1.038511	0.202987	-5.116156	0.0000
C	0.110342	0.046873	2.354091	0.0284
@TREND("1")	0.001696	0.002525	0.671550	0.5092

R-squared	0.558911	Mean dependent var	-0.005333
Adjusted R-squared	0.516903	S.D. dependent var	0.123215
S.E. of regression	0.085641	Akaike info criterion	-1.960839
Sum squared resid	0.154022	Schwarz criterion	-1.813582
Log likelihood	26.53007	Hannan-Quinn criter.	-1.921772
F-statistic	13.30473	Durbin-Watson stat	2.002598
Prob(F-statistic)	0.000185		

Null Hypothesis: D(LNGVTEX) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.538608	0.0001
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Residual variance (no correction)	0.004448
HAC corrected variance (Bartlett kernel)	0.004448

Phillips-Perron Test Equation
Dependent Variable: D(LNGVTEX,2)
Method: Least Squares
Date: 10/26/18 Time: 02:44
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTEX(-1))	-1.043636	0.188429	-5.538608	0.0000
C	0.136803	0.029770	4.595280	0.0001

R-squared	0.582354	Mean dependent var	-0.008061
Adjusted R-squared	0.563370	S.D. dependent var	0.105417
S.E. of regression	0.069657	Akaike info criterion	-2.410799
Sum squared resid	0.106747	Schwarz criterion	-2.312628
Log likelihood	30.92959	Hannan-Quinn criter.	-2.384754
F-statistic	30.67618	Durbin-Watson stat	2.138930
Prob(F-statistic)	0.000014		

Null Hypothesis: D(LNGVTEX) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.808443	0.0004
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Residual variance (no correction)	0.004218
HAC corrected variance (Bartlett kernel)	0.003328

Phillips-Perron Test Equation
Dependent Variable: D(LNGVTEX,2)
Method: Least Squares
Date: 10/26/18 Time: 02:45
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTEX(-1))	-1.054066	0.188060	-5.604954	0.0000
C	0.108623	0.039665	2.738486	0.0123
@TREND("1")	0.002195	0.002050	1.070512	0.2965

R-squared	0.603966	Mean dependent var	-0.008061
Adjusted R-squared	0.566248	S.D. dependent var	0.105417
S.E. of regression	0.069427	Akaike info criterion	-2.380600
Sum squared resid	0.101224	Schwarz criterion	-2.233343
Log likelihood	31.56720	Hannan-Quinn criter.	-2.341533
F-statistic	16.01288	Durbin-Watson stat	2.240132
Prob(F-statistic)	0.000060		

Null Hypothesis: D(LNGVTRV) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.369767	0.0002
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Residual variance (no correction)	0.006555
HAC corrected variance (Bartlett kernel)	0.004560

Phillips-Perron Test Equation
Dependent Variable: D(LNGVTRV,2)
Method: Least Squares
Date: 10/26/18 Time: 02:46
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTRV(-1))	-1.038179	0.200437	-5.179574	0.0000
C	0.133193	0.031832	4.184312	0.0004

R-squared	0.549439	Mean dependent var	-0.005333
Adjusted R-squared	0.528959	S.D. dependent var	0.123215
S.E. of regression	0.084566	Akaike info criterion	-2.022924
Sum squared resid	0.157329	Schwarz criterion	-1.924753
Log likelihood	26.27509	Hannan-Quinn criter.	-1.996879
F-statistic	26.82799	Durbin-Watson stat	1.961572
Prob(F-statistic)	0.000034		

Null Hypothesis: D(LNGVTRV) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.352196	0.0012
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Residual variance (no correction)	0.006418
HAC corrected variance (Bartlett kernel)	0.004194

Phillips-Perron Test Equation
Dependent Variable: D(LNGVTRV,2)
Method: Least Squares
Date: 10/26/18 Time: 02:47
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGVTRV(-1))	-1.038511	0.202987	-5.116156	0.0000
C	0.110342	0.046873	2.354091	0.0284
@TREND("1")	0.001696	0.002525	0.671550	0.5092

R-squared	0.558911	Mean dependent var	-0.005333
Adjusted R-squared	0.516903	S.D. dependent var	0.123215
S.E. of regression	0.085641	Akaike info criterion	-1.960839
Sum squared resid	0.154022	Schwarz criterion	-1.813582
Log likelihood	26.53007	Hannan-Quinn criter.	-1.921772
F-statistic	13.30473	Durbin-Watson stat	2.002598
Prob(F-statistic)	0.000185		

