EXAMINING THE RELATIONSHIP BETWEEN MACROECONOMIC FUNDAMENTALS AND EXCHANGE RATES: EVIDENCE FROM THE COMMON MONETARY AREA (CMA)

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ABSTRACT

This study investigated the relationship between macroeconomic fundamentals and exchange rates in the Common Monetary Area (CMA) using the Pooled Mean Group (PMG) methodology within a Panel Autoregressive Distributed Lag (PARDL) framework, accounting for structural breaks. Utilising panel data from 1991 to 2022, the study first applied Fisher-type Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the integration orders of variables, which were found to be a mix of I(0) and I(1). This mixed integration justified the PARDL approach. The findings revealed that the relative money supply significantly affects the exchange rate in both the long and short runs, with increases in money supply leading to currency depreciation. Thus, the overarching relationship between macroeconomic fundamentals and exchange rates in the CMA indicates a complex interaction where monetary supply significantly influences currency values in both the long and short run, albeit with varying magnitudes. The negative impact of increased money supply on the exchange rate necessitates vigilant monetary policy to prevent undue depreciation and associated economic vulnerabilities. However, the study found that interest rates and GDP growth had a neutral impact on exchange rate fluctuations, which suggests that these variables, under current economic conditions, may have a muted direct effect on exchange rate fluctuations, possibly due to integrated economic policies or external economic shocks that overshadow domestic policy impacts. The Granger causality results reveled significant causality from relative money supply and inflation to the nominal exchange rate showed the predictive power of these macroeconomic fundamentals on exchange rate fluctuations. The study recommends that central banks maintain stringent controls over the money supply to mitigate abrupt exchange rate fluctuations. Monetary policies should be carefully calibrated to manage inflation levels that could lead to rapid changes in exchange rates. Additionally, considering the significant short-run impacts of GDP growth, economic policies should also aim to foster stable economic growth that contributes to currency appreciation and macroeconomic stability. Moreover, economists should look at the underlying mechanisms through which GDP growth impacts exchange rates in the short run and explore the potential buffering effects of economic expansion on currency stability.

Keywords: *CMA, Panel Autoregressive Distributed Lag, Structural Breaks, Granger causality*

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DEDICATION

This thesis is dedicated to God, who has guided me and gave me the strength and insight to complete this journey. It is also dedicated to my wife, Lizelle Kharon, who unwaveringly supported me through this challenging yet exciting process; my son Lizano and daughter Lynae; my parents, Mr Paul Kharon and Mrs Mavis Kharon, and my siblings and friends whose words of encouragement never stop ringing in my ears and their helpful hand. I am immensely grateful to God for surrounding me with the love of these wonderful people.

DECLARATION

I, Melvilino Lesley Kharon, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof, has not been submitted for a degree in any other institution of higher education.

I, Melvilino Lesley Kharon, grant the University of Namibia the right to reproduce this thesis in whole, or in part, in any manner or format, which the University of Namibia may deem fit, for any person or institution requiring it for study and research; providing that the University of Namibia shall waive this right if the whole thesis has been or being published in a manner satisfactory to the University.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF – Augmented Dickey Fuller Test

ARDL – Autoregressive Distributed Lag

CD – Cross-sectional Dependence

CMA – Common Monetary Area

DFE – Dynamic Fixed effects

ECM – Error Correction Model

FE – Fixed effects

FPMM – Flexible-Price Monetary Model

IFS – International Financial Statistics

IMF – International Monetary Fund

IPS – Im-Pesaran-Shin

LLC – Levin, Lin, and Chu

LS – Level Shift

LST – Level Shift with Trend

MG – Mean Group

NEER - Nominal Effective exchange Rate

NOEX – Nominal Effective exchange Rate

NOIN – Nominal Interest rates

OLS – Ordinary Least Squares

PARDL – Panel Autoregressive Distributed Lag

PMG – Pooled Mean Group

PP – Phillips Perron

PPP – Purchasing Power Parity

RE – Random Effects

REGGDP – Real Gross Domestic Product

REMS – Relative Money Supply

RIDMM - Real Interest Differential Monetary Model

RS – Regime Shift

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1. Background of the study

Exchange rates play a pivotal role in determining relative prices across countries, affecting international trade, investment flows, and economic balance (Chang & Su, 2014). Exchange rate regimes vary significantly in their structure and impact on a nation's economy, with each type suited to different economic settings and goals. The Fixed Exchange Rate Regime stabilizes the value of a country's currency by pegging it to a major currency or a basket of currencies, necessitating active central bank intervention in the forex market to maintain the peg. This regime enhances international trade and investment stability by minimizing exchange rate volatility, though it requires substantial foreign currency reserves to support the peg (Nordås, 2019).

The study addresses a significant gap in the global body of knowledge by contributing to the understanding of macroeconomic fundamentals' influence on exchange rates within a fixed exchange rate regime, specifically in the Common Monetary Area (CMA). While existing literature has examined similar relationships in regions such as the West African Economic and Monetary Union (WAEMU) and the Economic and Monetary Community of Central Africa (CEMAC), the CMA presents a unique case due to its integrated economic structure and the pegging of member currencies to the South African Rand. Global studies, such as those by Frankel (1999) and Eichengreen and Lombardi (2015), emphasise the importance of understanding monetary dynamics within such unions, yet limited focus has been directed toward the CMA. This study fills that gap by offering empirical insights into the relationship between variables such as relative money supply, inflation, real economic growth, and nominal interest rates and their effects on exchange rates within the CMA framework. The findings will enrich the global discourse on fixed exchange rate regimes and provide comparative insights relevant to other monetary unions like WAEMU and CEMAC.

Conversely, the Floating Exchange Rate Regime allows the currency's value to fluctuate based on market dynamics, providing greater insulation from external shocks by enabling automatic exchange rate adjustments. This flexibility, however, may lead to increased economic uncertainty due to potential rate volatility (Obstfeld & Rogoff, 2020). The Managed Float

Regime, or Dirty Float, strikes a balance by permitting free currency fluctuation while allowing sporadic central bank interventions to stabilize or guide the currency, aiming to mitigate disruptive market fluctuations (Mishkin, 2021).

