EXAMINING THE TAXATION – INFLATION NEXUS IN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT

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ABSTRACT

This study investigates the complex relationship between taxation and inflation in Namibia from 1990Q1 to 2023Q4 using Nonlinear Autoregressive Distributed Lag (NARDL) methodologies. The Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests suggest that the variables are integrated to order I(0) and I(1). Unlike the traditional ARDL analysis which assumes linear associations, the Brock-Dechert-Scheinkman (BDS) and Wald tests revealed an asymmetric association between taxation and inflation in Namibia, justifying the suitability of the NARDL model. The results suggest that positive shocks in taxation have distinct short-term and long-term effects on inflation, challenging the assumption of a symmetrical relationship. Furthermore, only for robustness purposes, the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) estimates, while exhibiting some variation compared to the NARDL's long-run estimates, suggest a long-run relationship between taxation and inflation**.** The Vector Error Correction method (VECM) analysis reveals no causal relationship between taxation and inflation in Namibia in the short run but uncovers a long-run relationship. Additionally, the analysis exposes a nuanced relationship between taxation and inflation in Namibia, diverging from previous studies that often assume a linear connection. The study uncovers a long-term, nonlinear nexus between taxation and inflation in Namibia. Therefore,it is recommended that a gradual increase in taxation can effectively mitigate inflationary pressures by curbing excessive spending, and may enable the Bank of Namibia to sustain a stable interest rate environment in Namibia.

Keywords: Taxation, Inflation, Nonlinear Autoregressive Distributed Lag, Namibia, Fully Modified Ordinary Least Squares, Dynamic Ordinary Least Squares, Vector Error Correction Method

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I extend my sincere gratitude to the Almighty for bestowing upon me the health, strength, and opportunity to undertake this research. I am deeply indebted to my supervisor, Dr Canicio Dzingirai, for his invaluable guidance, insightful advice, and constructive criticism, which significantly enhanced the quality of this study.

I would also like to express my appreciation to my colleagues at the Bank of Namibia, the Ministry of Finance and Public Enterprises, the Namibia Revenue Agency, and the Namibia Statistics Agency for their generous contributions in elucidating the potential practical linkages between the variables, thereby enriching the depth of this study.

Finally, I would like to acknowledge the unwavering support of my fiancé, whose sacrifices and belief in me were instrumental in the completion of this work. To God be the glory for enabling me to persevere and successfully finish this study.

DEDICATION

I dedicate this work to my courageous daughter, who inspires me with her resilience in the face of adversity, and to my beloved future wife, whose unwavering support has been invaluable. I am also grateful to the Bank of Namibia and the University of Namibia for providing me with the practical experience and intellectual stimulation necessary to undertake this research.

DECLARATIONS

I, Ben Kennedy Stephanus, hereby declare that the work presented in this study titled **"Examining the Taxation – Inflation Nexus in Namibia"** in partial fulfillment of the requirement for the award of the degree of Master of Science in Economics and submitted at the university of Namibia, is a true reflection of my own research, under the supervision of Dr Canicio Dzingirai.Therefore, this work, or part thereof has not been submitted for a degree in any other institution of higher education.

…….. APRIL 2025

Ben Kennedy Stephanus Date

LIST OF ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey Fuller Test
ARDL	Autoregressive Distributed Lag
AIC	Akaike Information Criterion
BDS	Brock-Dechert-Scheinkman
BoN	Bank of Namibia
BIC	Bayesian Information Criterion
CIT	Corporate Income Tax
CED	Customs and Excise Duties
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Square of Recursive Residuals
DF	Dickey-Fuller
DOLS	Dynamic Ordinary Least Squares
DP	Diesel Pump Price
ECT	Error correction term
EU	European Union
FMOLS	Fully Modified Ordinary Least Squares
FPE	Final Prediction Error
FTPL	Fiscal theory of the price level
HICP	Harmonised Index of Consumer Prices
HQC	Hannan-Quinn Criterion
IID	Independently and Identically Distributed
INF	Inflation
IMF	International Monetary Fund

MOFPE	Ministry of Finance and Public Enterprises
MME	Ministry of Mines and Energy
NARDL	Nonlinear Autoregressive Distributed Lag
NCPI	Namibia Consumer Price Index
NSA	Namibia Statistics Agency
OLS	Ordinary Least Squares
PP	Phillips-Perron
QTM	Quantity Theory of Money
RGDP	Real Gross Domestic Product
RR	Repo Rate
SACU	Southern African Customs Union
SIC	Schwarz Information Criterion
UR	Unemployment Rate
VAT	Value Added Tax
VECM	Vector Error Correction Model

LIST OF TABLES

LIST OF FIGURES

Contents

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The evaluation of the relationship between taxation and inflation continues to receive attention in policy and academic discourses. The debate originates from the apparent trade-off between increasing taxes to increase government revenue and ensuring that taxes do not cause excessive price volatility (Ncanwa & Setati, 2022; Akpan et al., 2024). Thus, African countries have refrained from raising taxes to meet development needs, especially during the COVID-19 pandemic 2020, because of worries about social welfare and the alleged inflationary effect of taxes (Akpan et al., 2024). A recent study by James et al. (2023) analysed the relationship between tax laws and price changes. Their research suggests that personal income tax increases lead to relatively rapid price reductions across a broad spectrum of goods and services, with a particularly pronounced effect on non-durable goods. This finding aligns with Keynesian economic theory, specifically the Phillips Curve postulation. The Phillips Curve suggests that a rise in aggregate demand suppression, achieved through higher direct and indirect taxes, leads to a corresponding decrease in price levels.

Conversely, Inim et al. (2020) found that corporate tax increases have a minimal impact on short-term price fluctuations and inflationary pressures. However, the study identifies a potential for long-term price increases, particularly for durable goods, following corporate tax hikes. This observation suggests the influence of supply-side factors in the price dynamics associated with corporate tax policy. Therefore, the research offers evidence for a distinction in the price-influencing mechanisms of personal and corporate tax increases. Personal tax increases operate through demand-side channels, while corporate tax increases exert their influence through supply-side factors (Beer et al., 2023). Moreover, the debate also extends the view that lowering

government spending to reduce the budget deficit and tax burden may support the regulation of inflation volatility (Madni, 2014; Mozdzierz, 2017; Obaretin & Akhor, 2019). However, Adegbite (2019) posits a contrasting perspective, arguing against a causal link between inflation and specific tax instruments such as Value Added Tax (VAT), Corporate Income Tax (CIT), and Customs and Excise Duties (CED). This position aligns with the tenets of Modern Quantity Theory, championed by Milton Friedman. This theory posits that inflation primarily stems from excessive money supply expansion relative to overall economic output (Friedman, 1971). The underlying principle reverts to the earlier formulations of the Quantity Theory of Money.

Meanwhile, global inflation rates have remained elevated as inflation accelerated from 3.1 per cent in 2021 to 8.7 per cent in 2022, the highest global inflation registered in forty years (International Monetary Fund (IMF), 2022). Considering these conditions, less focus has been placed on how rising inflation affects fiscal aggregates and policy direction and how it interacts with the tax system and causes distortions that may be rectified (Beer et al., 2023). Therefore, the unpredictable nature of some macroeconomic indicators may have a negative effect on an economy, necessitating the harmonisation of fiscal and monetary policy to achieve macroeconomic stability (Sharma & Mittal, 2021). Finally, the debate spreads to assessing whether tax policy effectively contains inflation (Atan, 2013).

Namibia has been confronted with persistent increases in tax rates coupled with elevated inflation. The relationship between inflation and taxes shows that Value added tax, corporate income taxes and Customs and excise taxes have been above inflation since 2011, hovering in the range of 5.0 per cent to 8.1 per cent from 2011-2023, Figure1.1. Namibia employs a progressive tax system where higher earners

contribute a greater proportion of their income. This system can mitigate income disparity, a legacy of the apartheid era. Taxes on luxury goods and harmful substances can discourage consumption and foster healthier lifestyles. However, high national debt burdens future generations. Increased tax revenue can reduce debt and improve fiscal soundness. Historically, tax hikes have frequently surpassed inflation rates. The primary weapon of fiscal policy in Namibia has been spending to stimulate economic growth; nevertheless, this analysis focuses on examining the relationship between tax policy and inflation.

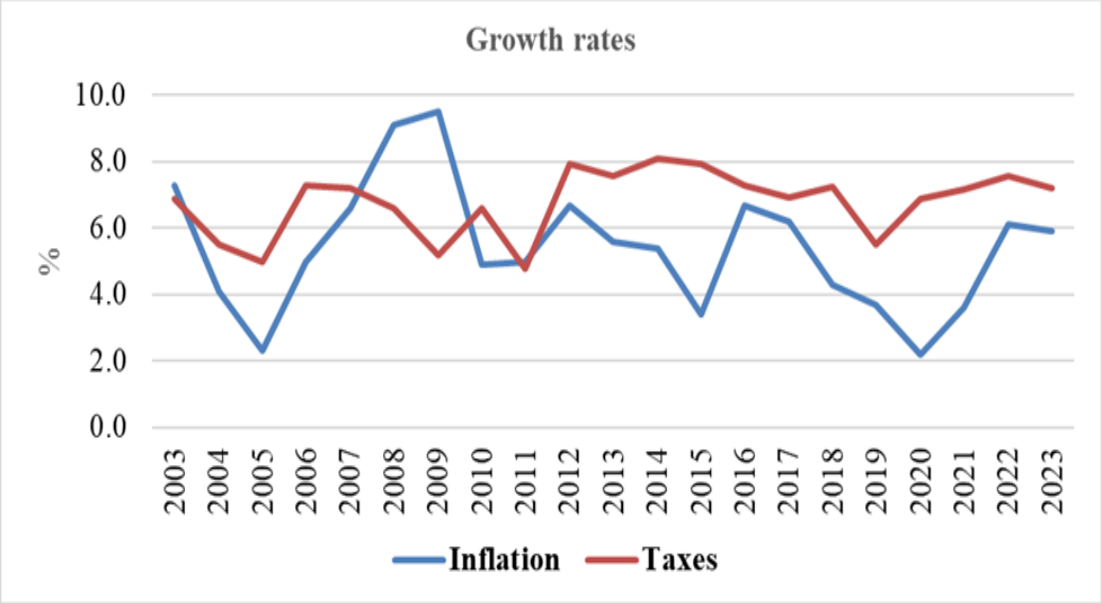


Figure 1.1: Trends in the relationship between Inflation and Indirect taxes
Source: Author's construction

When comparing Namibia's inflation to its major trading partners[1] it is relatively high, as shown in Figure 1.2. This suggests that the government may need to employ counteractive measures to address inflation disparities. Namibia's comparatively

[1] The major trading partners are South Africa, the Eurozone, Botswana, China, the United Arab Emirates, the United States, India, Zambia and Oman.

higher inflation rate relative to its trading partners often presents a competitive challenge. This economic condition interacts with exchange rates and trade balances to impact the nation's economic landscape. Elevated production costs stemming from inflation can hinder price competitiveness in international markets (Obaretin & Akor,2019). Consequently, governmental initiatives focused on research and development, export promotion, and industrial diversification are crucial to mitigating these economic headwinds.

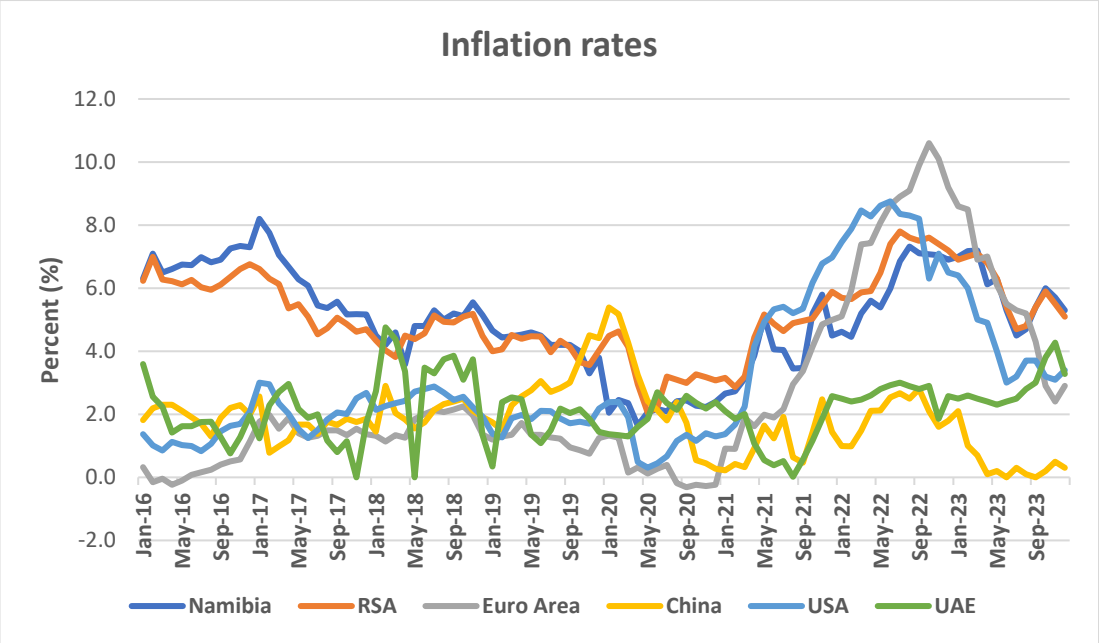


Figure 1.2:Namibia inflation versus Trading partner inflation
Source: Author's construction

Given the limited empirical research conducted on the topic, the evolution of the taxation-inflation nexus since the 2000s signals the significance of examining the causal relationship. This study aims to investigate the relationship empirically, given inconclusive literature evidence in different countries. Furthermore, this research is predicated on the potential policy benefits of employing tax instruments to mitigate inflationary pressures without sacrificing economic growth. By circumventing the

necessity for restrictive monetary policies, which can adversely impact aggregate demand, governments may be able to achieve a more balanced macroeconomic stabilization.

1.2 Statement of the Problem

Preserving price stability is the monetary and fiscal policy goal for most nations worldwide, including Namibia (Chakraborty & Varma, 2018). Despite efforts to keep Namibia's inflation in line with its major trading partners, it remains relatively high (Figure 1.2). This implies that policymakers may need to consider implementing measures to address the inflation differentials. According to the Bank of Namibia's 2019 to 2022 annual reports, this could involve a combination of monetary policy, fiscal policy, and structural reforms to stabilize the economy and enhance competitiveness. Numerous antecedent studies which examined the taxation-inflation nexus in different countries discovered inconsistent evidence. For instance, Mozdziers (2017) observed an inverse relationship between indirect taxes and inflation in selected EU countries. Akpan et al. (2024), motivated by the debate on how to use tax as a policy tool in selected African countries, found a unidirectional causality from taxes to inflation for some countries, while there was no relationship between taxes and inflation for a few countries. Conversely, Olatunji (2013) and Obaretin & Akhor (2019) found a positive relationship between indirect taxes and inflation in Nigeria. The corpus of international research on the relationship between taxes and inflation has been contradictory, divided, and divergent.

In Namibia, limited available empirical studies on the determinants of inflation (Odada & Eita, 2010; Ogbokor & Sunde, 2011; Undji & Kaulihowa, 2015; Eita et al., 2019) did not include taxation as a predictor of inflation in their models. Further, antecedent

literature only considered and assumed linearity when analysing the taxation-inflation nexus without testing for potential non-linearity. Thus, this study aims to close the methodological gap by testing for potential on non-linearity association between taxes and inflation. The goal of the study is to investigate nonlinear linkages between taxation and inflation because the literature that was previously accessible mainly concentrated on linear models without taking formal linearity tests and ignored possible existence of asymmetric relationships. Therefore, in recognition of the usefulness of taxation in curbing inflation, this study seeks to examine the effect of taxation on inflation in Namibia empirically.

1.3 Study Objective

1.3.1 Main objective

This study aims to examine Namibia's taxation-inflation nexus based on economic theory and econometric techniques over the period 1990 Q1 to 2023 Q4.

1.3.2 Specific objectives

- To determine the short-run and long-run effects of taxation on inflation in Namibia.
- To examine whether the relationship between inflation and taxation in Namibia is symmetry or asymmetry.
- To assess the direction of Granger causality between taxation and inflation in Namibia.

1.4 Hypotheses of the study

H_{01} = 0. Taxation has no short-run or long-run effect on inflation in Namibia.

$H_{11} \neq 0$. Taxation has a short-run and long-run effect on inflation in Namibia.