Null Hypothesis: D(LNPD) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.497562	0.0017
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

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

Residual variance (no correction)	0.029490
HAC corrected variance (Bartlett kernel)	0.029734

Phillips-Perron Test Equation
Dependent Variable: D(LNPD,2)
Method: Least Squares
Date: 10/26/18 Time: 02:48
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPD(-1))	-0.923252	0.205322	-4.496611	0.0002
C	0.160286	0.051869	3.090190	0.0053

R-squared	0.478914	Mean dependent var	-0.004929
Adjusted R-squared	0.455228	S.D. dependent var	0.243009
S.E. of regression	0.179362	Akaike info criterion	-0.519167
Sum squared resid	0.707755	Schwarz criterion	-0.420996
Log likelihood	8.230001	Hannan-Quinn criter.	-0.493122
F-statistic	20.21951	Durbin-Watson stat	2.108430
Prob(F-statistic)	0.000179		

Null Hypothesis: D(LNPD) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.541772	0.0073
Test critical values:	1% level	-4.394309	
	5% level	-3.612199	
	10% level	-3.243079	

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

Residual variance (no correction)	0.028159
HAC corrected variance (Bartlett kernel)	0.029805

Phillips-Perron Test Equation
Dependent Variable: D(LNPD,2)
Method: Least Squares
Date: 10/26/18 Time: 02:48
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPD(-1))	-1.010557	0.223272	-4.526126	0.0002
C	0.253266	0.106776	2.371929	0.0273
@TREND("1")	-0.005730	0.005751	-0.996284	0.3305

R-squared	0.502432	Mean dependent var	-0.004929
Adjusted R-squared	0.455044	S.D. dependent var	0.243009
S.E. of regression	0.179392	Akaike info criterion	-0.482016
Sum squared resid	0.675813	Schwarz criterion	-0.334759
Log likelihood	8.784195	Hannan-Quinn criter.	-0.442949
F-statistic	10.60264	Durbin-Watson stat	1.983890
Prob(F-statistic)	0.000656		

4. Johansen cointegration testing results

Sample (adjusted): 4 26
Included observations: 23 after adjustments
Trend assumption: Linear deterministic trend
Series: LNGVTEX LNGVTRV LNPD
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 *	0.827484	52.59090	29.79707	0.0000
At most 1	0.330254	12.17374	15.49471	0.1488
At most 2	0.120531	2.954045	3.841466	0.0857

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 Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.827484	40.41716	21.13162	0.0000
At most 1	0.330254	9.219692	14.26460	0.2683
At most 2	0.120531	2.954045	3.841466	0.0857

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):

LNGVTEX	LNGVTRV	LNPD
-29.41813	27.02459	3.417109
8.837102	-3.467877	-4.136388
-9.958009	11.19294	-1.798904

Unrestricted Adjustment Coefficients (alpha):

D(LNGVTEX)	0.011437	0.030842	0.003807
D(LNGVTRV)	0.000574	0.021841	-0.019543
D(LNPD)	-0.074932	0.053978	0.015258

1 Cointegrating Equation(s): Log likelihood 104.0588

Normalized cointegrating coefficients (standard error in parentheses)

LNGVTEX	LNGVTRV	LNPD
1.000000	-0.918637	-0.116157
	(0.02020)	(0.01719)

Adjustment coefficients (standard error in parentheses)

D(LNGVTEX)	-0.336455
	(0.41796)
D(LNGVTRV)	-0.016900
	(0.51590)

D(LNPD)	2.204373	
	(0.82944)	

2 Cointegrating Equation(s): Log likelihood 108.6686

LNGVTEX	LNGVTRV	LNPD
1.000000	0.000000	-0.730509
		(0.09705)
0.000000	1.000000	-0.668765
		(0.10604)

Adjustment coefficients (standard error in parentheses)

D(LNGVTEX)	-0.063901	0.202124
	(0.36142)	(0.32058)
D(LNGVTRV)	0.176107	-0.060215
	(0.51007)	(0.45244)
D(LNPD)	2.681378	-2.212206
	(0.75285)	(0.66779)

5. Residual unit root test results (ADF)

Null Hypothesis: U has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.435558	0.0171
Test critical values:	1% level	-2.660720	
	5% level	-1.955020	
	10% level	-1.609070	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(U)
Method: Least Squares
Date: 10/24/18 Time: 02:08
Sample (adjusted): 2 26
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U(-1)	-0.409393	0.168090	-2.435558	0.0227