The Crawling Peg system offers a more dynamic approach where the currency is fixed against another but adjusted periodically based on economic indicators like inflation differentials, allowing for gradual adaptations to economic conditions (Khatat et al., 2020). The Currency Board Arrangement takes a more stringent approach by backing the domestic currency fully with a foreign currency at a fixed rate, which enhances exchange rate stability and can reduce inflation but at the cost of sacrificing the central bank's monetary policy capabilities (Yeager & Hanke, 2024). Lastly, Dollarization involves adopting another country's currency as legal tender, eliminating exchange rate risk within the dollarized economy. While this ensures monetary stability, it also relinquishes all control over monetary policy to the foreign central bank whose currency is being used (Padilla, 2022). Essentially, under a fixed exchange rate regime, the stability of exchange rates is maintained through central bank interventions, ensuring predictable international transaction costs, which is particularly significant in regions like Africa and the Common Monetary Area (CMA) (International Monetary Fund, 2022). The Common Monetary Area (CMA) is an economic agreement among several Southern African countries established to facilitate a more integrated and efficient monetary environment within the region. The CMA was formally created in 1986, building on the earlier Rand Monetary Area agreement initiated in 1974. The member countries of the CMA include South Africa, which serves as the anchor economy, along with Namibia, Lesotho, and Eswatini (formerly Swaziland). These nations have closely linked their economies through this agreement, which allows for the free movement of capital and goods across their borders (Falalieieva & Strilets, 2023).

A critical aspect of the CMA is its exchange rate regime, where the currencies of Namibia, Lesotho, and Eswatini are pegged to the South African Rand. This arrangement ensures that while these countries issue their own currencies the Namibian Dollar, the Lesotho Loti, and the Swazi Lilangeni they maintain a one-to-one parity with the Rand. South Africa's central bank, the South African Reserve Bank, thus indirectly influences the monetary policies of the other member states, given that these countries need to align their interest rates and monetary policies with those of South Africa to maintain the fixed exchange rate (IMF, 2022).

This stability can promote trade and investment but may limit the flexibility of domestic monetary policy to respond to internal economic conditions. The CMA, linking South Africa, Namibia, Lesotho, and Eswatini, exemplifies a scenario where fixed exchange rates facilitate smoother trade and financial integration within the region (IMF, 2022).

Exchange rate changes under fixed regimes are influenced by a myriad of macroeconomic fundamentals. For example, discrepancies in inflation rates can affect exchange rates through purchasing power parity, while differences in interest rates can influence capital flows, altering exchange demand (Hillebrand et al., 2023). In the setting of the CMA, macroeconomic synchronization with South Africa significantly impacts the other member countries due to their fixed exchange rate arrangement (Shumba & Mukorera, 2023). The economic growth rates, inflation rates, and real interest rates of CMA countries are crucial in maintaining exchange rate stability within the union. The adherence to fiscal discipline and the execution of structural reforms are essential for these countries to manage the impact of macroeconomic fundamentals on exchange rates effectively (Masha et al., 2007, as cited in Shumba & Mukorera, 2023).

In addition to exploring exchange rate regimes, this study scrutinizes the interplay between macroeconomic fundamentals and exchange rates, particularly focusing on Relative Money Supply (REMS), Real Economic Growth (REGDP), Inflation (INCPI), and Nominal Interest Rate (NOIN). These variables are critical in understanding the dynamics of exchange rates within the Common Monetary Area (CMA) and broader economic settings.

Relative Money Supply (REMS) is pivotal as it reflects the liquidity available in the economy, which can influence inflation and, consequently, exchange rates. An increase in money supply typically leads to currency depreciation unless offset by equivalent growth in output (Eichengreen & Lombardi, 2015). In the context of the CMA, where economies are tightly interconnected, changes in REMS in one member country can have significant spill-over effects on others, impacting their exchange rates relative to the South African Rand (Shumba & Mukorera, 2023). Furthermore, Real Economic Growth (REGDP) is another fundamental indicator, directly impacting the demand for currency and thus its value. Economies exhibiting robust growth attract foreign investment, which strengthens the local currency by increasing demand (Nordås, 2019). Within the CMA, synchronized growth rates can enhance the stability of fixed exchange rate arrangements by reducing asymmetric shocks that could force adjustments in the pegged rates (Yeager & Hanke, 2024). In addition, inflation (INCPI) exerts a direct influence on purchasing power parity, a key theory in exchange rate determination. Higher inflation in a country, relative to its trading partners, tends to depreciate its currency by making its goods and services more expensive to foreigners (Rogoff et al., 2024). For CMA countries, maintaining similar inflation rates is crucial to ensuring the stability of their fixed exchange regime with South Africa, minimizing the need for frequent adjustments in their monetary policies (Mishkin, 2021). Lastly, the Nominal Interest Rate (NOIN) is instrumental in attracting foreign capital. Higher domestic interest rates offer better returns on investments denominated in that currency, typically appreciating the currency due to increased demand. However, in a fixed exchange rate system like that of the CMA, the ability to use interest rates independently is limited, as the rates must be aligned closely with those of the anchor country, South Africa, to maintain the exchange rate peg (Obstfeld & Rogoff, 2020).

Together, these macroeconomic fundamentals provide a comprehensive framework for examining the exchange rate dynamics in the CMA. Understanding the interactions among these variables is essential for crafting effective monetary policies and achieving economic stability within the union. This holistic approach ensures that the economic analyses conducted are grounded in robust empirical evidence, aligning with the broader objectives of regional economic stability and integration (Hillebrand et al., 2023; Shumba & Mukorera, 2023).

According to some authors, the relationship between exchange rates and macroeconomic fundamentals is bidirectional; exchange rates not only reflect current economic conditions but can also signal future changes in macroeconomic fundamentals (Chang & Su, 2014; Fakher et al., 2021). Asset-pricing models of exchange rates, like the Dornbusch (1976 as cited in Fakher et al., 2021) overshooting model, suggest that exchange rates can adjust ahead of economic fundamentals based on expectations about future policy actions and economic conditions. This is particularly relevant in fixed exchange rate regimes within the CMA, where expectations regarding South Africa's monetary policy and economic outlook can have widespread implications for the entire area (Shumba & Mukorera, 2023).