$H_{02} = 0$. Taxation does not Granger cause inflation in Namibia.

$H_{12} \neq 0$. Taxation Granger causes inflation in Namibia.

$H_{03} = 0$. Taxation has a symmetric relationship with inflation in Namibia.

$H_{13} \neq 0$. Taxation has an asymmetric relationship with inflation in Namibia.

1.5 Study Significance

While linear models have been widely used in empirical research to investigate the taxation-inflation nexus, specific issues still need to be explored (Obaretin & Akhor,2019). Empirically, there remains mixed and scant evidence supporting such a debate. Therefore, following symmetric diagnostic check results, this study aims to extend the literature by employing the Nonlinear Autoregressive Distributed Lag (NARDL) technique, which allows for a clear distinction between the positive and negative effects (Shin et al., 2014). Additionally, to the best of the researcher's knowledge, no study has been done to examine Namibia's taxation–inflation nexus. Further, the findings of the study may support the policy-making process as monetary policy proves to be ineffective in the long-term in curbing high inflation, and policymakers may consider employing alternative policies, such as fiscal policy, to address the issue. Finally, the study aims to close the Namibian and global literature gap and support future policy direction.

1.6 Limitations of the study

The study is limited to only three types of taxes in analyzing the taxation–inflation nexus in Namibia due to the limited availability of disaggregated time series data on direct taxes; hence, not all taxes are included in the scope of coverage. In this regard, only taxes such as value added tax (VAT), corporate tax, customs, and excise duties

are considered due to the inconsistent, varying, and divided evidence in antecedent literature. Furthermore, the study's scope is limited to the use of the Namibian Consumer Price Index (NCPI) as a proxy for inflation. This approach may not fully capture price increases in goods and services excluded from the NCPI basket, such as some inflation on specific commodities and services.

1.7 Delimitation of the study

This study is delimited to the Namibian economy, covering the period from the first quarter of 1990 to the fourth quarter of 2023. The analysis focuses on the relationship between taxation and inflation, excluding other potential influencing factors such as monetary policy and external shocks. Moreover, several macroeconomic variables affect inflation; however, the scope of this study solely focuses on taxation (VAT, corporate taxes, customs and excise duties and international crude oil price).

1.8 Structure of the study

The study is structured into five chapters of which contents are allocated as follows: Chapter one provides an introduction and overview of the study, introduces the statement of the problem, the objectives of the study, the hypotheses, the significance of the study, and the limitations and delimitations of the study. Chapter two reviews existing theoretical and empirical literature underpinning the taxation-inflation nexus. The third chapter presents a detailed explanation of the methodology by outlining the data types and sources, model specification, measurement of variables, estimation techniques and diagnostic tests employed in the study. Chapter four presents and discusses the model's results developed in the preceding chapter. Chapter five highlights the key conclusions and policy implications and provides areas for future research consideration.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The preceding chapter introduced the notion of the taxation-inflation nexus and provided a brief history of the relationship between taxes and inflation. Against this background, chapter two focuses on the underlying theoretical review and empirical studies pertaining to the taxation–inflation nexus.

2.2 Theoretical literature review

The nexus between taxation and inflation has ignited one of the most enduring debates within macroeconomics, spanning classical economic theory to contemporary discourse (Totonchi, 2011). This debate hinges on the divergent hypotheses proposed by various schools of thought. These disparities stem from contrasting perspectives on the most effective measures for inflation control and the unique economic realities faced by developed and developing nations. Therefore, the review explores the relationship between taxation and inflation (taxation-inflation nexus) through the lens of prominent economic theories. The study examines the Quantity Theory of Money (QTM), Monetarism, Keynesian Economics, Structuralist theory of inflation, Fiscal Theory of the Price Level and the Ricardian Equivalence theory, highlighting their convergences and divergences regarding the taxation-inflation nexus.

2.2.1 The Quantity Theory of Money

The quantity theory of money (QTM) is one of the longest-standing economic doctrines. It posits a direct relationship between the money supply and the general price level. This theory dominated 19th-century classical monetary analysis and served as the foundation for interpreting contemporary financial events and advocating for gold standard policies (Friedman & Schwartz, 1963). While David Hume (1711-17760) provided early insights into monetary changes affecting relative prices, David Ricardo, (1772-1823) downplayed these short-term effects in favour of long-run equilibrium analysis. Irving Fisher (1876 -1947) further formalized the QTM with his famous equation of exchange ($MV = PT$), alongside other equations like the Cambridge cash balance equation, reflecting the growing use of mathematics in neoclassical economics. These equations define conditions under which changes in money supply directly impact the price level.

However, these classical propositions do not directly address the taxation-inflation nexus. The QTM focuses on money supply as the primary driver of inflation. In contrast, the taxation-inflation nexus explores how specific taxes might influence price levels through demand-side or supply-side factors. While the QTM suggests inflation arises from changes in money supply, the taxation-inflation nexus explores how taxation policies might indirectly affect money supply or overall economic activity, ultimately influencing prices. For instance, higher taxes could decrease aggregate demand, potentially leading to disinflationary pressures (Beer et al.,2023). Conversely, certain taxes could impact production costs (supply-side), potentially pushing prices upwards (Pitchford & Turnovsky, 1975).

2.2.2 Monetary Theory of Inflation

Monetarism, championed by Milton Friedman, emphasizes the importance of money supply in influencing both short-run economic output and prices and long-run price levels. This school of thought argues that the long-run level of actual output remains unaffected by monetary policy (Friedman, 1963). Friedman famously stated, "Inflation is always and everywhere a monetary phenomenon," emphasizing that excessive money supply growth, outpacing overall economic output, is the primary driver of inflation. Conversely, according to Friedman (1963), central banks play a critical role in averting deflation by ensuring a sufficient money supply. Reducing the money supply or the velocity of money circulation causes deflationary forces. This core principle aligns with the earlier formulations of the Quantity Theory of Money, exemplified by Irving Fisher's well-known equation of exchange (MV=PT).

However, the taxation-inflation nexus diverges from this purely monetary perspective. Monetarism, by focusing solely on the money supply, does not explicitly consider the role of taxation in influencing inflation. The key distinction lies in the channels through which these theories propose inflation occurs. Monetarism views inflation as an imbalance between the money supply and actual output. On the other hand, the taxation-inflation nexus explores how specific taxes might influence prices through demand-side or supply-side factors. While both Monetarism and the taxation-inflation nexus address inflation, their explanatory frameworks differ significantly. Monetarism focuses on the money supply as the primary driver, while the taxation-inflation nexus explores the potential influence of taxation policies on inflation.

2.2.3 Demand-Pull Theory

Keynes (1936) and his followers, proponents of Keynesian economics, posit that inflation primarily arises from demand-pull pressures. Their framework suggests that any strategy that reduces aggregate demand can effectively mitigate inflationary or deflationary pressures. This is where the taxation-inflation nexus takes centre stage. According to Keynesian theory, raising or decreasing taxes is a potent tool for curbing or accelerating aggregate demand. Increased taxes reduce disposable income, thereby discouraging consumption spending.

Additionally, higher taxes on businesses can dampen investment activity. Consequently, by lowering aggregate demand, tax increases can help combat inflationary pressures (Sharma & Mittal, 2021). This linkage between taxation and inflation highlights a vital aspect of the taxation-inflation nexus. Keynesian economics provides a theoretical framework where specific tax policies can influence price levels through their impact on aggregate demand.

2.2.4 Structuralist Theory of Inflation

Nell (2004) posits that the foundation of structuralist inflation theory rests upon the identity that output price equals production costs. These costs comprise three components: gross profits, total wages, and intermediate inputs. Gross profits encompass taxes, depreciation, and productive costs. Total wages include taxes and employer-paid social contributions. Intermediate inputs can be domestic or imported, their value determined by international prices and the nominal exchange rate. According to structuralist inflation theory, two primary drivers of inflation in Namibia are identified: food supply rigidity and the insufficiency and instability of export

purchasing power. In a dual economy, food supply exhibits inelasticity, leading to highly flexible prices in response to demand fluctuations, whereas industrial sector prices exhibit upward rigidity and downward inflexibility, as per Nell (2004). Consequently, as Totonchi (2011) argues, overall inflation is induced, necessitating ratification by monetary authorities to maintain employment. Given that food prices react more swiftly than others, a price increase in food due to excess demand cannot be offset by a price decline in another product experiencing excess supply within the same period. This results in a temporary general price level increase, which becomes permanent if the money supply accommodates it. Conversely, if the money supply does not accommodate, the general price level may decline in the subsequent period in response to excess supply in the non-food sector. This recently proposed modified hypothesis of structural inflation, attributed to agricultural supply rigidity, elaborates upon the ratchet effect observed in the industrial sector.

2.2.5 Fiscal Theory of the Price Level

In this study, the relationship between taxes and inflation is attempted to be formed and explained, and one of the plausible theories to do so is the fiscal theory of the price level. Woodford's (1994) work highlights the role of fiscal policy, including taxes (present and future). The study investigates how taxes are affected by public debt and inflation expectations, which can lead to economic distortions. In this study, the fiscal theory of the price level is proposed as a suitable theory that attempts to form and explain the nature of the relationship between taxation and inflation. Traditionally, this role is tasked with the monetary policy advocated in the Quantity Theory of Money by

Friedman (1980). This theory challenges the monetarist hypothesis that money supply is the primary determinant of the price level and inflation.

According to the fiscal theory of the price level, the government can effectively inflate its debt. This implies that significant inflationary pressures brought on by the fiscal policy will reduce the actual amount of government debt that needs to be repaid. In terms of this theory, high price levels do not merit the need for present and future tax increases. Realizing that tax breaks and spending increases only sometimes need to be offset by future tax increases, however, this could lead to an overabundance of government and unstable public debt (Ncanywa & Setati, 2022). This theory is verified against the Ricardian equivalence proposition, which will be examined in the following subsection.

2.2.6 Ricardian Equivalence Theory

This study proposes the Ricardian equivalence hypothesis because it deviates from the fiscal theory of the price level on taxation perspective when the government raises spending. This idea was suggested by David Ricardo in 1951 and further expanded by Barro (1976). The theory accepts that economic agents are rational, enabling them to predict increased taxes when the government increases spending. According to this hypothesis, all government purchases must be funded by taxes. This theory does not consider inflation expectations brought on by an increase in government expenditure through borrowing, in contrast to the fiscal theory of the price level. Taxes must be raised to pay down the government debt. For the interest of this study, this theory predicts that when inflation rises, taxes will increase as well. According to this hypothesis, a tax decrease today is offset by a tax increase later. This economic theory

suggests that when a government tries to stimulate economic growth by decreasing taxes, this will lead to future inflation (Olatunji, 2013).

Therefore, a decrease in taxes has a negative relationship in the long run. The validity of the Ricardian equivalency theory is still up for discussion. Limited intertemporal awareness is a concept explored in economic theory, suggesting that consumers may only partially anticipate future consequences of their current financial decisions. This is evidenced by research indicating a potential disconnect between short-term spending behaviours and the long-term implications of policy changes, such as tax increases (Blanchard & Giavazzi, 2003). If accurate, the Ricardian equivalency theory may mitigate the effects of increases in government spending backed by debt. This could reduce the demand for governments to increase taxation to fight inflation. Even when expenditure is financed by debt, consumers may still need to anticipate future tax obligations fully and may respond to government stimulus by increasing their spending. However, the strength of this connection hinges on the empirical validity of the theory itself, which continues to be a topic of ongoing research.

2.3 Summary of theoretical review

Both QTM and Monetarism emphasize money supply as the primary driver of inflation. These theories diverge from the taxation-inflation nexus in their focus. QTM and Monetarism do not explicitly consider the role of taxes in inflation. Their explanatory framework revolves solely around money supply and its relation to actual output. Conversely, the taxation-inflation nexus explores how specific taxes can influence inflation through demand-side (consumption) or supply-side (production cost) factors.

Moreover, Keynesian economics provides a framework for tax policy to manage inflation. Increased taxes reduce disposable income, dampening aggregate demand (consumption and investment). This aligns with the taxation-inflation nexus, suggesting that raising taxes can be a tool to combat inflation.

According to structuralist inflation theory, two primary drivers of inflation in are identified as food supply rigidity and the insufficiency and instability of export purchasing power. They argue that in a dual economy, food supply exhibits inelasticity, leading to highly flexible prices in response to demand fluctuations, whereas industrial sector prices exhibit upward rigidity and downward inflexibility. This inflexibility in can result in slower adjustments of inflation when fiscal policy is employed to stabilise prices.

Further, The Fiscal Theory of the Price Level challenges the monetarist view of money supply being the sole determinant of inflation. It argues that government spending and taxation policies significantly influence inflation. Notably, high inflation can effectively erode the actual value of government debt, reducing the repayment burden. Furthermore, the Ricardian equivalence proposition offers a contrasting perspective. It posits that rational economic agents anticipate future tax increases to finance government spending. Therefore, a tax cut today will not stimulate spending as people expect higher taxes later. This contradicts the fiscal theory's idea of inflation reducing the real value of debt. Ricardian equivalence suggests that a decrease in taxes today might lead to higher inflation and future tax hikes in the long run.

Finally, the reviewed theories offer valuable insights into the taxation-inflation nexus. While QTM and Monetarism focus on money supply, Keynesian economics and fiscal theory highlight the potential influence of tax policy on inflation through demand and

supply-side effects. The Ricardian equivalence provides a counterpoint, suggesting that people's future tax expectations might negate the short-term impact of tax changes on inflation.

2.4 Empirical literature review

There is a dearth of literature on the relationship between taxation and Inflation, from Namibian researchers. The literature does not cover the relationship between taxes and inflation in Namibia; nonetheless, research on the subject is inconsistent worldwide because of various estimation methods and varying time periods. However, this component of the empirical approach brings to light studies that may support the topic in one way or another.

2.4.1 Studies outside Sub-Sahara Africa

A study by Madni (2014) analysed the effects of taxation, fiscal deficit, and inflation in Pakistan using annual time series data from 1979 to 2013. The study employed the bounds testing procedure and ARDL approach of co-integration. The results demonstrate that while the fiscal deficit contributes to the nation's rising inflation, direct and indirect taxes are also raising the inflation rate. According to the study, the government should cut spending to lower inflation, and investment should be encouraged to lower the budget deficit. In addition, reducing the tax rate is recommended to manage inflation. The analysis by Madni (2014) aligns with Keynesian economic principles.

Keynesian proposition suggests that taxation dampen inflation by reducing disposable income and, subsequently, aggregate demand (consumption and investment). This

aligns with Madni's finding of a positive correlation between taxation and inflation in Pakistan. However, it is essential to consider the long-term perspective offered by Ricardian equivalence. This theory suggests that tax reductions might ultimately lead to higher inflation in the future. The rationale lies in the expectation that governments will borrow to compensate for lost tax revenue, potentially increasing the money supply and fuelling inflation. Madni's study, focusing on the short-term impact, doesn't explore this long-term dynamic.

Similarly, Mozdziers (2017) investigated the impact of changes in indirect tax rates on inflation in selected European Union (EU) countries, namely Hungary, Romania, Greece, Latvia, Lithuania, and Estonia, using time series data for the period 2007-2016. The study employed a harmonised index of consumer prices (HICP). The study used two major statistical methods for estimating HICP: household surveys, which collect data on the prices of a basket of goods and services representing consumer expenditure. Weighted Averages: The total HICP index was calculated by weighting prices collected from surveys based on their relative importance in household consumption. According to Mozdzierz (2017), these procedures ensure that the HICP appropriately represents changes in the cost of living for all EU consumers. The study's findings revealed an inverse relationship between indirect taxes and inflation. This suggests that higher indirect taxes (VAT and CED) may exert downward pressure on inflation. The study suggests that a tax system with a significant share of indirect taxes equips fiscal authorities with a tool to indirectly influence price levels. This conclusion aligns with Keynesian economic principles, which posit that government spending and taxation can impact aggregate demand and inflation.

In addition, Sharma and Mittal (2021) conducted a study by revisiting the dynamics of India's fiscal deficit and inflation by employing a Nonlinear Autoregressive Distributed Lag (NARDL) approach. The study used annual times series data for the period 1980 to 2017. There was no evidence of a linear relationship between India's fiscal deficit and inflation. Additionally, the empirical findings of the NARDL model supported the concept of the Fiscal theory of the price level (FTPL) in the context of India by confirming the nonlinear long-term relationship between fiscal deficit and inflation and no association between money supply and inflation. According to the (FTPL), the overall level of prices in an economy is primarily determined by the government's fiscal policies, specifically its taxation and public debt management strategies.