R-squared	0.197346	Mean dependent var	0.002617
Adjusted R-squared	0.197346	S.D. dependent var	0.082745
S.E. of regression	0.074132	Akaike info criterion	-2.326763
Sum squared resid	0.131893	Schwarz criterion	-2.278008
Log likelihood	30.08454	Hannan-Quinn criter.	-2.313241
Durbin-Watson stat	1.637083		

6. OLS model results

Dependent Variable: LNGVTEX
Method: Least Squares
Date: 10/24/18 Time: 02:06
Sample: 1 26
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGVTRV	0.889288	0.065102	13.65993	0.0000
LNPD	0.086985	0.053055	1.639544	0.1147
C	0.329871	0.206656	1.596233	0.1241

R-squared	0.991591	Mean dependent var	9.360486
Adjusted R-squared	0.990860	S.D. dependent var	0.974881
S.E. of regression	0.093202	Akaike info criterion	-1.799928
Sum squared resid	0.199792	Schwarz criterion	-1.654763
Log likelihood	26.39907	Hannan-Quinn criter.	-1.758126
F-statistic	1356.113	Durbin-Watson stat	0.823317
Prob(F-statistic)	0.000000		

7. ECM model results

Dependent Variable: D(LNGVTEX)
Method: Least Squares
Date: 10/24/18 Time: 02:13
Sample (adjusted): 2 26
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.035326	0.024126	1.464179	0.1580
D(LNGVTRV)	0.360934	0.129112	2.795518	0.0108
D(LNPD)	0.284756	0.068655	4.147666	0.0005
U(-1)	-0.502892	0.139997	-3.592166	0.0017

R-squared	0.561556	Mean dependent var	0.137842
Adjusted R-squared	0.498922	S.D. dependent var	0.075614
S.E. of regression	0.053524	Akaike info criterion	-2.871709
Sum squared resid	0.060162	Schwarz criterion	-2.676689
Log likelihood	39.89636	Hannan-Quinn criter.	-2.817619
F-statistic	8.965566	Durbin-Watson stat	1.725916
Prob(F-statistic)	0.000509		

8. Serial correlation results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.261772	Prob. F(2,19)	0.7724
Obs*R-squared	0.670402	Prob. Chi-Square(2)	0.7152

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 10/24/18 Time: 02:20
Sample: 2 26
Included observations: 25
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001250	0.025463	0.049106	0.9613
D(LNGVTRV)	0.002254	0.140587	0.016033	0.9874
D(LNPD)	-0.011203	0.072951	-0.153570	0.8796
U(-1)	-0.015371	0.196649	-0.078165	0.9385
RESID(-1)	0.162840	0.290799	0.559976	0.5820
RESID(-2)	-0.102156	0.311658	-0.327782	0.7467

R-squared	0.026816	Mean dependent var	-2.66E-17
Adjusted R-squared	-0.229285	S.D. dependent var	0.050068
S.E. of regression	0.055511	Akaike info criterion	-2.738891
Sum squared resid	0.058549	Schwarz criterion	-2.446361
Log likelihood	40.23614	Hannan-Quinn criter.	-2.657756
F-statistic	0.104709	Durbin-Watson stat	1.919504
Prob(F-statistic)	0.989930		

9. Heteroscedasticity test results

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.250385	Prob. F(3,21)	0.8601
Obs*R-squared	0.863352	Prob. Chi-Square(3)	0.8343
Scaled explained SS	0.396120	Prob. Chi-Square(3)	0.9410

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 10/24/18 Time: 02:20
Sample: 2 26
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002070	0.001326	1.560631	0.1336
D(LNGVTRV)	0.004502	0.007097	0.634322	0.5327
D(LNPD)	-0.001382	0.003774	-0.366191	0.7179
U(-1)	0.003607	0.007695	0.468767	0.6441

R-squared	0.034534	Mean dependent var	0.002406
Adjusted R-squared	-0.103390	S.D. dependent var	0.002801

S.E. of regression	0.002942	Akaike info criterion	-8.673690
Sum squared resid	0.000182	Schwarz criterion	-8.478670
Log likelihood	112.4211	Hannan-Quinn criter.	-8.619599
F-statistic	0.250385	Durbin-Watson stat	2.109124
Prob(F-statistic)	0.860146		