Macroeconomic fundamentals like economic growth, inflation, and real interest rates have a profound relationship with exchange rates. In fixed exchange-rate regimes, such as that of the CMA, these fundamentals must align closely with the anchor country (South Africa) to maintain exchange rate stability (Shumba & Mukorera, 2023). The monetary model of

exchange rate determination suggests that a country’s money supply, relative to another’s, is a fundamental determinant of exchange rates. This model has varying applicability across different exchange rate regimes, depending on the degree of capital mobility and the independence of monetary policy (Frankel, 1979; Frenkel, 1976; Mussa, 1976).
Central banks globally, particularly within the CMA, play a crucial role in aligning macroeconomic fundamentals with monetary models of exchange rate determination. The shift from pegged exchange rates to more flexible arrangements in South Africa, for example, illustrates a strategic adaptation to enhance monetary policy effectiveness and address external shocks (IMF, 2022). The experience within the CMA shows the importance of fiscal discipline, structural reforms and prudent monetary management in maintaining exchange rate stability and economic resilience.

1.2. Problem Statement

The nexus between macroeconomic fundamentals and exchange rates is pivotal in understanding the dynamics of global and regional economies, including the Common Monetary Area (CMA). Globally, the theoretical underpinnings from the flexible-price monetary model (FPMM) by Frenkel (1976) and Mussa (1976), as well as the scapegoat theory of exchange rates, suggest a direct link between macroeconomic fundamentals and exchange rates (Pozzi & Sadaba, 2017). These models posit that fundamentals should predictably influence exchange rates; however, empirical evidence often shows a disconnection, leading to what is known as the “exchange rate disconnect puzzle” (Pozzi & Sadaba, 2017).

In the setting of the CMA, comprising South Africa, Namibia, Lesotho, and Eswatini, the problem becomes varied due to the fixed exchange rate regime pegged to the South African Rand (Shumba & Mukorera, 2023). This regime theoretically implies that macroeconomic fundamentals within these countries should move in tandem with those of South Africa to maintain exchange rate stability. However, the reality presents a multifaceted challenge.

Despite the expectations set by FPMM and the scapegoat theory, the CMA experiences persistent asymmetries in how macroeconomic shocks are absorbed and reflected in exchange rates and economic performance across member countries. The essence of the problem lies in the differential impact of external shocks and the divergent capacity of member countries to implement fiscal and monetary policy adjustments (Masha et al., 2007; Shumba & Mukorera, 2023). For instance, Masha et al. (2007) in their study, indicated that South Africa's move to a more flexible exchange rate and inflation targeting has helped it manage external shocks and maintain macroeconomic stability. The smaller CMA countries, on the other hand, have limited autonomy to respond to macroeconomic fundamentals uniquely affecting them. This discrepancy between theoretical expectations and empirical realities in the CMA shows the challenges of applying standard monetary models to such an integrated economic environment, highlighting significant implications for economic stability, policy effectiveness, and the benefits of monetary union membership.

Further complicating this dynamic are the structural economic differences among CMA countries, including diversification levels, export bases, and fiscal capacities, leading to varying responses to similar shocks. For example, Namibia's and Lesotho's reliance on specific sectors (diamonds and textiles, respectively) makes them vulnerable to sector-specific shocks that do not necessarily affect South Africa or the CMA's exchange rate policy directly (Shumba & Mukorera, 2023). For instance, from 2000 to 2022, Namibia's nominal effective exchange rate (NEER) exhibited a slight upward trend, reflecting currency appreciation, while South Africa's NEER depreciated significantly, indicating divergent economic pressures within the CMA (Shumba & Mukorera, 2023). These disparities challenge the theoretical expectation of synchronized macroeconomic fundamentals in fixed exchange rate regimes. Furthermore, while the CMA ensures stability through its pegged system, South Africa's inflation rates, which ranged between 3.2% and 10.1%, diverged from Lesotho's 6.1% to 33.8% and Eswatini's 2.6% to 13.2% over the same period, highlighting asymmetries in policy outcomes. This misalignment raises questions about the CMA's ability to absorb shocks uniformly, necessitating a study to explore these dynamics. Such disparities underscore the relevance of this research in understanding the structural and economic challenges that complicate monetary policy effectiveness within the CMA.

The purpose of this study, thereof, is to investigate the relationship between macroeconomic fundamentals and exchange rates within the common monetary area.

1.3. Research Objectives

The main objective of the study is to examine the relationship between macroeconomic fundamentals and exchange rates in the CMA. The specific objectives of the study are:

- To examine the long-run and short-run relationship between macroeconomic fundamentals and exchange rates in the CMA.
- To examine the causal relationship between macroeconomic fundamentals and exchange rates in the CMA.

1.4. Hypotheses of the study

H_{01}: Macroeconomic fundamentals have no long-run and short-run relationship with the exchange rate in the CMA.

H_{11}: Macroeconomic fundamentals have a long-run and short-run relationship with exchange rate in the CMA.

H_{02}: Macroeconomic fundamentals do not have a causal relationship with exchange rates in the CMA.

H_{12}: Macroeconomic fundamentals have a causal relationship with exchange rates in the CMA.

1.5. Significance of the study

Essentially, the relevance of this study stems from its focus on a gap in the global literature concerning fixed exchange rate regimes in the view of regional monetary agreements like the CMA giving both practical and literature contribution significance. By examining the fixed exchange rate regime and monetary policy, this research addresses an underexplored area that is crucial for policymakers and economic stakeholders within the region.

Beneficiaries of this study include the Central banks within the CMA policymakers, CMA countries economists, researchers, and academic institutions. The findings offer practical insights into the effective management of monetary policy under fixed exchange rate constraints, potentially guiding policy adjustments that enhance economic stability and growth. Additionally, this study contributes to the academic process, providing a model for analysing similar economies within fixed or semi-fixed exchange rate regimes.