Furthermore, an empirical investigation into the Structuralist theory of inflation, conducted by Kim (2024), significantly expanded upon previous research. This study assembled a comprehensive dataset encompassing 21 OECD countries, utilizing time-series data spanning four decades from 1973 to 2019. The robustness of the findings was rigorously examined through the incorporation of a diverse array of control variables and the application of various econometric techniques, including panel ARDL.

The study revealed a notable association between inflation and the variables identified within the Structuralist framework, particularly the labour share. The findings strongly suggest that the disinflationary trend observed over the past four decades can be primarily attributed to a diminished intensity of social conflict acting as price-propagating mechanisms, manifested in a declining labour share, which corresponds to an increase in income inequality.

Robust evidence of inflation persistence (inertia) was observed, as the lagged inflation term demonstrated statistical significance across all estimation models. The study's results are in strong alignment with the tenets of the Structuralist theory of inflation.

2.4.2 Studies from Sub-Sahara Africa

Moreover, Atan (2013) examined the use of taxation to influence inflation and unemployment in Nigeria. The study used time series data that covered the period 1970 to 2008 and employed Ordinary Least Squares (OLS) for the estimations. According to the study, when taxes were low there were years during which the inflation rate was lower and years during which it was higher. In years when the economy was experiencing high rates of inflation, the government reduced taxes. The study's findings indicate that taxes have a small but detrimental impact on the rate of inflation. The analysis concluded that tax policy was not effective in controlling inflation.

The study findings are in line with the Quantity Theory of Money (QTM) and Monetarism, which present opposing viewpoints. These theories emphasize the money supply as the primary driver of inflation. Their explanatory approach is primarily focused on the relationship between the money supply and real output, ignoring the potential influence of taxation on inflation dynamics. This contrasts with the taxation-inflation nexus, which highlights the impact of specific taxes on inflation via demand-side (consumption) or supply-side (production cost) variables.

Empirical work by Madito and Odhiambo (2018) investigated the main determinants of inflation in South Africa using quarterly data from 1970Q1 to 2015Q4. The study employed Error Correction Model (ECM) modelling techniques. The empirical results revealed that inflation expectations, labour cost, government expenditure and import prices are positive determinants of inflation in South Africa. At the same time, GDP

and exchange rate are negative determinants of inflation. According to the study, anchoring inflation expectations which had a major role in driving inflation should receive more attention. This result adds to the conventional Keynesian Phillips Curve by taking expectations into account. It implies that expectations for future inflation as well as previous inflation have an impact on current inflation. This idea is supported by the observation that anchoring inflation expectations is important.

Further, Obaretin and Akhor (2019) investigated the empirical relationship between taxation and inflation in Nigeria from 1994 to 2014 using ECM and found a positive relationship between indirect taxes and inflation in Nigeria. The results suggest that lawmakers in Nigeria should formulate an active tax policy to curb inflation. The study also suggested constantly reviewing tax policy in Nigeria to determine whether taxes contributed to the country's reduced inflation rates. These results are consistent with Keynesian economic concepts, which hold that government spending and taxation can influence aggregate demand and, therefore, inflation.

Furthermore, aiming to bridge the knowledge gap regarding the taxation-inflation nexus in diverse contexts, Adegbite (2019) investigated the relationship between various tax components and inflation in Nigeria. The study utilized Johansen cointegration and Granger causality tests on time series data from 1970 to 2017. Interestingly, the findings revealed no causal effect from individual tax components (petroleum tax, VAT, corporate tax, customs and excise duties) on inflation. However, the study identified a statistically significant negative relationship between aggregate taxation and inflation in the short and long run. This suggests that higher overall tax levels in Nigeria might act as a buffer against inflation. It is essential to acknowledge that Adegbite's (2019) findings diverge from perspectives like the Quantity Theory of

Money (QTM) and Monetarism. These theories prioritize money supply as the primary driver of inflation, neglecting the potential role of taxation.

Over and above, Ncanywa and Setati (2022) further explored the South African context by investigating the impact of inflation expectations and public debt on taxation using time series data from 2000 to 2020. Their analysis employed ARDL and Granger Causality techniques to reveal a long-term positive relationship between inflation expectations and taxation and a negative relationship between public debt and taxation. Notably, the study suggests that when consumers and businesses anticipate rising inflation, taxable income is also likely to increase. These findings align with Keynesian economic principles, where increased aggregate demand driven by inflationary expectations can lead to higher tax revenues.

Motivated by the ongoing debate on utilizing taxation as a policy tool for price stability, Akpan et al. (2023) employed the GARCH-MIDAS framework to analyse the relationship between tax measures and inflation in a selection of African countries. These countries included Burkina Faso, Cote d'Ivoire, Ethiopia, Ghana, Madagascar, Mauritius, Morocco, and South Africa. The study's unique strength lies in its incorporation of high- and low-frequency time series data from 2001 to 2021. This comprehensive approach allowed for a nuanced understanding of the dynamic relationship between taxation and inflation.

The findings revealed a diversified landscape across the countries. While unidirectional causality from taxes to inflation was observed in some cases, other countries exhibited no statistically significant relationship. This heterogeneity underscores the need for country-specific tax policy designs and implementation strategies. Furthermore, the study suggests that increases in overall tax revenue were

not a strong predictor of inflation volatility for most countries examined. Notably, Cote d'Ivoire and Madagascar emerged as exceptions, where higher tax revenue exacerbates inflation volatility.

Intriguingly, the study's overall results align more closely with theoretical perspectives such as the Fiscal Theory of the Price Level (FTPL), Quantity Theory of Money (QTM), Monetarism, and Ricardian Equivalence. These theories generally place less emphasis on the role of taxation in influencing inflation dynamics, in contrast to Keynesian economics, which emphasizes the potential impact of taxation on aggregate demand and, consequently, inflation.

2.4.3 Studies for Namibia

In Namibia, Odada and Eita (2010) investigated the determinants of inflation using time series data from 1972 to 2008. Their analysis employed a Vector Error Correction Model (VECM) technique. The study findings revealed a positive relationship between inflation and two key variables: money supply and imports. Notably, the model did not incorporate taxation as a potential determinant of inflation. Consequently, the results support theoretical frameworks like the Quantity Theory of Money (QTM) and Monetarism, emphasising money supply as the primary driver of inflation.

Building on prior research, Ogbokor and Sunde (2011) employed Ordinary Least Squares (OLS) regression to examine the hypothesis that import levels in Namibia drive inflation. Their analysis utilized annual time series data from 1990 to 2007. The study identified money supply and imports as statistically significant variables influencing Namibian inflation dynamics. However, similar to Odada and Eita (2010), their model did not incorporate the potential impact of taxation on inflation. The study adds empirical support for the fundamental ideas of Monetarism, Quantity Theory of

Money (QTM) and to a lesser extent, Fiscal Theory of the Price Level (FTPL) to the continuing discussion on factors influencing inflation. These theories prioritize money supply and government spending, respectively, as primary drivers of inflation, with less emphasis on the role of taxation.

Moreover, Undji and Kaulihowa (2015) employed a co-integration approach to investigate the determinants of inflation in Namibia. Their analysis utilized time series data spanning 1993 to 2013. The study identified government expenditure and imports as the primary drivers of inflation in the country. Notably, taxation was not included as a determinant in their model, unlike government expenditure. Interestingly, the authors connect their findings to the Keynesian proposition.

Eita et al. (2021) investigated the impact of fiscal deficit on inflation in Namibia using an Autoregressive Distributed Lag Model (ARDL) and Granger causality approach. Their study employed quarterly data from 2002 to 2007 and identified a positive long-run relationship between fiscal deficit and inflation. While their model incorporated government debt, discount rate, total tax revenue, total government expenditure, and broad money, it did not explicitly examine the impact of specific tax components on inflation. In contrast, this study aims to address this gap in the literature by focusing on the taxation-inflation nexus. This study employs a more granular approach, utilizing disaggregated tax data such as VAT, corporate tax, and customs and excise duties, to explore the potential non-linear relationship between taxation and inflation in Namibia. This focus on specific tax components and the potential for non-linear dynamics distinguishes the study from prior research like Eita et al. (2021).

2.5 Chapter Summary and Conclusion

The existing body of research on the relationship between taxation and inflation presents a complex and multifaceted picture. Keynesian theory posits a positive association between taxation and inflation due to its influence on aggregate demand. Conversely, Ricardian equivalence theory suggests that tax reductions might have a long-term offsetting effect on inflation. Further complicating the picture, Quantity Theory of Money (QTM) and Monetarism prioritise money supply as the primary driver of inflation. Empirical studies in Sub-Saharan Africa, such as those conducted in Nigeria and South Africa, yield diverse results. Some studies support Keynesian predictions, while others align more closely with QTM and Monetarism. Within the Namibian context, a critical gap exists in the literature. Existing research on inflation determinants by Odada & Eita (2010), Ogbokor & Sunde (2011), Undji & Kaulihowa (2015), and Eita et al. (2021) has not explicitly examined the impact of specific tax components on inflation. These studies primarily focus on money supply, imports, government expenditure, and fiscal deficit as inflation drivers. This study aims to address this gap by investigating the non-linear relationship between disaggregated tax components (VAT, corporate tax, customs and excise duties) and inflation in Namibia.Prior research has predominantly employed linear models, neglecting the potential for asymmetric relationships. Recognizing the potential effectiveness of taxation in managing inflation, this study uses a more granular approach to explore these dynamics in the Namibian context. This research design capitalises on the limitations identified within the existing literature. By focusing on disaggregated tax components and employing a non-linear framework, the study offers a novel contribution to the understanding of the taxation-inflation nexus in Namibia. The next chapter outlines the research methodology of the study in detail.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

To examine the taxation-inflation nexus in Namibia, various econometric techniques are employed in this study. This chapter briefly discusses the time series properties of the data and variables, model specification, and diagnostic test.

3.2 Data and Data Sources

The study selects economic variables and data based on the theories that pertain to the taxation-inflation nexus. The study follows a quantitative analysis, which is dependent on secondary data. Further, analysis in this study uses quarterly time series data that covers the period 1990Q1 to 2023Q4, which includes data on value added tax, corporate taxes and customs, customs and excise duties, diesel pump price, real gross domestic product, repo rate, unemployment rate and inflation rate. The identified period was chosen to provide valuable insights by capturing long-term trends, mitigating the impact of short-term shocks, and enhancing the robustness and reliability of research findings. Log-transformed variables are used for the analysis.

The estimation package is the 13th version of the EViews software and R-studio for the BDS test. Table 3.1 provides a detailed description of the data, while Table 3.2 presents the macroeconomic linkages between variables.

Table 3.1: Variables, Definition and Data Sources

Dependent Variable	Variable description	Source
INF	Inflation	NSA
Independent Variables		
VAT	Value added tax (N$ million)	MoFPE
CIT	Company income tax (N$ million)	MoFPE
CED	Customs and Excise Duties revenue (N$ million)	MoFPE
DP	Diesel pump price N$/L	MME
RGDP	Real gross domestic product (income)-2015 base year	NSA
RR	Repo Rate	BoN
UR	Unemployment rate	NSA

Source: Author's own construction

Note: The sources of the data are the Ministry of Finance and Public Enterprises (MoFPE), Bank of Namibia (BoN), Namibia Statistics Agency (NSA), Ministry of Mines and Energy (MME).

Table 3.2: Macroeconomic linkages between variables

Variable	Expected sign	Rationale
INF and VAT	Positive	According to the Fiscal theory of price level any increase in an indirect tax will cause an increase in the general price level over time.
INF and CIT	Positive	Keynesian theory postulates that any increase in production cost will be passed on to the consumer through higher prices in goods and services.
INF and CED	Positive	The Keynesian aggregate demand approach regard Import taxes as having a negative effect on prices of goods and services and translate into higher prices of goods and services.
INF and DP	Positive	Diesel price has a positive relationship with inflation through higher/lower transport inflation and production cost.
INF and RGDP	Positive	Classical economic view (neutrality of money) suggest that moderate inflation can sometimes accompany healthy GDP growth. As an economy expands, demand for goods and services increases, which can lead to some price hikes.
INF and RR	Positive	When the Consumer Price Index (CPI) exhibits a significant upward trend, indicating inflationary pressures, central banks often implement a policy of increasing the repo rate. Conversely, if the CPI demonstrates a downward trajectory, suggesting deflationary tendencies or a lack of price growth, central banks may opt to lower the repo rate.
INF and UR	Negative	**The Phillips Curve** is a macroeconomic concept that illustrates the inverse relationship between unemployment and inflation. In general, it suggests that: **Low unemployment:** As unemployment rates decrease, demand for goods and services increases. This can lead to higher prices,

		resulting in inflation. **High unemployment:** When unemployment rates rise, spending decreases, which can put downward pressure on prices, reducing inflation.

Source: Author's own construction

3.3 Model Specification

To examine the taxation – inflation nexus,the model by Sharma and Mittal (2021) is modified for the research. The Bounds test, unlike other cointegration tests, is robust to sample size limitations (Narayan, 2005), enabling reliable cointegration analysis with smaller datasets. Nkoro and Uko (2016) advocate for the ARDL/NARDL approach due to its advantages, including the capacity to assess asymmetric effects, crucial for this study, and its adaptability to variables with varying orders of integration, enhancing its versatility in economic modelling.

Additionally, the study employs the Consumer Price Index (CPI) as a proxy for the inflation rate as the dependent variable, a common approach in the literature (Cecchetti & Debelle, 2005).

The methodologies and proxies for the variables are as follows, intended for the purposes of this study:

Inflation - dependant variable- NCPI

Taxation - measured by Value Added Tax (VAT) revenue, Companies' Income Tax (CIT) revenue, Customs and Excise Duties (CED) revenue, independent variables.

Control variables:

Fuel pump price (DP): measured by Namibia diesel price

Income - measured by real gross domestic product (RGDP)

Interest rate - measured by the Repo rate (RR)

Unemployment rate - UR

The functional model is specified as:

$$INFL_t$$

$$= f(VAT_t,\ CIT_t,\ CED_t, DP_t, RGDP_t, RR_t, UR_t\ ) \quad (1)$$

The generic form NARDL model to test asymmetric cointegration is as follows:

$$INF_t = \beta_0 + \beta_1^+ VAT_t^+ + \beta_2^- VAT_t^- + \beta_3^+ CIT_t^+ + \beta_4^- CIT_t^- + \beta_5^+ CED_t^+ + \beta_6^- CED_t^- +$$

$$+\beta_7 RGDP_t + \beta_8 DP_t + \beta_9 RR_t + \beta_{10} UR_t + e_t$$

(2)

In equation (2), $VAT_t^+ and\ VAT_t^-$; CIT_t^+ & CIT_t^-; CED_t^+ & CED_t^- are the partial sum of positive and negative changes in VAT, companies' tax revenue, customs and excise duties respectively:

$$VAT_t^+ = \sum_{j=1}^{t} \Delta VAT_j^+ = \sum_{j=1}^{t} max(\Delta VAT_j, 0) \quad (3)$$

$$VAT_t^- = \sum_{j=1}^{t} \Delta VAT_j^- = \sum_{j=1}^{t} min(\Delta VAT_j, 0) \quad (4)$$

$$CIT_t^+ = \sum_{j=1}^{t} \Delta CIT_j^+ = \sum_{j=1}^{t} max(\Delta CIT_j, 0) \quad (5)$$

$$CIT_t^- = \sum_{j=1}^{t} \Delta CIT_j^- = \sum_{j=1}^{t} min(\Delta CIT_j, 0) \quad (6)$$

$$CED_t^+ = \sum_{j=1}^{t} \Delta CED_j^+ = \sum_{j=1}^{t} max(\Delta CED_j, 0) \quad (7)$$

$$CED_t^- = \sum_{j=1}^{t} \Delta CED_j^- = \sum_{j=1}^{t} min(\Delta CED_j, 0) \quad (8)$$

Equations 3-8 is the positive and negative partial sum decomposition for investigating the asymmetric impact of taxation on inflation., Shin and Greenwood-Nimmo (2014) NARDL approach modified equation (2). In similar spirit and suggestions of Pesaran and Shin (1998) and Pesaran et al. (2001), the study specifies the error-correction representation of the NARDL from (2) as follows:

$$\Delta INF_t = \sigma + \rho INF_{t-1} + \omega_1^+ VAT_{t-1}^+ + \omega_2^- VAT_{t-1}^- + \omega_3^+ CIT_{t-1}^+ + \omega_4^- CIT_{t-1}^- +$$

$$\omega_5^+ CED_{t-1}^+ + \omega_6^- CED_{t-1}^- + \omega_7 RGDP_{t-1} + \omega_8 DP_{t-1} + \omega_9 UR_{t-1} + \omega_{10} RR_{t-1} +$$

$$\sum_{j=1}^{p-1} \delta_j \Delta INF_{t-j} + \sum_{j-0}^{p-1} \left(\Theta_j^+ \Delta VAT_{t-j}^+ + \Theta_j^- \Delta VAT_{t-j}^- + \pi_j^+ \Delta CIT_{t-j}^+ + \pi_j^- \Delta CIT_{t-j}^- \right. +$$

$\Phi_j^+ \Delta CED_{t-j}^+ + \Phi_j^- \Delta CED_{t-j}^- + \varphi_j \Delta RGDP_{t-j} + \lambda_j \Delta DP_{t-j} + \sigma_j \Delta UR_{t-j} +$

$\gamma_j \Delta RR_{t-j}) + \mu ECT_{t-1} + e_t$ (9)

In equation (9), the coefficients $(\omega_1^+, \omega_2^-, \omega_3^+, \omega_4^-, \omega_5^+, \omega_{6,}^-, \omega_7, \omega_8, \omega_9, \omega_{10})$ represent the long run relationship, while coefficients $\sum_{j=0}^{q-1}[\theta_j^+, \theta_j^-, \pi_j^+, \pi_j^-, \phi_j^+, \phi_j^-, \varphi_j, \lambda_j, \sigma_j, \gamma_j]$ represent the short term dynamics of the model. Also μ represents the adjusted coeficient and ECT_{t-1} is the error correction term.

In addition , $\beta_1^+ = \left(-\frac{\omega_1^+}{\rho}\right)$, $\beta_2^- = \left(-\frac{\omega_2^-}{\rho}\right), \beta_3^+ = \left(-\frac{\omega_3^+}{\rho}\right)$, $\beta_4^- = \left(-\frac{\omega_4^-}{\rho}\right), \beta_5^+ = \left(-\frac{\omega_5^+}{\rho}\right), \beta_6^- = \left(-\frac{\omega_6^-}{\rho}\right)$, are the asymmetric long run elasticities for $VAT_t^+, VAT_t^-, CIT_t^+, +CIT_t^-, CED_t^+, CED_t^-$, respectively, whereas, e_t is the error term.

3.4 Diagnostic tests

3.4.1 Unit root Test

Testing for unit root is very critical when dealing with time series data as almost all macroeconomic time series exhibit trending behaviour. When time series data is nonstationary it may produce nonsensical results (Gujarati & Porter, 2009). Therefore, it is imperative to remove unit root from a series by differencing the variables, however, it must be noted that some macroeconomic variables do not become stationary at first difference and require further differencing. The existence of a unit root signifies that a shock to the series has a persistent effect, potentially rendering it indefinitely non-stationary (Enders, 2010).

Dickey-Fuller (DF) and Phillips-Perron (PP) tests have become cornerstones of unit root testing in time series econometrics. This dominance stems from their ability to address the challenge of non-stationarity, a common characteristic where the data's

mean and variance fluctuate over time. The Dickey-Fuller test, introduced by (Dickey & Fuller (1979), laid the foundation for modern unit root testing. It regresses the differenced series on its lagged level (past value) and tests the null hypothesis of a unit root against the alternative of stationarity (Gujarati, 2003). The Phillips-Perron test (Phillips & Perron, 1988) builds upon the DF test by addressing a potential limitation. The DF test assumes no serial correlation (dependence) in the error terms. In practice, however, serial correlation can be present. The PP test tackles this by employing a non-parametric correction to the t-statistic, making it robust to unspecified autocorrelation in the errors (Gujarati & Porter, 2009). While the PP test offers robustness, Davidson and MacKinnon (2004) suggest it might have lower power (ability to correctly reject a false null) compared to the DF test in finite samples (limited data). The Dickey-Fuller and Phillips-Perron tests provide a solid foundation for unit root testing in time series analysis. The DF test offers a clear starting point, while the PP test adds robustness. Understanding the trade-offs between power and robustness allows researchers to choose the most appropriate test for their specific data and research question (Asteriou & Hall, 2007).

In practice, when the ADF p-value is less than significance level (e.g., 0.05 percent), the study rejects the null hypothesis and conclude that the underlying series is stationary. On the other hand, ADF value that is greater than its critical value shows that the underlying series is stationary. However, the null hypothesis cannot be rejected about non-stationarity based on the ADF test, since its power is not that strong (Gujarati & Porter, 2009). Therefore, the PP test is also employed for the study to test for stationarity, which has the same null hypothesis as ADF, and its distribution is the same as the ADF test statistic.

The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) equations are presented by Nkoro and Uko (2016) as follows:

ADF equations:

The equation 10 is a pure random walk model with no intercept and time trend.

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{p} \mu_{1i} \Delta Y_{t-i} + \varepsilon_t \quad (10)$$

The random walk model with a drift implies an intercept but no time trend as reported in equation 11.

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum_{i=1}^{p} \mu_{1i} \Delta Y_{t-i} + \varepsilon_t \quad (11)$$

Model 12 displays a random walk model with an intercept and trend

$$\Delta Y_t = \beta_0 + \beta_1 T + \delta Y_{t-1} + \sum_{i=1}^{p} \mu_{1i} \Delta Y_{t-i} + \varepsilon_t \quad (12)$$

PP equations:

The equation 13 is a pure random walk model with no intercept and time trend.

$$\Delta Y_t = \delta Y_{t-1} + \varepsilon_t \quad (13)$$

The random walk model with a drift implies an intercept but no time trend.

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \varepsilon_t \quad (14)$$

Model 15 displays a random walk model with an intercept and a time trend

$$\Delta Y_t = \alpha_0 + \alpha_1 T + \delta Y_{t-1} + \varepsilon_t \quad (15)$$

3.4.2 Bounds Test for Cointegration

According to Wooldridge (2003) cointegration is the concept that a linear combination of two time series, each of which is integrated of order one, is integrated of zero. To examine the long-run relationship between variables, the study employ the bounds testing approach of Pesaran et al. (1999, 2001). Whether the underlying variables are integrated by order I (0), order I(1), or both, this approach can be used.

Unlike other cointegration tests, the Bounds test is less susceptible to sample size limitations (Narayan, 2005). This flexibility allows researchers to confidently assess cointegration even with limited data sets. Nkoro and Uko (2016) in their study of the ARDL bounds testing approach outline the reasons why the method is preferred over other methodologies. The ARDL technique is advantageous for its applicability to smaller datasets, a characteristic relevant to this study. Furthermore, its ability to accommodate variables with different orders of integration makes it a versatile tool in economic modelling. Lastly, the ARDL framework allows for the derivation of a dynamic error correction model (ECM) through a straightforward linear transformation (Nkoro & Uko, 2016). Following Nkoro and Uko (2016), the ARDL model is a preferred approach due to its efficiency and robustness to lag length selection. Furthermore, the model is less likely to suffer from endogeneity problems when the error terms are not serially correlated.

The ARDL bounds test technique uses the F-statistic and critical values to draw conclusions about the hypothesis. If the computed F statistic is larger than the upper bound critical values,

the null hypothesis of no cointegration is rejected at all significance levels. Therefore, the short or long-run NARDL model is estimated (Equation 9).

The hypotheses are as follows.

H_0: No cointegration

H_1: There is a cointegration

The test is found to be inconclusive if the calculated F statistic lies between the upper and lower bounds.

3.4.3 Lag selection Criteria

Selecting the appropriate lag length in time series analysis is paramount for obtaining reliable and efficient estimates. Underfitting (too few lags) can lead to biased and inefficient estimates by neglecting past information crucial for the model (Gujarati, 2003). Conversely, overfitting (too many lags) introduces random noise alongside relevant relationships, overstating the variance of estimates and reducing the model's generalizability (Gujarati, 2003).

To navigate this challenge, researchers leverage lag length selection criteria like Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Criterion (HQC), Final Prediction Error (FPE), and Bayesian Information Criterion (BIC). These criteria aim to strike a balance between the model's goodness-of-fit and its parsimony (complexity). Selecting the optimal lag length significantly improves model performance by capturing relevant data dynamics without unnecessary complexity (Lutkepohl, 2005). This translates to more trustworthy estimates and accurate forecasts.

Inappropriate lag selection can lead to spurious regressions, where seemingly significant relationships arise due to model misspecification (Hendry, 1995). Lag length criteria help circumvent these pitfalls, ensuring robust model inference.

Each criterion employs a distinct approach to penalize complexity while considering goodness-of-fit. For instance, AIC generally favours more parsimonious models compared to BIC (Burnham & Anderson,2002).

Some criteria, like AIC, exhibit lower bias with respect to sample size compared to SIC (Hannan & Quin, 1979). This is particularly important for limited data sets. For smaller samples, AIC or FPE might be preferred due to their lower bias compared to SIC or BIC (Lutkepohl, 2005). If the model already possesses high complexity due to numerous variables, a more parsimonious criterion like SIC or BIC might be a better choice to avoid overfitting (Shibata, 1976). The selection of the appropriate criteria, to ensure the robustness and reliability of their time series models is based on the length selected by the majority of the criteria.

3.4.4 Test for long run and short run asymmetries

To analyse the asymmetric effects in the short-run and long-run within the context of Equation (9), this study utilizes the Wald test developed by (Shin & Greenwood-Nimmo, 2014). The short run asymmetric test null hypothesis is stated as $\sum_{j=0}^{q-1}[\theta_j^+, \phi_j^+, \pi_j^+] = \sum_{j=0}^{q-1}[\theta_j^-, \phi_j^-, \pi_j^-]$,while long run asymmetric null hypothesis is $\omega_1^+, \omega_3^+, \omega_5^+, = \omega_2^-, \omega_4^-, \omega_6^-$. The null hypothesis is that the relationship is symmetrical, while the alternative hypothesis states that the relationship is asymmetrical. The null hypothesis is rejected if the p-value is less than the 5% level of significance, implying an asymmetric relationship exist between the variables (Quamruzzaman & Jianguo, 2018).

3.4.5 Causality Test

The Wald test can be used to further hone the Granger causality analysis inside the NARDL framework. It is possible to identify asymmetries in the causal relationship with this test. The study will test for both short-run and long-run causality which can

be obtained from the significance of the adjustment coefficient of the error correction term.

Essentially, it evaluates whether changes in one variable, whether positive or negative, have a distinct influence on the other variable than changes in any other variable. This feature is especially useful when taking into account non-linear dynamics, which NARDL models are good at representing (Pesaran et al.,2001).

The short and long run causality is examined using the Wald test from equation (9), we have:

$$\Delta INF_t = \sigma + \rho INF_{t-1} + \omega_1^+ VAT_{t-1}^+ + \omega_2^- VAT_{t-1}^- + \omega_3^+ CIT_{t-1}^+ + \omega_4^- CIT_{t-1}^- + \omega_5^+ CED_{t-1}^+ + \omega_6^- CED_{t-1}^- + \omega_7 RGDP_{t-1} + \omega_8 DP_{t-1} + \omega_9 UR_{t-1} + \omega_{10} RR_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta INF_{t-j} + \sum_{j-0}^{p-1} \left(\Theta_j^+ \Delta VAT_{t-j}^+ + \Theta_j^- \Delta VAT_{t-j}^- + \pi_j^+ \Delta CIT_{t-j}^+ + \pi_j^- \Delta CIT_{t-j}^- + \Phi_j^+ \Delta CED_{t-j}^+ + \Phi_j^- \Delta CED_{t-j}^-\right) + \varphi_j \Delta RGDP_{t-j} + \lambda_j \Delta DP_{t-j} + \sigma_j \Delta UR_{t-j} + \gamma_j \Delta RR_{t-j}) + \mu ECT_{t-1} + e_t \quad (16)$$

Equation (17) below uses the Walt test to capture both short-run and long run dynamics in the relationship between VAT and the independent variables including the lag value of VAT. The test helps to determine if the positive (or negative) changes in one independent variable have a different impact on VAT compared to negative (or positive) changes in the other independent variables.

$$\Delta VAT_t = \sigma + \rho VAT_{t-1} + \omega_1^+ INF_{t-1}^+ + \omega_2^- INF_{t-1}^- + \omega_3^+ CIT_{t-1}^+ + \omega_4^- CIT_{t-1}^- + \omega_5^+ CED_{t-1}^+ + \omega_6^- CED_{t-1}^- + \omega_7 RGDP_{t-1} + \omega_8 DP_{t-1} + \omega_9 RR_{t-1} + \omega_{10} UR_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta VAT_{t-j} + \sum_{j-0}^{q-1} \left(\Theta_j^+ \Delta INF_{t-j}^+ + \Theta_j^- \Delta INF_{t-j}^- + \pi_j^+ \Delta CIT_{t-j}^+ + \pi_j^- \Delta CIT_{t-j}^- + \Phi_j^+ \Delta CED_{t-j}^+ + \Phi_j^- \Delta CED_{t-j}^-\right) + \varphi_j \Delta RGDP_{t-j} + \lambda_j \Delta DP_{t-j} + \gamma_j \Delta RR_{t-j} + \infty_j \Delta UR_{t-j} + \mu ECT_{t-1} + e_t \quad (17)$$

Similarly, Equation (18) employs the Wald test to analyse the short-run and long-run dynamics within the relationship between CIT and the independent variables, which incorporate a lagged term for CIT itself. This test specifically assesses whether the impact of positive (or negative) changes in one independent variable on CIT differs significantly from the impact of negative (or positive) changes in another independent variable.

$$\Delta CIT_t = \sigma + \rho CIT_{t-1} + \omega_1^+ INF_{t-1}^+ + \omega_2^- INF_{t-1}^- + \omega_3^+ VAT_{t-1}^+ + \omega_4^- VAT_{t-1}^- +$$

$$\omega_5^+ CED_{t-1}^+ + \omega_6^- CED_{t-1}^- + \omega_7 RGDP_{t-1} + \omega_8 DP_{t-1} + \omega_9 RR_{t-1} + \omega_{10} UR_{t-1} +$$

$$\sum_{j=1}^{p-1} \delta_j \Delta CIT_{t-j} + \sum_{j-0}^{q-1} \left(\Theta_j^+ \Delta INF_{t-j}^+ + \Theta_j^- \Delta INF_{t-j}^- + \pi_j^+ \Delta VAT_{t-j}^+ + \pi_j^- \Delta VAT_{t-j}^- + \right.$$

$$\left. \Phi_j^+ \Delta CED_{t-j}^+ + \Phi_j^- \Delta CED_{t-j}^- \right) + \varphi_j \Delta RGDP_{t-j} + \lambda_j \Delta DP_{t-j} + \gamma_j \Delta RR_{t-j} +$$

$$\infty_j \Delta UR_{t-j} + \mu ECT_{t-1} + e_t \quad (18)$$

Like Equation (18), Equation (19) utilizes the Wald test to examine the short-run and long-run interactions between CED and the independent variables, including a lagged CED term. This statistical test is employed to determine if the effect of positive (or negative) changes in one independent variable on CED is statistically different from the effect caused by negative (or positive) changes in another independent variable.

$$\Delta CED_t = \sigma + \rho CED_{t-1} + \omega_1^+ INF_{t-1}^+ + \omega_2^- INF_{t-1}^- + \omega_3^+ CIT_{t-1}^+ + \omega_4^- CIT_{t-1}^- +$$

$$\omega_5^+ VAT_{t-1}^+ + \omega_6^- VAT_{t-1}^- + \omega_7 RGDP_{t-1} + \omega_8 DP_{t-1} + \omega_9 RR_{t-1} + \omega_{10} UR_{t-1} +$$

$$\sum_{j=1}^{p-1} \delta_j \Delta CED_{t-j} + \sum_{j-0}^{q-1} \left(\Theta_j^+ \Delta INF_{t-j}^+ + \Theta_j^- \Delta INF_{t-j}^- + \pi_j^+ \Delta CIT_{t-j}^+ + \pi_j^- \Delta CIT_{t-j}^- + \right.$$

$$\left. \Phi_j^+ \Delta VAT_{t-j}^+ + \Phi_j^- \Delta VAT_{t-j}^- \right) + \varphi_j \Delta RGDP_{t-j} + \lambda_j \Delta DP_{t-j} + \gamma_j \Delta RR_{t-j} +$$

$$\infty_j \Delta UR_{t-j} + \mu ECT_{t-1} + e_t \qquad (19)$$

The causal effect in the equations above is measured using the Wald test (F- statistics). Therefore, the null hypothesis is rejected if the probability value is less than 5% significance level otherwise it is not rejected.