1.6. Study Limitations

In conducting this study, several limitations were encountered that may impact the generalizability and precision of the findings. One significant limitation was the availability and reliability of data, particularly concerning real-time macroeconomic indicators in the Common Monetary Area (CMA) countries. This challenge was mitigated by utilizing a comprehensive review of historical data and supplementing it with information from reputable international financial institutions and Namibian governmental agencies. Despite these efforts, the potential for data gaps or inaccuracies remains, which could affect the study's conclusions. Another notable limitation involved the application of global monetary models to the specific economic contexts of the CMA countries. While these models provide a useful theoretical framework, their direct applicability to the CMA's unique economic and monetary union, characterized by a fixed exchange rate regime, posed challenges. The study addressed this by adapting these models to better reflect the CMA's economic structures, thereby enhancing the relevance and applicability of the findings. Nonetheless, these adaptations may not fully capture all local nuances, potentially limiting the study's scope and accuracy in predicting exchange rate dynamics within the CMA. These limitations underscore the need for cautious interpretation of the study's results and highlight areas for future research to further refine and validate these findings.

1.7. Delimitations of the Study

The study focused exclusively on the relationship between macroeconomic fundamentals and exchange rates within the CMA's fixed exchange rate regime, deliberately excluding flexible or floating exchange rate regimes. This focus was chosen because the CMA's fixed regime offers a unique context for analysing how tightly linked economies respond to macroeconomic variables. Including flexible or floating regimes would have introduced variables that are not directly comparable due to differences in policy frameworks and economic structures. Additionally, the study concentrated on a post-1992 timeframe, capturing the period after all four CMA member states had fully integrated, ensuring the relevance and cohesiveness of the data. The analysis was limited to the variables of Relative Money Supply (REMS), Real Economic Growth (REGDP), Inflation (INCPI), and Nominal Interest Rate (NOIN), chosen for their significant roles in exchange rate determination and economic stability. These delimitations were intended to maintain a focused and coherent scope, enabling a more precise examination of the CMA's monetary dynamics without the confounding effects of divergent exchange rate policies or unrelated economic contexts.

1.8. Outline of the study

The structure of the thesis is designed to provide a clear and logical progression through the research process. Chapter 1: Introduction sets the stage for the study, outlining the background, objectives, and a brief overview of the research. Chapter 2 investigates the Common Monetary Area (CMA), exploring the exchange rates and macroeconomic variables of member countries, providing a foundational understanding of the regional economic environment. Chapter 3: Literature Review expands on the existing body of knowledge, covering conceptual, theoretical, and empirical studies relevant to the research questions. This chapter serves as a critical appraisal of past research, identifying gaps and framing the theoretical basis for the study.

Chapter 4: Research Methodology outlines the methods and procedures used in the study, detailing the research design, data collection techniques, and analytical strategies. This chapter is crucial as it ensures the reliability and validity of the research findings. Chapter 5: Presentation of Results reveals the outcomes of the research, presenting data and findings in a structured manner to address the research objectives. Finally, Chapter 6: Summary, Conclusion, and Recommendations synthesize the findings, linking them to the literature reviewed and the study's objectives. This chapter not only summarizes the conclusions drawn but also offers practical recommendations for organizations and outlines potential areas for future research, thereby contributing to the field and suggesting pathways for further scholarly exploration.

CHAPTER TWO

OVERVIEW OF THE CMA MEMBERS, EXCHANGE RATES AND MACROECONOMIC VARIABLES

2.1. How Monetary Policy Is Implemented in the CMA

2.1.1. South Africa

The South African Reserve Bank (SARB) has recently transitioned to a new Monetary Policy Implementation Framework (MPIF), shifting from a classical cash reserve system to a more modern 'tiered floor' framework. This change, effective from November 2021, addresses previous system inefficiencies exacerbated by the COVID-19 pandemic and various liquidity operations. The new framework is designed to better manage market liquidity and stabilize policy implementation, maintaining the primary goal of monetary policy—price stability—without altering the policy stance or objectives (South Africa Reserve Bank, 2022).

Under the new 'tiered floor' system, the SARB ensures a surplus liquidity condition in the banking system, wherein banks receive interest on excess reserves held up to certain quota limits at the repo rate. This system aims to provide a stable environment for policy rate transmission by creating a floor for interbank rates, preventing them from falling below the set policy rate due to excess liquidity. The tiered aspect allows for managing liquidity effectively, limiting excess reserve accumulation that could lead to inflationary pressures or undermine the policy rate's influence (South Africa Reserve Bank, 2022).

This framework accommodates significant liquidity from structural surpluses in the banking sector, a situation that has been persistent since the 2000s and intensified during the pandemic. The SARB's capability to absorb these surpluses without needing extensive liquidity-draining operations marks a strategic shift towards a more flexible and crisis-resilient monetary system. This is particularly crucial given South Africa's need to adapt to both internal economic shifts and external financial shocks (South Africa Reserve Bank, 2022).

Moreover, the tiered floor system allows the SARB to balance the liquidity through quotas and supplementary facilities, ensuring that the banking system operates efficiently without excessive reliance on the central bank for daily liquidity adjustments. The system is crafted to maintain stability in the face of potential liquidity shocks by setting operational targets that reflect the current economic realities and the central bank's strategic preferences (South Africa Reserve Bank, 2022).