3.4.6 Normality Test

This test determines whether the residuals are normally distributed using the (Jarque & Bera, 1987) test. The test measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The importance of normality stems from the reliance of statistical tests, such as t-tests and F-tests, on critical values and probability distributions derived from the normal distribution (Wooldridge, 2003). When the error terms deviate from normality, the validity of these tests and their associated p-values can be compromised (Gujarati, 2003).

The hypothesis is specified as follows:

H_0: Residuals are normally distributed

H_1: Residuals are not normally distributed

In this test, a probability value that is less than 5% level of significance, leads to the rejection of the null hypothesis of a normal distribution.

3.4.7 Heteroscedasticity Test

A cornerstone of robust regression analysis is the application of heteroscedasticity tests. These tests play a critical role in safeguarding the validity and reliability of inferences drawn from regression models. By identifying the presence of unequal error variances, heteroscedasticity tests prevent the misinterpretation of results and facilitate the construction of more robust and informative models (Hjort et al., 2018).

This test, which derives from the Lagrange multiplier test principle, determines whether there is homoscedasticity. It evaluates if the regressor values have an impact on the variance of the regression error term. White (1980) and Breusch-Pagan (1979) methods are the tests that are employed.

The hypotheses are:

H_0: Homoscedastic residuals.

H_1: Heteroscedastic residuals.

In this test, a probability value that is less than 5% level of significance, implying that the variance is not constant.

3.4.8 Test for Serial Correlation

The presence of serial correlation induces a downward bias in the estimated standard errors of regression coefficients. This underestimation manifests as unduly narrow confidence intervals, thereby jeopardizing the validity of statistical inference. Consequently, the perceived significance of estimated effects may be artificially inflated, potentially leading to spurious conclusions (Gujarati & Porter, 2009). Fortunately, the application of serial correlation tests can readily identify this issue. By implementing corrective measures, such as the adoption of robust standard errors or alternative estimators like the Cochrane-Orcutt procedure (Wooldridge, 2010).

This test aids in finding out whether the period's residual depends on the previous period’s residuals. For evaluating serial correlation, the study uses the Breusch-Godfrey (1978) test, which is based on the Lagrange multiplier test. The hypotheses are:

H_0: No serial correlation.

H_1: There is serial correlation.

When the probability value is less than the 5% level of significance, the null hypothesis that there is no serial correlation is rejected.

3.4.9 Test for Misspecification of the Model

Misspecified models may lead to biased estimates and unreliable inferences. Tests help identify these concerns, allowing one to refine the model by including missing variables, transforming variables, or choosing a more appropriate functional form. This leads to a model that better reflects the underlying relationships in the data and produces more valid results (Ramsey & McFadden, 1979). This test uses the Ramsey (1969) regression specification error (RESET) test to assist determine whether the model is accurately described. In this test, the null hypothesis of accurate specification cannot be rejected if the estimated F-value is significant at the 5% level.

3.4.10 Model Stability Test

Stable models are more trustworthy when used for policy analysis or forecasting. By confirming the model's capacity to generate consistent predictions across diverse scenarios, the foundation for policy recommendations is solidified (Stock & Watson, 2003).

The CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Square of Recursive Residuals) tests for residuals following Galpin and Hawkins (1984) are carried out to validate the stability of the model estimates in the short- and long-run.

Maintaining the CUSUM and CUSUMQ figures within the 5% critical bound is crucial. This guarantees that the model is sufficiently stable and effective in estimating the short- and long-term relationships of the variables being explained. Therefore, one can reject the null hypothesis of stability if the CUSUM and CUSUMSQ cross the 5% significance level, as this is evidence against the structural stability of the given model.

3.4.11 Dynamic Multipliers

Asymmetric dynamic multipliers measure how shocks or changes to exogenous variables affect the endogenous variables of a model over time (Shin et al., 2014). These multipliers help us understand the short-term and long-term impacts of policy interventions. By analysing dynamic multipliers, we can assess the effectiveness of policy measures and predict potential economic outcomes under different scenarios.

3.4.12 Test for Robustness of the Results

To guarantee the reliability and generalisability of the study findings of the taxation – inflation nexus in Namibia, a multifaceted methodological approach is essential. While traditional Ordinary Least Squares (OLS) regression has been widely used, it may be insufficient to address the complexities inherent in economic time series data.

To mitigate potential endogeneity concerns, arising from the bidirectional causality between taxes and inflation, the study employs Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) as additional estimation techniques. These methods have been extensively validated in the econometric literature for their ability to handle endogeneity issues, cointegrated relationships and address issues of serial correlation and heteroscedasticity (Pesaran, Shin, & Smith, 1992; Stock & Watson, 1993). By incorporating FMOLS and DOLS, we aim to produce more robust and efficient estimates of the tax-inflation nexus.

3.5 Chapter conclusion

This chapter discussed econometric techniques employed in examining the taxation - inflation nexus in Namibia. The chapter focused on the definitions and time series characteristics of the study's variables, the development of the appropriate model and the various diagnostic test of the model that are considered. By combining these rigorous methodological approaches, we aim to produce robust and reliable empirical evidence on the complex interplay between taxes and inflation. The Ethical Clearance Certificate was obtained from the University of Namibia's Decentralised Ethics Committee, find attached in Appendices.

CHAPTER FOUR: ESTIMATION, ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents the estimation, analysis and interpretation of the result using the methodology explained in the previous chapter. The chapter starts with an introduction and sections 4.2 to 4.5 which discuss the results of the time series properties of the variables used in modelling the taxation-inflation nexus. The analysis of the bounds test for cointegration is presented in section 4.6 and 4.7 encompass model specification. Section 4.8 to 4.10 is the Granger causality and alternative model analysis whereas section 4.11 to 4.15 deals with NARDL analysis and robustness checks of the results, before concluding in section 4.16.

4.2 Descriptive Statistics

Table 4.1 presents summary statistics of the variables of interest for the taxation – inflation nexus in Namibia over the horizon of 1990Q1 to 2023Q4.

Table 4.1: Descriptive Statistics

	INF	VAT	CIT	CED	RGDP	RR	DP	UR
Mean	7.2	914.0	811.8	2722.5	26223.4	10.2	7.1	22.0
Median	6.9	956.0	853.0	1992.3	24972.3	7.8	6.1	21.7
Maximum	20.4	1441.6	1322.0	6196.9	39410.2	21.1	23.0	31.0
Minimum	1.3	320.1	311.4	713.9	16373.1	3.8	1.1	18.1
Std. Dev.	3.4	285.9	267.3	1523.7	7581.8	4.9	5.5	2.6
Skewness	1.1	-0.5	-0.1	0.6	0.2	0.8	0.9	1.1
Kurtosis	5.1	2.4	2.5	2.1	1.5	2.1	3.0	3.9
Jarque-Bera	49.5	6.8	2.5	13.3	14.3	14.9	16.4	29.3
Probability	0.000	0.033	0.287	0.001	0.001	0.001	0.0037	0.001
Sum	968.4	123390.3	109568.8	367534.0	3540156.0	1382.4	957.1	2977.3

Sum Sq. Dev.	1532.8	10951767	9571988	3.110	7.700	3274.571	4048.991	873.195
Observations	135	135	135	135	135	135	135	135

Source: Ben Kennedy Stephanus

Table 4.1 shows that the Namibia Real Gross Domestic Product (RGDP) have the largest mean and widest standard deviation of 7581.8. CIT exhibits the lowest mean value, whereas CED displays the highest. This implies that SACU receipts constitute 61 percent of total tax revenue, followed by VAT at 20 percent, and CIT at 18 percent. This indicates a reliance on SACU receipts and suggests potential for increased revenue collection from VAT and CIT. Regarding inflation, the mean value of 7.2 percent suggests that Namibia's inflation rate has exceeded the South African inflation target of 6 percent on average throughout the study period. This may be attributed to the country's currency peg to the South African Rand and the consequent adherence to South Africa's monetary policy.

The standard deviation across the variables ranges from 2.6 to 7581.9. The distributions of the variables exhibit both negative and positive skewness. All variables exhibited platykurtic distributions, characterized by kurtosis values less than 3. However, the unemployment and RGDP deviated from this pattern, displaying a marginal leptokurtic distribution with a kurtosis value of 3.9 and 5.1, respectively. This indicates a slight departure from normality, characterized by thinner tails and a flatter peak compared to the mesokurtic standard. Consequently, the occurrence of outliers in the data is less frequent than would be expected under a normal distribution. Further, using the probabilities of the Jarque-Berra test for normality test, we reject the null hypothesis of normal distribution at 5 percent significance level and conclude all the variables are not normally distributed based on the test results, except corporate taxes.

4.3. Correlation Matrix

The correlation matrix in Table 4.2 involves understanding the relationships between variables in the dataset as it displays the correlation coefficients between pairs of variables pertaining to the taxation – inflation nexus.

Table 3.2: Correlation coefficients

	LINF	LVAT	LCIT	LCED	LUR	LRR	LRGDP	LDP
INF	1							
LVAT	-0.6568	1						
LCIT	-0.6528	0.5857	1					
LCED	-0.6237	0.6307	0.5380	1				
LUR	-0.4068	0.5804	0.6669	0.6328	1			
LRR	0.6981	-0.8459	-0.8806	-0.6498	-0.5291	1		
LRGDP	-0.6082	0.8631	0.8736	0.7421	0.5511	-0.8564	1	
LDP	-0.5879	0.9120	0.9359	0.9392	0.6097	-0.8950	0.8599	1

Source: Ben Kennedy Stephanus

Multicollinearity occurs when independent variables in a regression model are highly correlated (Field, 2018). This can lead to unstable and unreliable coefficient estimates (James et al.,2013), inflated standard errors, and reduced statistical significance (Montgomery, et al., 2012). To address multicollinearity, researchers can employ various strategies. These include removing highly correlated variables, considering theoretical justifications, and examining variance inflation factors (VIF) (Hair et al.,2010). Data transformations, such as logarithmic transformations or creating new variables, can also mitigate multicollinearity (Kutner et al., 2005). While increasing sample size may help, it may not always be feasible.

The choice of the most effective strategy depends on the specific research context and data characteristics (Kleinbaum et al., 2008). Careful consideration of the potential implications of each method is crucial.

A comprehensive understanding of the interrelationships among variables within a dataset is essential for accurate interpretation of a correlation matrix. This matrix quantifies the linear associations between pairs of variables. As presented in Table 4.2, the correlation coefficients between the dependent variable and the independent variables corroborates with theoretical expectations.

Moreover, Table 4.3 shows the results of the unit root test based on the ADF and PP approaches.

Table 4.3: Unit Root Test

Variable	**Model**	**ADF Test**		**PP Test**		**Order of integration**
		Level	**1st Diff**	**Level**	**1st Diff**	
LINF	None	-1.4658 (-1.9434)	-4.6580 (-1.9434) ***	-0.7859 (-1.9432)	-9.5497 (-1.9432) ***	I(1)
	Intercept	-2.2914 (-2.8837)	-4.5927 (-2.8852) ***	-2.8061 (-2.8830)	-12.3852 (-2.8832) ***	I(1)
	Intercept & Trend	-3.3860 (-3.4470)	(-4.7454) (-3.4471) ***	-3.2213 (-3.4437)	-17.9794 (-3.4439) ***	I(1)
LVAT	None	-2.9176 (-1.9432)	-2.6841 (-1.9433) ***	-3.9221 (-1.94322)	- 7.0811 (-1.9432) ***	I(1)
	Intercept	-4.1189 (-2.8834)***	-4.9962 (-2.8834)***	-4.2116 (-2.8830) ***	-8.7583 (-2.8832) ***	I(0)
	Intercept & Trend	-3.7688	-5.7762 (-3.4442)	-2.8590 (-3.4437)	-9.1871	I(0)

		(-3.4442)**			(-3.4439)***	
LCIT	None	-1.6712 (-1.9433)	-2.02612 (-1.9433) **	-5.1580 (-1.9432)	-9.2954 (-1.9432)***	I(1)
	Intercept	-1.7874 (-2.8841)	-2.6744 (-2.8841) *	-3.7878 (-2.8830)***	-11.4861 (-2.8832)***	I(0)
	Intercept & Trend	-1.9956 (-3.4453)	-2.8705 (-3.4453)	-2.4796 (-3.4437)	-11.9481 (-3.4439)***	I(1)
LCED	None	-4.5200 (- 1.9432)	-4.9746 (-1.9432) ***	-3.8370 (-1.9432)	-10.2523 (-1.9432)***	I(1)
	Intercept	-0.3990 (-2.8835)	-5.8301 (-2.8835) ***	-1.0376 (-2.8830)	-10.9760 (-2.8832)***	I(1)
	Intercept & Trend	-1.9554 (-3.4444)	-5.7735 (-3.4444) ***	-2.1802 (-3.4437)	-10.9745 (-3.4439)***	I(1)
LRR	None	-1.1466 (-1.9432)	-6.3844 (-1.9432) ***	-0.6818 (-1.9442)	-5.3943 (-2.5897)***	I(1)
	Intercept	-1.7828 (-2.8830)	-5.3414 (-3.5014) ***	-6.4005 (-2.8832)	-5.374555 (-3.5014)***	I(1)
	Intercept & Trend	-2.2997 (-3.4437)	-5.3731 (-4.0586) ***	- -2.2997 (-3.4439)	-6.3851 (-3.4439)***	I(1)

LRGDP	None	-2.6953 (-1.9433)	-5.3857 (-1.9433) ***	-2.8541 (-1.9432)	-16.9657 (-1.9432) ***	I(1)
	Intercept	-0.5650 (-2.8837)	- 6.1513 (-2.8837) ***	-0.4588 (-2.8830)	- 18.9108 (-2.8832) ***	I(1)
	Intercept & Trend	-1.9846 (-3.4447)	-6.1277 (-3.4447) ***	-3.7906 (-3.4437)**	-18.8248 (-3.4439) ***	I(0)
LDP	None	-2.5539 (-1.943)	-7.6392 (-2.5900) ***	-2.5503 (-1.9432)	-7.0727 (-1.9432) ***	I(1)
	Intercept	-0.4023 (-2.8834)	-8.5587 (-2.8834) ***	-0.4572 (-2.8830)	-7.1737 (-2.8832) ***	I(1)
	Intercept & Trend	-2.4910 (-3.4442)	-8.5225 (-3.4442) ***	-2.1832 (-3.4437)	-7.1346 (-3.4439) ***	I(1)
LUR	None	-1.2298 (-1.9432)	-10.6894 (-1.9432) ***	-1.0448 (-1.9432)	-17.2945 (-1.9432) ***	I(1)
	Intercept	-0.4421 (-2.8834)	-10.7735 (-2.8834) ***	-0.3960 (-2.8830)	-17.5186 (-2.8832) ***	I(1)
	Intercept & Trend	-1.1293 (-3.4442)	-11.0397 (-3.4442) ***	-2.1077 (-3.4437)	-18.6856 (-3.4439) ***	I(1)

Source: Ben Kennedy Stephanus

Note 1: The test statistics in brackets indicates the t-values

Note 2: Statistical significance at the:10% level (*), 5% level (**) and 1% level (***)

The stated hypothesis is:

H_0: There is a unit root (Non – Stationarity)

H_1: There is no unit root (Stationary time series)

Unit root tests, specifically the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, indicate that the time series are integrated of order I(0) and I(1). Specifically, the NARDL model is designed to accommodate both I(0) and I(1) variables. It allows for both short-run and long-run dynamics, as well as asymmetric effects (Shin & Greenwood-Nimmo, 2014)

4.4 Lag Length Selection Criteria

Determining the optimal lag length to include in the model is essential before doing the bounds test for cointegration, (Yesigat et al., 2018). The autocorrelation that could exist in the residuals of cointegrated variables is eliminated by adding lags.

Table 4.4: Optimal lag length Criteria results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	140.3314	NA	1.72e-11	-2.083960	-1.904798	-2.011169
1	1460.619	2453.447	4.40e-20	-21.86801	-20.25556*	-21.21289*
2	1544.281	144.9274	3.27e-20*	-22.17766	-19.13192	-20.94021
3	1591.794	76.31946	4.36e-20	-21.91802	-17.43898	-20.09824
4	806.0274	94.4835*	4.62e-20*	-21.91529*	-16.00296	-19.51318
5	1715.712	81.38338	5.40e-20	-21.85373	-14.50811	-18.86929
6	1767.881	64.08174	7.53e-20	-21.66742	-12.88851	-18.10065
7	1830.513	69.04283	9.52e-20	-21.64587	11.43367	-17.49678
8	1902.400	70.18878	1.14e-19	-21.77007	-10.12458	-17.03865

Source: Ben Kennedy Stephanus

*Indicates lag order selected by the criterion

Following Gujarati (2004), the model's integrity hinges on the selection of an appropriate lag length to ensure adequate degrees of freedom, absence of multicollinearity, and the avoidance of misspecification errors. This study identified four lags as potential optimal lag lengths based on the frequency of selection across multiple information criteria. Schwarz and Hannan-Quinn information criteria favored a one-lag structure, the rest of the metrics indicated a more suitable four lag specification. Given its lower values, the AIC criterion is selected for lag length determination in this analysis and its ability to penalise the addition of extra regressors.

4.5 Nonlinearity BDS Test

The Brock-Dechert-Scheinkman (BDS) test, introduced in 1987, is a nonparametric statistical tool employed to ascertain the presence of nonlinear dependencies within time series data. As a cornerstone for diagnostic in econometrics and time series analysis, the BDS test addresses the prevalent challenges of linearity assumptions often contradicted by empirical observations. The underlying hypothesis of the test posits that the data is independently and identically distributed (IID). A rejection of this null hypothesis indicates the existence of nonlinear patterns within the series.

Table 4.5: Nonlinearity BDS Test Results

Variable	Statistic	P-value < 0.01	Parameter Epsilon (m=2)
INF	34.2996	0.0000	3.3821
RR	54.3233	0.0000	4.9433
RGDP	266.5249	0.0000	7581.7717
UR	22.2958	0.0000	2.5527
VAT	50.6444	0.0000	285.8839
CED	54.6969	0.0000	1523.6858
CIT	45.9218	0.0000	267.2690
DP	60.7971	0.0000	5.4969

Source: Ben Kennedy Stephanus

The results of the BDS test for nonlinearity across multiple embedding dimensions (m) in Table 4.5 reveal a statistically significant departure from the null hypothesis of independent and identically distributed (IID) data. The significant BDS test statistic suggests that the data exhibits non-linear dependencies, indicating that it may not be adequately represented by models that assume independence and identical distribution. Consequently, nonlinear modeling approaches might be more suitable. The embedding dimension (m), a key parameter in the BDS test, significantly influences the test's sensitivity to non-linear patterns within time series data. The study found that an embedding dimension of 2 was significant, suggesting that this was the optimal value for capturing the underlying non-linear structure of the data. The findings from the BDS test provide evidence of asymmetry in the taxation-inflation nexus relationship. This finding supports the use of the NARDL (Nonlinear Autoregressive Distributed Lag) model for further analysis.

4.6 Results of bounds cointegration test (NARDL)

To examine the asymmetric effects of taxation on inflation in both the short and long run in Namibia, this study utilized the Nonlinear Autoregressive Distributed Lag (NARDL) model. As shown in Table 4.6, the calculated F-statistic of the bounds test is 4.2946 and falls above the critical bounds at a 5% significance level, indicating a nonlinear cointegrating relationship. This suggests a potential nonlinear association between taxation and inflation in both the short and long run in Namibia, consistent with the findings of Sharma and Mittal (2021). Their study, employed a NARDL methodology and analyzed the relationship between India's fiscal deficit and inflation and discovered evidence of a nonlinear association.

Table 4.6: Nonlinear ARDL-bound test

Test Statistic	Value	Significance level	Lower bound	Upper bound
F-statistic	4.2946	1 %	2.540	3.860
-	-	5 %	2.060	3.240
-	-	10 %	1.830	2.940

Source: Ben Kennedy Stephanus

4.7 Estimates of the long run (LR) and short run (SR) dynamics (NARDL)

Having established a nonlinear cointegrating relationship among the variables of interest, the study proceeds to estimate the long-run and short-run coefficients using a Nonlinear ARDL (NARDL) model. The NARDL model employed in this analysis takes the form ARDL (2,2,2,2,1,4,0,1), with the results summarized in Panels A, B and C of Table 4.7.

Table 4.7: Asymmetric Long-run and Short-run Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob
Panel A: Long run results of NARDL (Dependent variable- Inflation				
LINF(-1)	-0.4873***	0.0876	-5.5618	0.0000
LVAT_POS (-1)	-20.8904***	7.0754	-2.9525	0.0046
LVAT_NEG (-1)	-8.7765	15.6735	-0.5599	0.5772
LCIT_POS (-1)	22.5173***	7.6947	2.9263	0.0045
LCIT_NEG (-1)	-15.1218	28.2161	-0.5359	0.5936
LCED_POS (-1)	0.2421	2.5715	0.0941	0.9252
LCED_NEG (-1)	2.8715	3.8956	0.7371	0.4634
Panel B: Short-Run Results (ECM) of NARDL (Dependent Variable-Inflation)				
D (LINF (-1))	0.5033***	0.0845	5.9503	0.0000
D(LVAT) POS	-14.8884*	8.2175	-1.8117	0.0736
D(LVAT_POS (-1))	33.6280***	8.3776	4.0140	0.0001
D(LCIT_POS (-1))	-25.6681***	8.1942	-3.1324	0.0024
ECT (-1)	-0.4873***	0.0674	-7.2313	0.0000
Panel C: Wald Test results Asymmetry Test-Dependent Variable-Inflation (NCPI)				
Variable	**Long-run**		**Short run**	
	F-Statistics	**Probability**	**F-Statistics**	**Probability**
LVAT_	8.6431***	0.0004	2.0348**	0.0535

LCIT	5.9275***	0.0027	1.4938	0.1738
LCED	0.3211	0.7263	0.4772	0.8686

Note: ***, **and* represents 1%,5% and 10% level of significance.

Source: Ben Kennedy Stephanus

Panel A of Table 4.7 presents the empirical long-run NARDL model estimation results. The analysis indicates evidence of an asymmetric effect of taxation on inflation in the long run. Value-added tax (VAT) and corporate income tax (CIT) has a negative and positive asymmetric long run effect on inflation and is significant in Namibia. This suggests that a 1 percent increase in VAT will lead to a 0.20 percentage points decrease in inflation in the long run. Contrary, a 1percent increase in CIT will lead to a 0.22 percentage points increase in inflation in the long run. The findings suggest that positive tax shocks have a more significant effect on long-term inflationary pressures in Namibia. Moreover, the null hypothesis of symmetry from the Wald test is rejected at a 5 percent significance level, hence it is concluded that taxation has an asymmetric influence on inflation in Namibia as displayed in Table 4.9, panel C.

These findings are consistent with Keynesian theory, which posits that increased production costs are passed on to consumers through higher prices and the fiscal theory of price level, that suggest that public debt and tax policies influence the price level. The observed asymmetric long-run relationship between taxes and inflation contrasts with previous research, such as Ncanywa and Setati (2022), Adegbite (2019), Obaretin and Akhor (2019) which identified linear long-term relationships between taxation and inflation and corroborates Sharma and Mittal (2021) who found a nonlinear association.

Table 4.7, Panel B, presents the short-run dynamic effects of taxation on inflation in Namibia. The analysis reveals a complex interplay between positive and negative tax

shocks and their impact on inflation. Most tax categories considered exhibit significant, asymmetric short-run relationships with inflation, suggesting that the short-term effects of taxation on inflation are more pronounced than the long-term effects. The value-added tax (VAT) exhibits a significant short-term asymmetry. Positive VAT shocks, particularly one period ago, have a more pronounced impact on inflation, as a 1 percent increase of VAT in the previous period leads to a 0.33 percentage points increase in inflation. However, this effect may be temporary due to short-term rigidities in Namibian tax policy. This phenomenon will be short-lived and is unlikely to translate throughout the general price level and may be sector-based and only be reflected in price statistics as a deflation due to the temporary low base effect of the shock. Corporate Income Tax (CIT) also demonstrates a short-run asymmetry. Positive shocks to CIT, one period back, have a statistically significant asymmetric impact on inflation in Namibia. Notably, the short-term effects of CIT on inflation differ from the long-term trend. A one percentage point decrease in CIT in the previous period leads to a 0.25 percentage points reduction in inflation in the short run. The study found no significant relationship between Customs and Excise Duties (CED) and inflation in Namibia, neither in the short nor long term. This suggests a complex relationship influenced by various factors, including payment delays and fluctuations in trade volumes and international commodity prices.

Furthermore, Wald test results in the analysis reveals a nuanced relationship between taxation and inflation in Namibia, diverging from previous studies that often assume a linear connection. This study demonstrates that VAT and CIT exhibits a positive asymmetric causal effect on inflation in both the long run, and short run in Namibia.

These findings contradict those of Eita et al. (2021), Akhor (2019), and Adegbite (2019), who proposed a solely linear relationship between taxes and inflation. However, the results align more closely with the work of Sharma and Mittal (2021).

The error correction term (ECT) is negative and significant at a one percent level, confirming the long-run relationship between inflation and its covariates. The coefficient of -0.48 indicates that 48 percent of short-run deviations in inflation from its long-run equilibrium are corrected in the subsequent period. The study challenges the assumption of a symmetrical relationship between taxation and inflation in Namibia. The findings emphasize that changes in taxation, whether positive or negative, have distinct long run and short-term impacts on inflation, highlighting the importance of considering asymmetric effects when analysing the relationship between these variables in the Namibian context.

4.8 NARDL Model Diagnostic

To assess the reliability and validity of the analysis, the study conducted a thorough examination of the model's statistical properties. This involve testing for common diagnostic issues, such as heteroscedasticity, serial correlation, and potential model misspecification. By addressing these concerns, the study ensure the robustness and accuracy of the findings. The results of the diagnostic test are presented in Table 4.8.

Table 4.8: NARDL Model Diagnostic Tests

Test	Test Statistic	Probability value
Heteroscedasticity (Breusch-Pagan-Godfrey)	0.9057	0.6465
Heteroscedasticity (Harvey)	1.0941	0.3558
Heteroscedasticity (Glejser)	0.9627	0.5541

Serial Correlation (Breusch-Godfrey LM Test)	1.9967	0.1431
Normality (Jarque Berra)	0.4615	0.7939
Ramsey RESET Test	1.7875	0.1853

Source: Ben Kennedy Stephanus

According to Table 4.8, all the test statistics have p-values greater than 5 percent. This implies we cannot reject the null hypotheses of the tests at a 5 percent significance level. In other words, the results suggest errors have constant variance (homoscedastic), and the model is adequately specified.

4.8 NARDL Model Stability

The CUSUM and CUSUMSQ tests were employed to assess the stability of the LR and SR coefficients over time. The results of the CUSUM and CUSUMSQ test for residuals following Galpin & Hawkins (1984) were carried out to validate the stability of the model estimates in the short-run and long-run. The CUSUM and CUSUMSQ tests, conducted at a 5% significance level, indicate that the variance and parameters are insensitive to changes as demonstrated in Figure 4.1. Hence, Figure 4.1 shows that the CUSUM test statistic remains within the critical bounds for the 5% significance level throughout the sample period. This indicates that the estimated model for the taxation-inflation relationship in Namibia exhibits stability. Similarly, the CUSUMSQ statistic also falls within the 5 percent significance level, further supporting the model's stability and its effectiveness in capturing both short-run and long-run dynamics between the variables. As a result, the study fails to reject the null hypothesis of structural stability, suggesting evidence that the model's relationships hold true over the observed period.

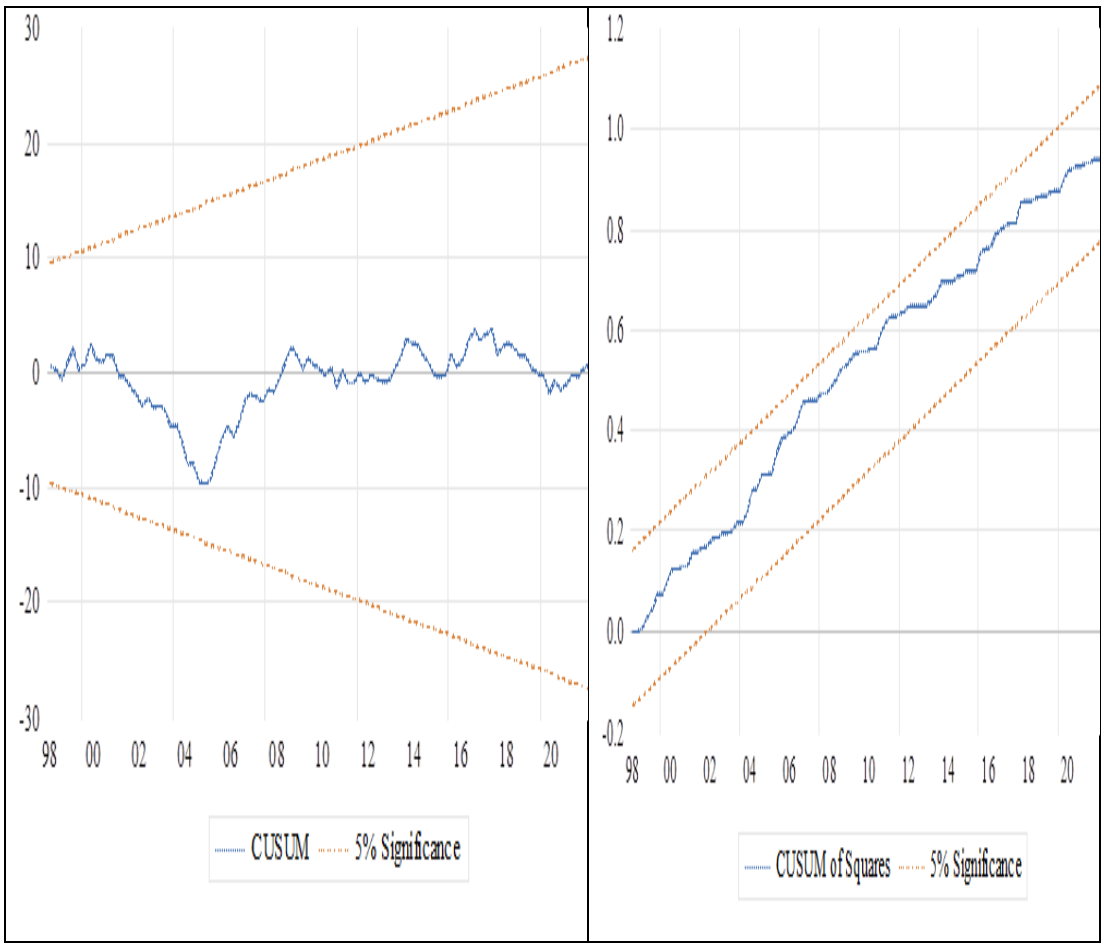


Figure 4.1: NARDL Stability test (Source: Ben Kennedy Stephanus)