2.1.2. Namibia

Namibia's monetary policy, aligned with the fixed peg to the South African Rand, primarily aims at ensuring price stability to foster sustainable economic growth. This policy framework limits Namibia's monetary policy independence due to the "impossible trinity," which asserts that a country cannot simultaneously have a fixed exchange rate, independent monetary policy, and open capital account. Given this, Namibia's policy adjustments are largely influenced by monetary conditions in South Africa, requiring close alignment of interest rates between the two countries to maintain the currency peg and control capital flows (Bank of Namibia, 2023). Despite the constraints of the fixed exchange regime, Namibia retains some policy flexibility. This flexibility is possible through transaction costs, capital controls, and regulatory measures that allow slight deviations in short-term interest rates from those in South Africa without prompting significant capital shifts. Such measures help manage domestically induced inflation and influence private sector credit extension through the bank rate and repo rate channels. These channels affect consumer spending and investment decisions, significantly impacting domestic demand and inflation (Bank of Namibia, 2023). The asset price channel in Namibia also plays a critical role in transmitting monetary policy effects, especially through real estate prices, which affect household spending and inflation. However, the impact of interest rate changes on equity and bond markets in Namibia is limited by market liquidity issues and the dominance of institutional investors, which dampens the responsiveness of asset prices to interest rate fluctuations (Bank of Namibia, 2023). Overall, while Namibia's monetary policy operates under constraints due to its peg to the Rand, the Bank of Namibia utilizes various tools and mechanisms to exert influence over domestic economic conditions. This approach includes maintaining adequate international reserves to support the currency peg and using monetary policy instruments to adjust market liquidity and stabilize domestic inflation despite the challenges of a fixed exchange rate system (Bank of Namibia, 2023).

2.1.3. Lesotho

For Lesotho, the central tenet of monetary policy is achieving price stability, underpinned by the nation's adherence to a fixed exchange rate regime as part of the Common Monetary Area (CMA) agreement. This regime involves a one-to-one peg of Lesotho's currency, the Loti, to the South African Rand. To sustain this peg, Lesotho maintains a strict level of international reserves, ensuring that each Loti in circulation is backed by an equivalent value in foreign currency reserves, effectively tying Lesotho's monetary policy directly to that of South Africa (Khoabane, 2020).

The primary aim of this policy framework is to foster economic stability, supporting growth and maintaining high levels of employment. The mechanism through which these policy goals are achieved, the monetary policy transmission mechanism is crucial for the effective implementation of monetary strategies. This transmission mechanism outlines how monetary policy decisions impact the broader economy, particularly in terms of influencing price levels (Khoabane, 2020).

The effectiveness of this transmission is heavily influenced by various dynamic factors within the economy. These include the development level of the financial sector, market liquidity conditions, the quality of financial assets, the extent of financial market activities, and the competitive and regulatory environment. External economic indicators such as inflation rates and exchange rate flexibility also play significant roles. Changes in these factors can either enhance or diminish the efficacy of monetary policy over time (Khoabane, 2020).

2.1.4. Eswatini

Meanwhile, in Eswatini, monetary policy is closely intertwined with its membership in the Common Monetary Area (CMA), where it, along with other smaller member states, maintains a fixed exchange rate pegged one-to-one with the South African Rand. Due to this arrangement, the South African Rand also serves as legal tender within Eswatini, reflecting a deep economic integration within the region (Dlamini & Kunene, 2023). This setup allows for free capital flows across borders but also restricts Eswatini's monetary policy independence. Consequently, Eswatini's policy rate mirrors South Africa's repo rate, although it occasionally maintains a slightly higher rate to deter capital flight. When this differential becomes negative, Eswatini employs additional monetary tools such as central bank bills, call accounts, and special deposit facilities to manage capital flows effectively (Dlamini & Kunene, 2023).

The fixed peg with the Rand is not merely a monetary strategy but serves a broader economic purpose by importing low and stable inflation from South Africa, which benefits Eswatini given its significant trade links with South Africa. Most of Eswatini's imports are sourced from, and a large portion of its exports are destined for, South Africa, making the stability of this exchange rate crucial for the country's economic equilibrium (Dlamini& Kunene, 2023). Thus, the monetary policy in Eswatini, while limited in scope due to the CMA's structure, plays a critical role in maintaining economic stability through strategic management of the currency peg and careful monitoring of cross-border capital flows.

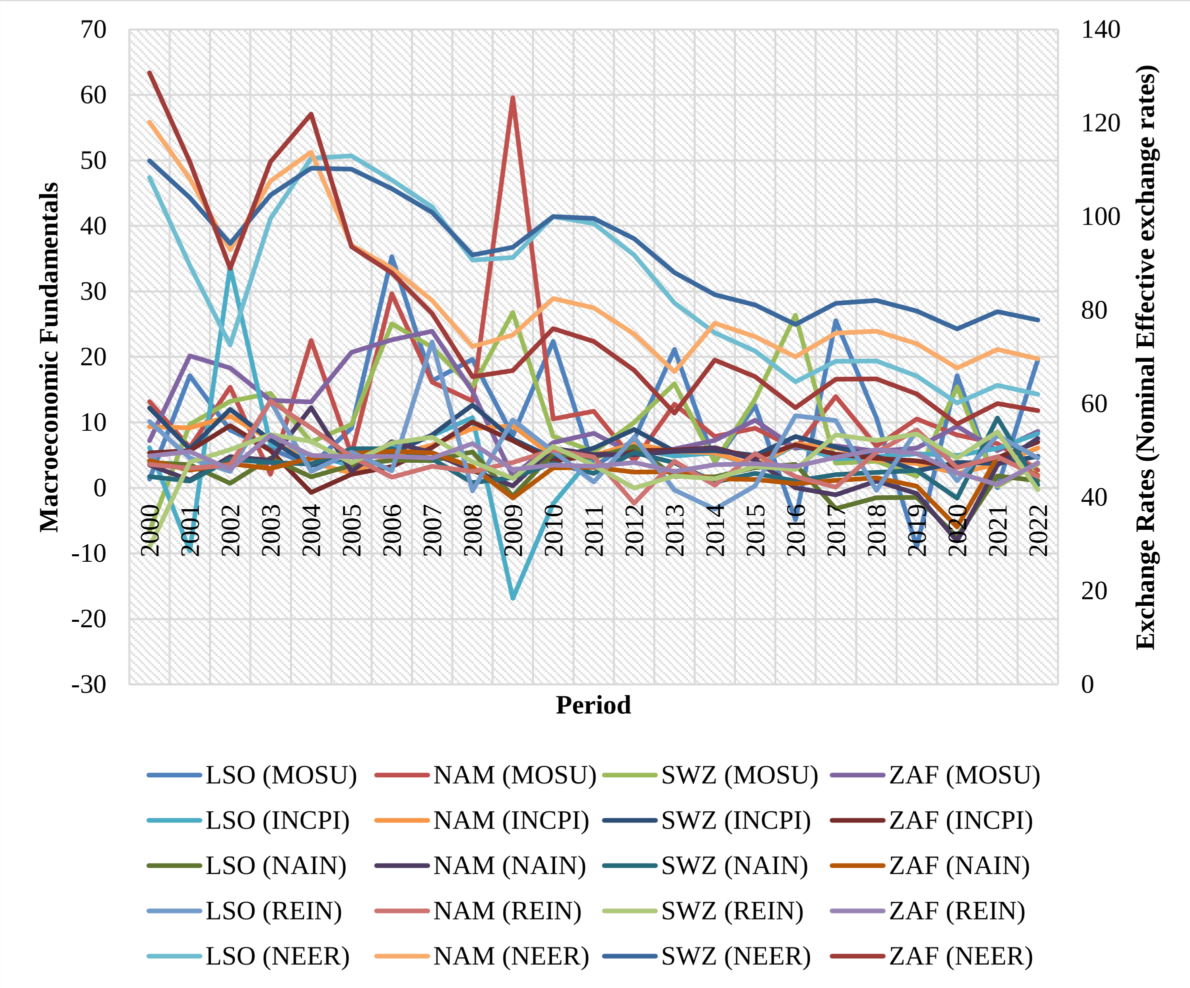
Noticeably, the Common Monetary Area (CMA) presents a unique framework where monetary policy is closely integrated due to fixed exchange rates, with the South African Rand serving as a common anchor. This system requires member states, including Namibia, Lesotho, and Eswatini, to maintain a high level of monetary alignment with South Africa, limiting their independent monetary policy capabilities. The primary goal across these nations remains price stability, which is crucial for fostering sustainable economic growth and financial stability.