Figure 4.2.1

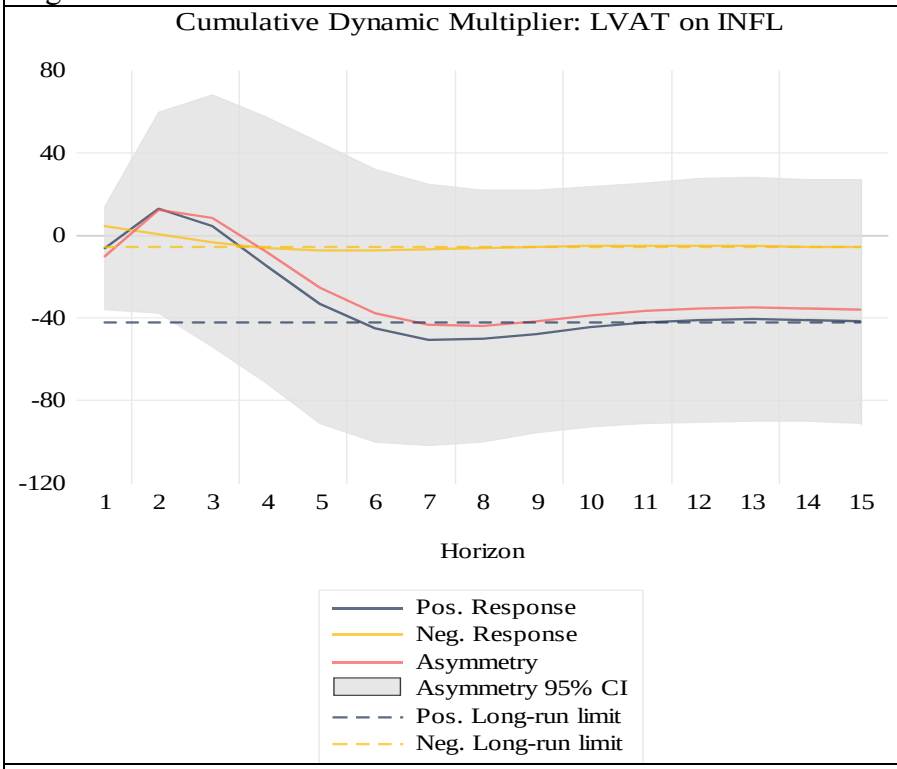
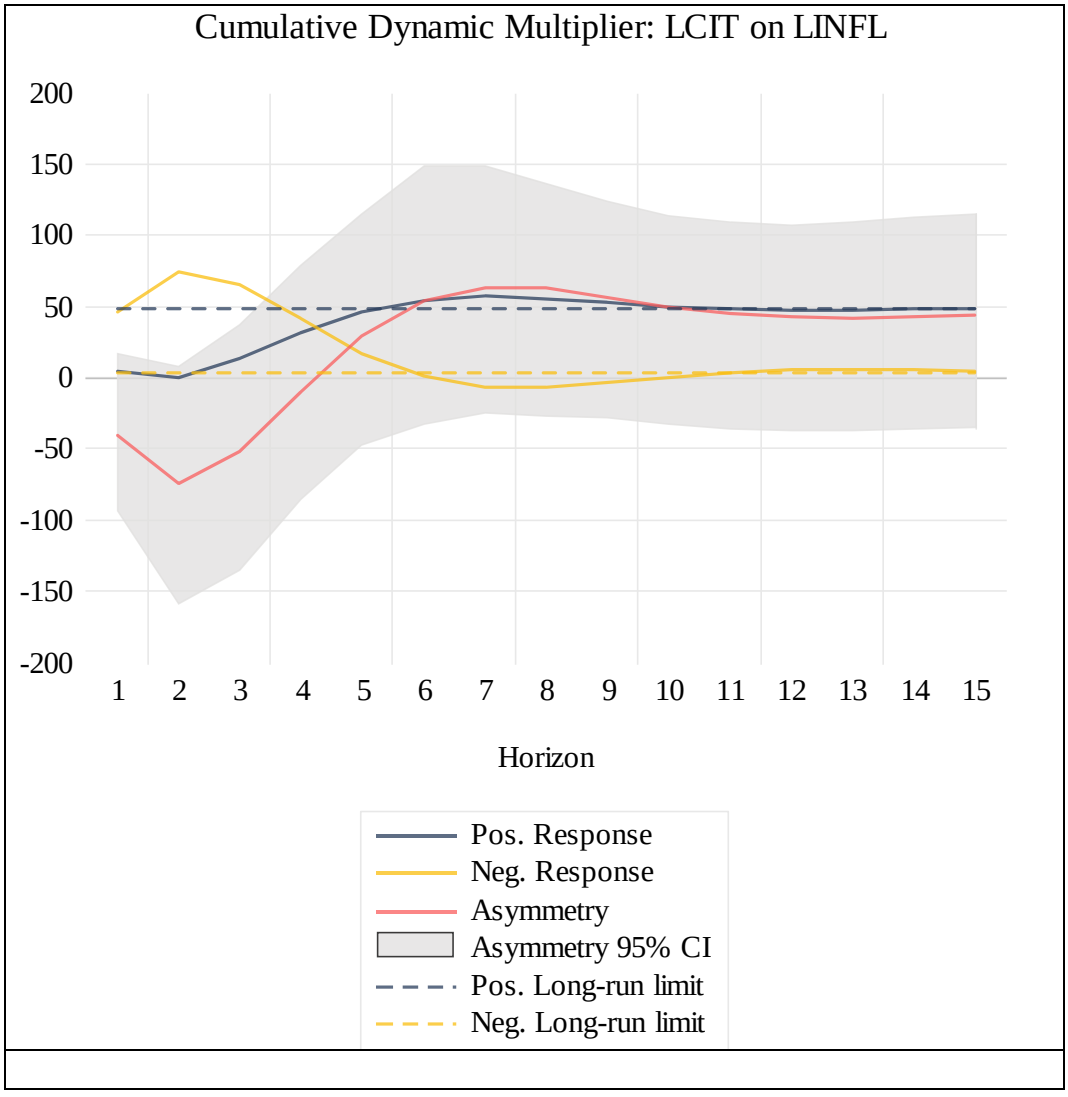


Figure 4.2.2


Cumulative Dynamic Multiplier: LCIT on LINFL
200
150
100
50
0
-50
-100
-150
-200
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Horizon
Pos. Response
Neg. Response
Asymmetry
Asymmetry 95% CI
Pos. Long-run limit
Neg. Long-run limit

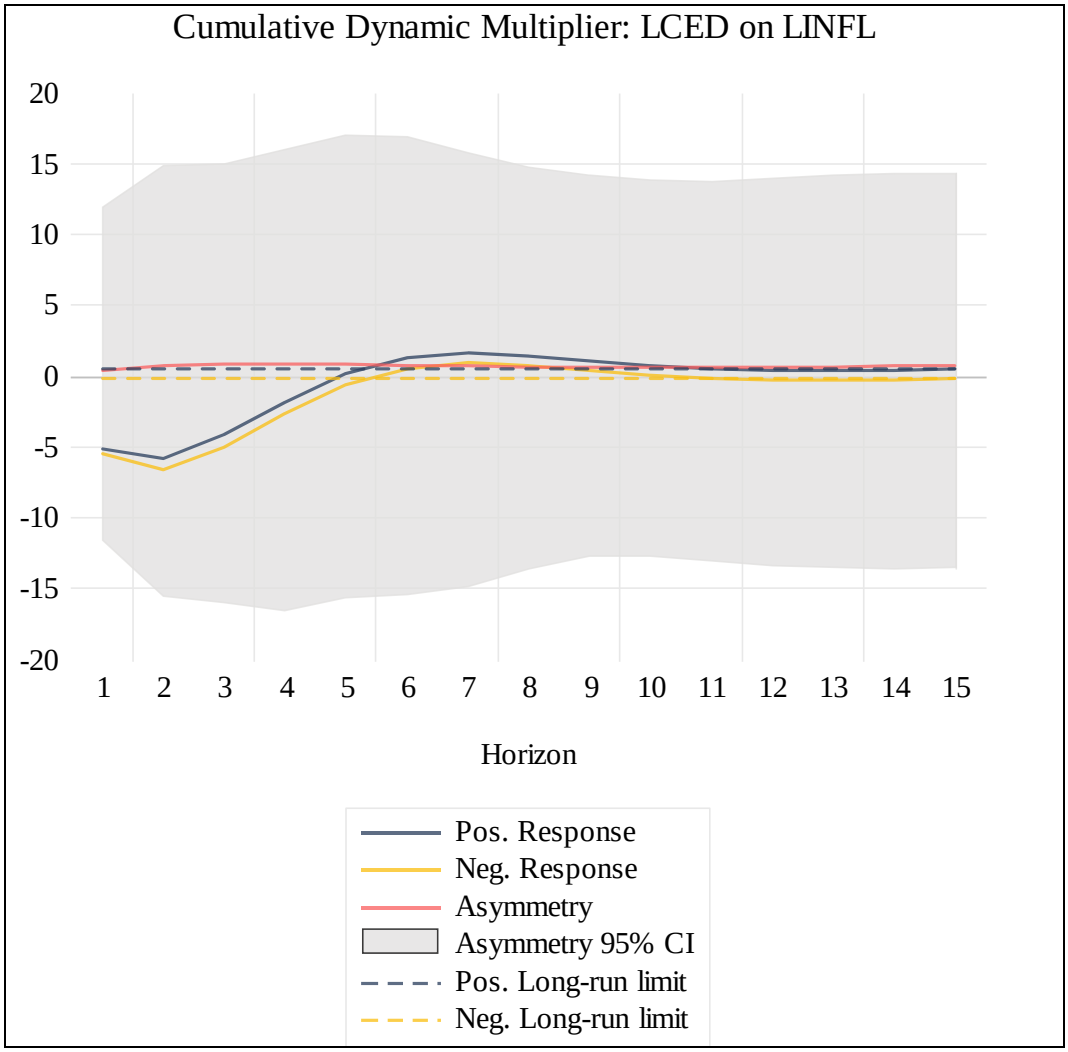


Figure 3.2: Asymmetric Cumulative Dynamic Multiplier Effects of Taxation on Inflation (Source: Ben Kennedy Stephanus)

Figure 4.2 depicts the asymmetric cumulative dynamic multipliers, illustrating the differential long-run effects of positive and negative tax shocks on inflation. While the short-run effects are more pronounced, the multipliers appear to converge over time. Notably, negative tax shocks exhibit a more significant and persistent inflationary impact than positive shocks, suggesting that the Namibian economy is more sensitive to tax cuts than tax increases regarding inflationary consequences. A comprehensive understanding of this phenomenon requires consideration of broader economic factors, including monetary policy and the specific tax structure.

4.9 Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS).

In this section for a more robust analyses, the study employs alternative cointegration techniques, namely Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS). The results of the FMOLS and DOLS estimations are summarised in Table 4.9.

Table 4.9: FMOLS and DOLS – Dependent variable: LINF

	FMOLS			**DOLS**		
Variable	**Coefficient**	**St. Error**	**P-value**	**Coefficient**	**St. Error**	**P-value**
LVAT	-17.5583**	6.4169	0.0071	-20.2535**	8.2084	0.0153
LCIT	11.0272	8.4975	0.1968	12.3830	11.3457	0.2776
LCED	3.5401*	1.9464	0.0713	4.6719**	2.1933	0.0355
LRR	6.8451***	1.4391	0.0000	7.8824***	1.7937	0.0000
LDP	6.0523***	1.6176	0.0003	7.6782***	2.0553	0.0003
LUR	-11.0305***	4.6994	0.0205	-12.9485**	6.6242	0.0533
LRGDP	-12.8356**	4.4138	0.0043	-16.5401**	5.5158	0.0034

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

Source: Ben Kennedy Stephanus

These complementary methods are utilized to corroborate the findings of the Autoregressive Distributed Lag (ARDL) model (Majeed et al., 2021). The results from FMOLS and DOLS exhibited evidence of a linear long-run relationship between taxation and inflation. The results indicate that VAT and CED has a statistically

significant long run effect on inflation in Namibia. As in Table 4.9, the results, somewhat corroborates with the ARDL's long-run estimates, and suggest linear long-run relationship between taxation and inflation. In alignment to the bounds test, the FMOLS and DOLS models indicate a long-run linear relationship between taxation and inflation in Namibia. The results of the bounds test and the satellite models suggest the potential for nonlinearity and asymmetric effects and warranted further investigation by employing a Nonlinear ARDL (NARDL) approach.

4.10. FMOLS and DOLS Model Diagnostic

To evaluate the trustworthiness and accuracy of the analytical results, the study undertook a comprehensive assessment of the model's statistical characteristics. This involved rigorous examinations for common diagnostic challenges, including heteroscedasticity, serial correlation, and potential instances of model misspecification. By diligently addressing these concerns, the study ensured the robustness and precision of its findings. The outcomes of the diagnostic tests are presented in Tables 4.10.1 and 4.10.2.

Table 4.10.1: FMOLS Model Diagnostic Tests

Test	**Test Statistic**	**Probability value**
Heteroscedasticity (Breusch-Pagan-Godfrey)	0.6121	0.2531
Serial Correlation (Breusch-Godfrey LM Test)	1.7581	0.1211
Normality (Jarque Berra)	2.4116	0.7939

Ramsey RESET Test	1.7875	0.1303

Source: Ben Kennedy Stephanus

Table 4.10.2: DOLS Model Diagnostic Tests

Test	**Test Statistic**	**Probability value**
Heteroscedasticity (Breusch-Pagan-Godfrey)	0.5220	0.3535
Serial Correlation (Breusch-Godfrey LM Test)	2.7581	0.5230
Normality (Jarque Berra)	0.4116	0.1929
Ramsey RESET Test	1.3135	0.2203

Source: Ben Kennedy Stephanus

According to Table 4.10.1 and 4.10.2, all the test statistics have p-values greater than 5 percent. This implies we cannot reject the null hypotheses of the tests at a 5 percent significance level. In other words, the results suggest errors have constant variance (homoscedastic), and the model is adequately specified.

4.11 The Vector Error Correction Model (VECM)

While the long-run and short-run dynamics captured by cointegration analysis provide valuable insights into the nature of the relationship between variables (Engle & Granger, 1987), effective policy recommendations often require a deeper understanding of causal directionality (Sims, 1980). To address this gap, this study

employs the Vector Error Correction Model (VECM) Granger Causality Test to investigate the causal relationship between the variables under study.

Table 4.11. Results of VECM Granger Causality

Dependent Variable	SR causality Wald test				LR causality t-statistic
	ΔLINF	ΔLVAT	ΔLCIT	ΔLCED	ECT_{t-1}
ΔLINF (-1)		-0.00017 (-0.1689)	-0.00003 (-0.0041)	0.00194 -0.78988	-0.31296* (-5.9817)
ΔLVAT (-1)	16.1128* -2.683		0.13447 -1.6072	0.32597 -1.4943	-0.061156* (-2.2183)
ΔLCIT (-1)	-2.00523 (-0.303)	0.14166 -1.4336		0.074044 -0.30837	-0.088607* (-4.45283)
ΔLCED (-1)	-3.0303 (-1.253)	0.03782 -1.0463	0.045651 -1.3519		-0.00009863 (-0.0645)

Source: Ben Kennedy Stephanus

* Denotes significance, t-statistics in parentheses.

Table 4.11.1: Pairwise Granger Causality Tests

Null hypothesis	Observations	F-Statistic	F-Prob.	Signif.
LVAT does not Granger Cause LINF	133	7.43415	0.0009	Yes
INF does not Granger Cause LVAT		0.06763	0.9346	No
LCIT does not Granger Cause LINF	133	4.65456	0.0112	Yes
LCIT does not Granger Cause LINF		1.91576	0.1514	No
LCED does not Granger Cause LINF	133	4.86737	0.0092	Yes
LINF does not Granger Cause LCED		0.26792	0.7654	No

Source: Ben Kennedy Stephanus

The empirical evidence presented in Table 4.11, based on t-statistic analysis for both the short and long run suggests that there is evidence that taxation causes inflation. However, the results by the pairwise Granger causality test indicates a potential causal relationship from taxation to inflation. These findings align with the results of Ncanywa and Setati (2022), who identified a unidirectional relationship between taxation and inflation in South Africa. Additionally, the current analysis shows that taxation Granger-causes inflation in Namibia, further supporting the existence of a significant unidirectional relationship between these two variables in this context.

These findings align with the results of the BDS test in this study and other empirical studies, indicating a weak linear association between taxes and inflation in Namibia. While Eita et al. (2021) identified a positive long-run relationship between fiscal deficit and inflation in Namibia, the results from the VECM model in Table 4.11 are also consistent with the findings of Akpan et al. (2023). Akpan et al. (2023) employed the GARCH-MIDAS framework to investigate the relationship between tax measures and inflation in a selection of African countries, including Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Madagascar, Mauritius, Morocco, and South Africa. Their analysis revealed a heterogeneous relationship, with unidirectional causality from taxes to inflation observed in some countries but not in others.

4.16 Chapter conclusion

Chapter four analysed the results obtained from the NARDL model constructed in Chapter three together with VECM granger causality and models for robustness checks FMOLS and DOLS. The analysis reveals that taxation has an asymmetric and significant relationship with inflation in the long term as well as short term in Namibia. These results contrast with studies by Obaretin and Akhor (2019), Adegbite (2019), which only found entirely linear short and long-term relationships between taxation and inflation.