Namibia and Eswatini, despite their limited monetary policy autonomy, manage domestically induced inflation and control capital flows through minor deviations in interest rates from South Africa and the use of monetary tools like repo rates, central bank bills, and special deposit facilities. Lesotho's approach, emphasizing strict reserve requirements to maintain its currency peg, underscores a reliance on South African monetary policy which dictates their economic conditions.

This structure, while promoting stability and reducing transaction costs within the CMA, also poses challenges for examining the relationship between macroeconomic fundamentals and exchange rates. The intertwined policies and shared economic outcomes mean that traditional models of exchange rate determination might underperform without considering the variances of this monetary union. Insights into how these nations go through the "impossible trinity" can provide valuable perspectives on the dynamics of exchange rate adjustments within similar monetary frameworks, highlighting the need for tailored analytical approaches in such integrated economic environments.

2.2. The Evolution of CMA Countries' Exchange Rates Against Selected Macroeconomic Fundamentals variables

Figure 1: Evolution of CMA countries' Exchange Rates vs Selected Macroeconomic Fundamentals



Source: Author's compilation. Data from Central bank of Lesotho, Central bank of Eswatini, South African Reserve Bank, Bank of Namibia, International Monetary Fund. NEER is Nominal Effective Exchange Rates, INCPI is Inflation, REIN is Real Interest Rate, NAIN is Economic Growth Rate, and MOSU is Money Supply. Lesotho (LSO); Namibia (NAM); Eswatini (SWZ); South Africa (ZAF).

To determine how CMA's countries exchange rates have evolved against selected macroeconomic fundamentals, the researcher compiled Figure 1. From 2000 to 2022, it is shown that for the CMA countries, the macroeconomic fundamentals of Money Supply (MOSU) and the exchange rate measured by Nominal Effective Exchange Rates (NEER) exhibit varied dynamics.

Lesotho's NEER displays a generally increasing trend, indicating an appreciation of the Loti against the currency basket over the 22-year period. Concurrently, Lesotho's Money Supply growth fluctuates but also trends upward overall, especially noticeable with significant surges in 2005, 2009, and 2022. The simultaneous appreciation in NEER might suggest that an increasing Money Supply did not lead to proportional depreciation, which could imply other compensatory economic factors or potential lags in currency valuation adjustments.

Namibia's NEER fluctuates but with a slight upward trend over the two decades, showing a modest appreciation in the currency's value. This is coupled with a Money Supply growth that shows substantial increases in certain years, such as 2009 and 2017, followed by a sharp decline in 2018. This erratic movement in Money Supply could indicate responsive adjustments or interventions in monetary policy that aim to maintain exchange rate stability under the fixed peg system of the CMA (Dlamini & Kunene, 2023).

Eswatini's NEER follows a downward trend, suggesting a long-term depreciation of the Lilangeni relative to its trading partners' currencies. The Money Supply growth, while fluctuating, has periods of contraction, such as in 2000 and 2016, contrasting with significant growth in years like 2009 and 2020. The depreciating NEER in the face of fluctuating Money Supply growth could reflect challenges in maintaining the fixed exchange rate's stability, possibly due to differential inflation rates or economic shocks.

South Africa's NEER shows a decline overall, indicating a depreciation trend of the Rand. The Money Supply growth exhibits both periods of expansion and contraction, with prominent expansions during 2009 and 2020, likely influenced by economic stimuli in response to global crises. The depreciation trend in NEER, despite increasing Money Supply, could suggest external pressures or domestic economic challenges impacting the Rand's value.

Also, inflation and exchange rate movements have varied interplays across the region. For Lesotho (LSO), the overall trend in NEER shows a tendency towards appreciation, implying a stronger currency over time against its trading partners. Inflation shows significant fluctuations with periods of high inflation, particularly notable in 2008 and 2009, followed by a sharp deflation in 2009 and then a relatively stable, lower inflation rate thereafter, barring the uptick in 2022. This suggests that despite periods of high inflation, Lesotho's currency has maintained or increased its value, possibly indicating robust macroeconomic policies or the influence of the fixed peg to the South African Rand moderating the direct impact of inflation on currency value.

Namibia (NAM) presents a NEER profile with slight upward movements over the period, indicating a modest appreciation trend. Inflation in Namibia follows an erratic path, with high inflation seen in the early 2000s, stabilizing somewhat towards the middle of the dataset, and again experiencing fluctuations towards the end. The relative stability of the NEER despite these fluctuations could reflect the currency peg's buffering effect or Namibia's economic policies aimed at stabilizing the exchange rate against inflationary pressures.

Eswatini's (SWZ) NEER data shows a general trend of depreciation, with the currency losing value against its trading partners overall. Inflation rates are volatile, with notable peaks and troughs throughout the period. The NEER decline amid fluctuating inflation rates might suggest a relatively weaker capacity to absorb inflation shocks, possibly due to less diversified economic structures or trade imbalances.

South Africa (ZAF), as the anchor country in the CMA, shows a depreciating trend in NEER, with the Rand losing value against the basket of currencies. Concurrently, inflation rates demonstrate substantial variability, with notable inflation spikes, particularly during global economic crises. The depreciating NEER, even as the anchor, may be reflective of broader economic challenges that South Africa faces, which also have implications for its CMA partners due to the integrated nature of their economies.

Meanwhile, the trends in Economic Growth (NAIN) and Nominal Effective Exchange Rates (NEER) show that certain patterns emerge which illustrate the interplay between economic growth and currency strength. Lesotho (LSO) demonstrates a generally positive trend in NEER over the given period, suggesting a relative appreciation of its currency, which may point to a consistent demand for its currency relative to its trading partners. This currency appreciation occurred despite varied growth rates, which peaked notably around 2004 and 2012, and dipped into negative territory in 2009 and 2020, aligning with global economic downturns. The data implies that Lesotho's exchange rate is not solely dependent on national income changes, possibly due to the fixed exchange rate mechanism within the CMA or other mitigating economic factors. For Namibia (NAM), NEER trends also indicate an appreciation over the long term. Growth rates in Namibia are more consistent than in Lesotho, with significant growth peaks around 2004 and 2016 and notable declines in 2020. The positive correlation between national income growth and NEER suggests that Namibia's economic strength translates to a more robust currency value, supporting the hypothesis that a growing economy can bolster currency strength (Mankiw, 2023).

Eswatini (SWZ) shows more variability in NEER, with a general depreciating trend, particularly from 2014 to 2022. National income growth has been more erratic, with several years of negative growth. The depreciating NEER alongside fluctuating growth rates may reflect the vulnerability of Eswatini's currency to changes in economic performance and external economic shocks, underscoring the importance of stable economic growth for maintaining currency value. South Africa (ZAF), the anchor economy in the CMA, exhibits a depreciating NEER trend throughout the period, with a consistent decrease from 2013 onwards. National income growth has seen significant volatility, with notable contractions in 2009 and 2020. The divergence between national income growth and exchange rate trends could indicate the influence of broader global economic factors or internal economic challenges, such as structural issues, on South Africa's currency valuation.

Furthermore, the trends in Real Interest Rates (REIN) and Nominal Effective Exchange Rates (NEER) reveal a complex interaction between monetary policy and currency strength. For instance, Lesotho's real interest rates fluctuate significantly over the period, with high rates in the early 2000s, a notable dip in 2008, and a general decline towards 2022. The NEER for Lesotho exhibits an overall appreciation trend, with some years of decline. The data suggests that despite the volatility in real interest rates, the Loti has generally appreciated, indicating that factors other than domestic interest rates—such as fiscal policies or remittances—may exert strong influences on the currency's value. Namibia's real interest rates present a relatively stable trend with some declines, particularly noticeable in 2012. The NEER shows a depreciating trend starting around 2013. The generally stable but declining interest rates in Namibia, coupled with a depreciating currency, could imply that external factors or market perceptions of economic health may have contributed to the currency's performance, overshadowing the impact of interest rates.

For Eswatini, real interest rates are mostly positive but with a noticeable drop in 2008 and fluctuations thereafter. The NEER depicts depreciation over time, especially from 2013 to 2022. The mismatch between generally positive real interest rates and a depreciating currency could suggest that investor confidence or external economic shocks, rather than domestic interest rates alone, have a significant impact on the currency's strength. South Africa's real interest rates show an overall declining trend, with significant dips in 2008 and 2020, corresponding with global economic crises. The NEER trend is also depreciating over the period. As the anchor economy in the CMA, South Africa's exchange rate trends are crucial for the area. The depreciating NEER despite varying interest rates might reflect broader global influences or internal challenges, affecting the region's exchange rate dynamics.

Therefore, the selection of the CMA as a case study is motivated by its unique economic and monetary integration, which sets it apart from other African monetary unions such as WAEMU and CEMAC. Unlike WAEMU, which uses the CFA Franc pegged to the Euro, and CEMAC, which exhibits weaker economic integration, the CMA operates under a one-to-one pegging system with the South African Rand. This creates a dynamic where South Africa's monetary policies significantly influence the entire region. For instance, when South Africa implemented its tiered floor monetary policy framework in 2021, the ripple effects were felt across the CMA, underscoring the region's interdependence (South African Reserve Bank, 2022). Furthermore, the CMA's institutional framework, allowing for the free movement of capital and trade while maintaining fixed exchange rate stability, provides a distinct environment for examining how macroeconomic fundamentals interact with exchange rates. This study leverages this uniqueness to provide insights that are not only relevant to the CMA but also applicable to other monetary unions seeking to understand the complexities of fixed exchange rate systems in interconnected economies

CHAPTER THREE

LITERATURE REVIEW

3.1. Introduction

This chapter provides a comprehensive review of literature relevant to understanding the dynamics between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA). It begins with an exploration of the theoretical literature that informs the study in Section 3.2, namely the Flexible-Price Monetary Model (FPMM) and the Real Interest Differential Monetary Model (RIDMM), also known as the Hybrid Monetary Model. This section also discusses other foundational theories, including the Purchasing Power Parity (PPP), Mark's specification, the Portfolio Balance model, and the demand-pull theory, which collectively provide a theoretical basis for interpreting the complex interactions between macroeconomic variables and exchange rates.

Section 3.3 looks at the empirical literature, focusing on two main areas: the long-run and short-run linkages between macroeconomic fundamentals and exchange rates (3.3.1), and the causal relationships between these variables (3.3.3). These sections synthesize findings from previous studies to contextualize the current research within the broader discourse on exchange rate economics, providing insights into how past research has approached similar questions and the conclusions drawn from such analyses.