The contradictory findings of these study may arise from methodological differences, such as the use of linear models that may not fully capture nonlinear relationships, as well as variations in tax policies across different economies. Moreover, the inclusion of control variables, such as economic growth, interest rates, and diesel pump price and unemployment, can affect the estimated relationship between taxation and inflation and yield different results while some of these determinants of inflation are excluded in some studies. By employing a nonlinear approach to the taxation-inflation nexus, this study addresses a methodological gap and contributes to the existing empirical literature. Additionally, the chapter reassures that the estimated model for the relationship between taxation and inflation in Namibia exhibits stability. The variations in the dynamic multipliers caused by the negative and positive shocks in taxation are more pronounced in the short run and appear to flatten out towards the end of the long run over a specific period. Moreover, the reliability of the results is demonstrated by the diagnostic tests conducted throughout this chapter. The following chapter concludes the study with a comprehensive summary, policy recommendations, implications, and guidance for future research.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter four estimated, analysed and interpreted empirical findings. This chapter provides a summary of the study, highlighting key policy implications and outlining conclusions drawn from the study. The chapter will also cover important policy recommendations that can be considered together with possible areas of further research.

5.2 Summary of findings and conclusion

Namibia faces a dual challenge of rising tax rates and high inflation. While price stability is a key economic objective, Namibia's inflation remains elevated despite efforts to align it with trading partners. This study investigated the relationship between taxes (VAT, corporate income tax, customs & excise) and inflation in Namibia. Unlike previous research that assumed a linear relationship, this study found potential non-linear associations to provide a more comprehensive understanding of the issue.

The main objective of the study is to examine Namibia’s taxation-inflation nexus leveraging on economic theory and econometric techniques. The study employed time series data over the period 1990Q1 to 2023Q4, to analyse the relationship between taxation and inflation in Namibia. This study employed corporate income tax (CIT), customs and excise duties (CED), and value-added tax (VAT) as proxies for the overall tax burden in Namibia. In addition to these taxation variables, the analysis incorporated several macroeconomic factors that might influence inflation. These auxiliary determinants included real gross domestic product (RGDP), repo rate, unemployment

and domestic fuel price. All variables were integrated into the model specification and estimation process. To comprehensively capture the potential short-run and long-run effects of taxation on inflation, the study utilized a combination of econometric techniques. These techniques included the fully modified ordinary least squares (FMOLS) method, the dynamic ordinary least squares (DOLS) method, and non-linear ARDL approaches. Furthermore, a vector error correction model (VECM) Granger causality test was employed to investigate the causal relationships between taxation and inflation. The NARDL method was considered to capture asymmetric effects of positive and negative changes in tax variables.

While the estimated long-run and short-run coefficients of other auxiliary models indicate a linear association, the overall impact of inflation on taxation appears less pronounced, with a stronger reverse impact. This suggests that factors beyond taxation may play a more significant role in driving inflationary trends within Namibia. Value Added Tax and CIT demonstrated a positive long-run association with inflation. However, CED exhibit no such relationship and appear to be insignificant determinants of inflationary pressures. Furthermore, the FMOLS and DOLS estimates, while exhibiting some variation compared to the ARDL's long-run estimates, generally suggest a linear long-run relationship between taxation and inflation**.** This finding aligns with previous research by Obaretin and Akhor (2019), Adegbite (2019), and Ncanywa and Setati (2022), who identified a linear long-run relationship between taxation and inflation. However, after further investigation of the taxation- inflation nexus in Namibia, the study found a nonlinear association which align with Sharma and Mittal's (2021) findings on India's fiscal deficit and inflation. The second objective of the study was to identify asymmetric association between taxation and inflation. The Wald test results concluded that taxation has an asymmetric influence on inflation

in Namibia. These findings are consistent with Keynesian theory, which posits that increased production costs are passed on to consumers through higher prices and the fiscal theory of price level, that suggest that public debt and tax policies influence the price level. The observed asymmetric long-run relationship between taxes and inflation corroborates Sharma and Mittal (2021) who found a nonlinear association.

The third objective of the study was to assess the causal relationship between taxes and inflation. The VECM analysis indicates that there is a causal relationship between taxation and inflation in Namibia. This is further amplified by the pairwise Granger causality test which suggest that all taxes Granger-cause inflation. These findings, consistent with the FMOLS and DOLS model estimates and other empirical research, point to a linear association between taxes and inflation in Namibia. The VECM model results are consistent with the findings of Adebite (2019), who also identified a causal relationship in the Nigerian context. The Nonlinear Autoregressive Distributed Lag (NARDL) analysis indicates a significant long run and short-term nonlinear relationship between taxation and inflation in Namibia. This finding aligns with Sharma and Mittal's (2021) research on India's fiscal deficit and inflation, which also found a nonlinear association using a similar approach. The study reveals a complex relationship between taxation and inflation in Namibia, departing from previous assumptions of a linear connection. Value-added tax (VAT) exhibits a negative causal effect on inflation in the long run but a positive one in the short run. Corporate income tax (CIT) shows a negative short-run effect. Customs and excise duties (CED) have no long-run causal effect with asymmetry, while the short-run effect is negative and asymmetric. These findings contradict those of Eita et al. (2021), Akhor (2019), and Adegbite (2019), but align more closely with Sharma and Mittal's (2021) work.

The error correction term (ECT) is negative and significant at a level, confirming the long-run relationship between inflation and its covariates. The coefficient of -0.48 indicates that, on average, 48 percent of the gap between current inflation and its long-run equilibrium level is closed in the subsequent period. The study challenges the assumption of a symmetrical relationship between taxation and inflation in Namibia. The study findings emphasize that changes in taxation, whether positive or negative, have distinct short-term and long-term impacts on inflation, highlighting the importance of considering asymmetric effects when analysing the relationship between these variables in the Namibian context.

To validate the model's empirical relevance, the study assesses its statistical properties. This includes checking for common issues like the normality of residuals, unequal variance (heteroscedasticity), serial correlation, and potential model misspecification. The results indicate that the model passes all the diagnostic test carried out. Also, the CUSUM and CUSSUMSQ tests statistic remains within the critical bounds for the 5 percent significance level throughout the sample period. This indicates that the estimated model for the taxation-inflation relationship in Namibia exhibits stability of the model and its effectiveness in capturing both short-run and long-run dynamics between the variables.

Further research is needed to understand the specific mechanisms driving the taxation - inflation dynamics. Important caveats are some findings contradict existing economic theories and require further investigation. The study focuses on Namibia and might not be generalisable to other countries. The study concludes that neglecting the asymmetric effects of tax changes on inflation can lead to inaccurate results. It highlights the need for more advance models to understand the complex relationship

between taxation and inflation in Namibia. The study challenges the assumption of a symmetrical relationship between taxes and inflation. Both positive and negative changes in taxes have different impacts on inflation in both the short and long run. Concisely, the study concludes that the assumption of a symmetrical relation between taxation and inflation can lead to inaccurate results in the context of Namibia.

5.3 Policy Recommendations and Implications

This study's findings offer valuable insights for policymakers aiming to control inflation in Namibia through fiscal policy. Firstly, the study suggests that a well-calibrated increase in taxation can exert a gradual downward pressure on inflation in the long run. This, in turn, would allow the Bank of Namibia to maintain a more stable interest rate regime. This highlights the importance of coordinated fiscal and monetary policies for achieving economic stability. Secondly, after the finding of asymmetry in the taxation inflation nexus, the study emphasizes the need for a concerted approach to tax policy in Namibia, considering prevailing economic conditions. During inflationary periods, moderate tax hikes can discourage excessive spending, thereby dampening inflation. Conversely, during recessions, tax reductions can stimulate production and job creation in Namibia. Additionally, employ flexible monetary policy tools to respond to asymmetric shocks to stabilize the economy.

Thirdly, the study recommends exploring a broader range of fiscal and industrial policy instruments alongside taxation. This could include measures like financial incentives for manufacturing by offering financial incentives, in the form of subsidies, to stimulate growth within the manufacturing sector. Together with reduction of import tariffs on input materials which may lower import costs for essential production inputs not readily available in Namibia. Moreover, tariff-based industry protection is needed

as a non-monetary mechanism to foster domestic industrial development, particularly for emerging industries. Further, cost-saving and industrial policy programs are essential in implementing initiatives like special economic zones to boost production efficiency and reduce costs, in Namibia the export processing zone needs to be revived.

Finally, the study acknowledges the need for a multifaceted approach. While some readily implementable solutions may face political hurdles, pursuing comprehensive reforms is crucial. Examples of such reforms include automatic tax system adjustments for inflation and addressing timing issues in capital gains taxation. Additionally, simpler solutions like increased reliance on withholding taxes and more frequent asset re-evaluations can mitigate the impact of timing issues. By effectively implementing these policy recommendations, Namibia can foster economic growth, improve disposable income, reduce unemployment, and ultimately achieve price stability**.**

5.4 Suggestions for Future Research

The study recommends future research to explore the cross-border implications of tax policies on inflation, especially in highly interconnected economies. By examining how global economic shocks and trade policies influence this relationship, researchers can contribute to regional policymaking and potentially foster greater policy coordination among nations**.**

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APPENDICES

Appendix 1

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ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: DEC FOC/20/06/ 08 Date: 20/06/2024

This Ethical Clearance Certificate is issued by the University of Namibia Ethics Committee (REC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the ethics committee.

Title of Project: EXAMINING THE TAXATION – INFLATION NEXUS IN NAMIBIA

Student: Mr. BEN KENNEDY STEPHANUS

Student Number: 99900030
Supervisor(s): Dr. . C. DZINGIRAI

Centre for Research Services
Take note of the following:

1. Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the ethics committee. An application to make amendments may be necessary.
2. Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the ethics committee
3. The Principal Researcher must report issues of ethical compliance to the ethics committee (through the Chairperson) at the end of the Project or as may be requested by the ethics committee
4. The ethics committee retains the right to:

i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,

ii) Request for an ethical compliance report at any point during the course of the research.

The ethics committee wishes you the best in your research.

Precious Mushendami (Decentralized Research Ethics Committee)

Prof. Davis Mumbengegwi (Head, Multidisciplinary Research)

Table A1: Lag Structure selection Criteria

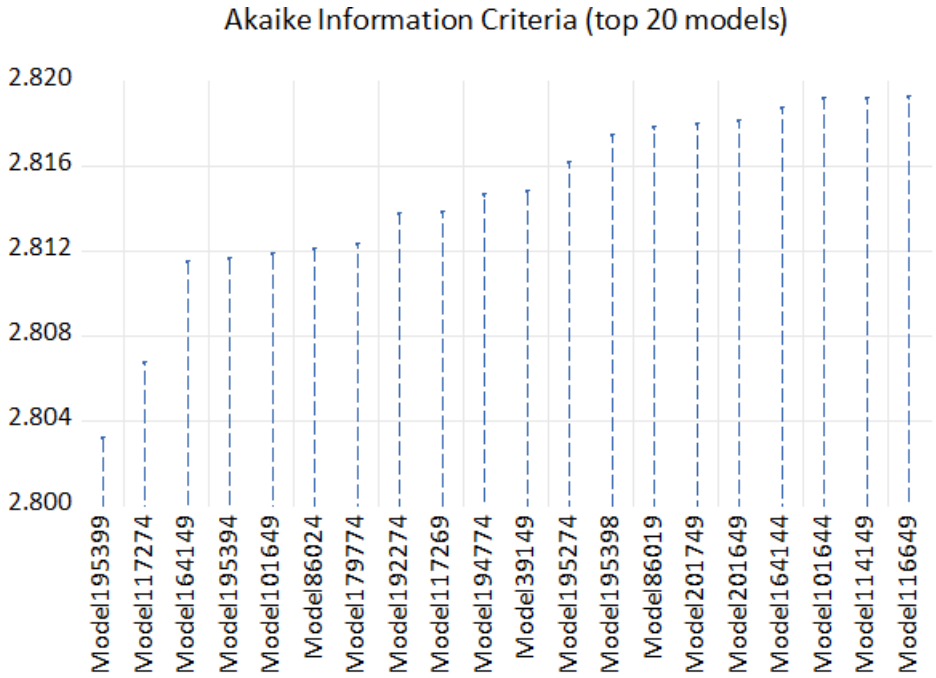

Table A2: Wald test Long run coefficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	8.643120	(2, 75)	0.0004
Chi-square	17.28624	2	0.0002

Null Hypothesis: C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	-20.89046	7.075454
C(7)	-8.776540	15.67356

Restrictions are linear in coefficients.

Table A3: Wald test, VAT short run coeficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	2.034872	(8, 75)	0.0535
Chi-square	16.27897	8	0.0386

Null Hypothesis: C(31)=C(32)=C(33)=C(34)=C(35)=C(36)
=C(37)=C(38)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(31)	-14.88842	10.44666
C(32)	4.452109	17.38774
C(33)	33.62808	9.927129
C(34)	-7.233946	16.74316
C(35)	12.05308	9.923614
C(36)	-2.994795	14.68876
C(37)	9.322855	9.639493
C(38)	14.38064	14.22699

Restrictions are linear in coefficients.

Table A4: Wald test, CIT Long run coefficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	5.927529	(2, 75)	0.0041
Chi-square	11.85506	2	0.0027

Null Hypothesis: C(8)=C(9)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	22.51733	7.694763
C(9)	-15.12181	28.21610

Restrictions are linear in coefficients.

Table A5: Wald test, CIT short run coeficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	1.493874	(8, 75)	0.1738
Chi-square	11.95099	8	0.1534

Null Hypothesis: C(39)=C(40)=C(41)=C(42)=C(43)=C(44)
=C(45)=C(46)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(39)	10.07128	10.32549
C(40)	34.93429	41.58751
C(41)	-25.66812	11.80298
C(42)	49.49395	46.25950
C(43)	6.458019	11.56733
C(44)	-24.42577	47.60906
C(45)	-15.26578	10.33822
C(46)	41.58254	47.47244

Restrictions are linear in coefficients.

Table A4: Wald test, CED Long run coefficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	0.321196	(2, 75)	0.7263
Chi-square	0.642393	2	0.7253

Null Hypothesis: C(10)=C(11)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(10)	0.242100	2.571545
C(11)	2.871503	3.895600

Restrictions are linear in coefficients.

Table A5: Wald test, CED short run coeficients

Wald Test:
Equation: EQ04

Test Statistic	Value	df	Probability
F-statistic	0.477267	(8, 75)	0.8686
Chi-square	3.818135	8	0.8731

Null Hypothesis: C(47)=C(48)=C(49)=C(50)=C(51)=C(52)
=C(53)=C(54)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(47)	-3.944686	5.146773
C(48)	-1.850353	5.644418
C(49)	-3.491691	4.629197
C(50)	-3.284933	6.171300
C(51)	0.799879	3.585248
C(52)	-3.134930	5.890036
C(53)	-1.994353	3.726023
C(54)	-3.761882	6.171816

Restrictions are linear in coefficients.

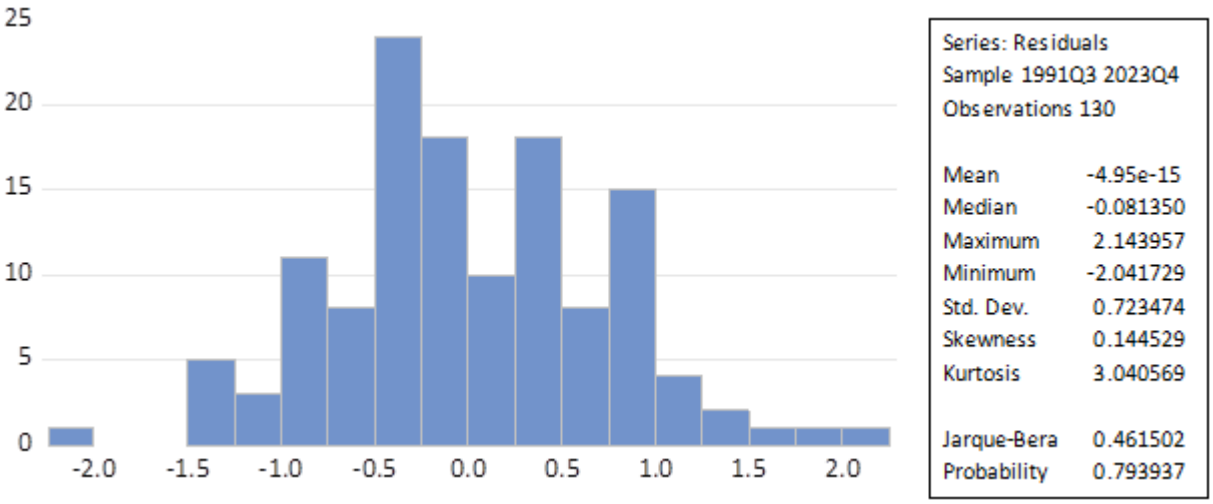

Figure A1: Normality test (Jarque Bera)