3.2. Theoretical Literature

The theoretical literature of this study is underpinned by the Flexible-Price Monetary Model (FPMM) and the Real Interest Differential Monetary Model (RIDMM) or the Hybrid Monetary Model Frankel (1979), the Purchasing Power Parity (PPP), Mark's specification, The Portfolio Balance model, and the demand-pull theory.

3.2.1. Flexible-Price Monetary Model (FPMM)

The Flexible-Price Monetary Model (FPMM), pioneered by Frenkel (1976) and Mussa (1976), posits that the exchange rate is determined by the supply and demand for different currencies, which in turn are influenced by factors such as relative money supplies, income levels, and interest rates across countries. The FPMM suggests that exchange rates are influenced by relative money supplies, income levels, and interest rates, assuming that prices and wages are flexible and can adjust to equate money supply with demand. This model posits a direct relationship between the money supply and exchange rate: an increase in money supply leads to depreciation of the currency.

For CMA, the relevance of FPMM lies in understanding how external factors, particularly those related to South Africa as its main trading partner and the anchor for its fixed exchange rate, impact its exchange rate stability. Given, for instance Namibia's fixed exchange rate regime, the model shows the importance of maintaining monetary discipline and monitoring external economic conditions that could influence the Namibia Dollar's peg to the South African Rand. Essentially, for CMA countries, this theory underscores the need to manage money supply carefully to maintain exchange rate stability, particularly given their fixed exchange rate regime (Mankiw, 2020).

3.2.2. Real Interest Differential Monetary Model (RIDMM) or the Hybrid Monetary Model

Frankel (1979) introduced the Real Interest Differential Monetary Model (RIDMM) or the Hybrid Monetary Model, which integrates elements of the FPMM with a focus on the real interest rate differential between countries as a determinant of exchange rate movements. It assumes that exchange rates reflect the expected returns on financial assets across countries, which are influenced by real interest rates. A key aspect is that higher real interest rates attract capital inflows, leading to currency appreciation. This model is essential for understanding how differences in real interest rates between South Africa and other CMA countries can impact exchange rates, given the fixed regime's reliance on harmonized interest rate policies (Frankel, 1979).

In essence, this model is particularly relevant for CMA countries like Namibia, Lesotho and Eswatini in analysing the impact of interest rate differentials and inflation expectations on its fixed exchange rate regime. Given the peg to the South African Rand, understanding these differentials is crucial for monetary policy, especially in terms of managing inflation and interest rates in alignment with those of South Africa to maintain the peg's stability (Bank of Namibia, 2023).

3.2.3. The Purchasing Power Parity (PPP)

The Purchasing Power Parity (PPP) theory, proposed by Cassel (1918), posits that exchange rates between currencies are in equilibrium when their purchasing power is the same in each of the two countries. This theory is based on the law of one price, which states that identical goods in different countries should have identical prices when expressed. The PPP theory asserts that exchange rates adjust to equalize the price levels of identical goods and services between countries, assuming perfect market arbitrage. It suggests a long-term equilibrium relationship between exchange rates and inflation differentials. In the CMA, the PPP theory highlights how inflationary pressures in South Africa can transmit to other member countries, affecting their price stability and real exchange rates despite the nominal peg (Sarno & Taylor, 2002). The point is, in the setting of the CMA, PPP can be used to analyse how inflation differentials between member countries impact the exchange rate, particularly given the fixed exchange regime tied to the South African Rand.

3.2.4. Mark's (1995) Specification

Kenneth Mark (1995) developed a model that integrates short-run dynamics with long-run equilibriums from the PPP and uncovered interest rate parity (UIP) theories, typically used in examining exchange rate behaviours within a coherent economic framework (Itskhoki & Mukhin, 2021). This model combines elements of PPP and uncovered interest rate parity (UIP), suggesting that short-term exchange rate movements are influenced by changes in expectations about long-term fundamentals. The model assumes deviations from long-term equilibrium due to market frictions or speculative bubbles can occur but will eventually correct. In the CMA, Mark's specification helps explain the dynamic adjustment of exchange rates to macroeconomic fundamentals, considering both immediate and delayed responses to economic policies and shocks (Itskhoki & Mukhin, 2021). Accordingly, this model is particularly relevant for the CMA in understanding how exchange rates respond to changes in fundamentals over time, considering both short-term and long-term adjustments.

3.2.5. The Portfolio Balance Model

The Portfolio Balance Model, developed by Hooper and Morton (1982), extends the analysis of exchange rates beyond price mechanisms to include financial assets (Hooper & Morton, 1982). This model emphasizes that exchange rates are influenced by the supply and demand for financial assets of different countries and that these rates adjust to balance the relative supplies of financial assets. Essentially, Hooper and Morton (1982) extend exchange rate analysis to include financial assets, suggesting that currency values are determined by the demand and supply of these assets, influenced by risk perceptions and relative asset returns. The model assumes that investors diversify portfolios internationally, and exchange rates adjust to balance the relative supplies of different countries' financial assets. For the CMA, this model illustrates how cross-border capital flows and asset preferences can impact exchange rates, particularly under scenarios of financial instability or policy changes (Hooper & Morton, 1982). Therefore, the model particularly applies to the CMA setting, where cross-border capital flows and asset holdings can influence exchange rates among the member states. For example, the Bank of Namibia recently postponed changes related to cross-border payments within the Common Monetary Area (CMA), which includes Namibia, Eswatini, Lesotho, and South Africa. These changes (which impact cross-border Electronic Fund Transfer (EFT) payments processed and received by clients within the CMA, restricting the use of domestic payment methods and channels) were initially scheduled to take effect from April 15, 2024, but postponed were to 15 September 2024 (Bank of Namibia, 2024).

3.2.6. Demand Pull Theory

The Demand-Pull Theory of Inflation argues that prices increase due to an increase in aggregate demand relative to aggregate supply and is often associated with Keynesian economics. In the view of exchange rates, stronger economic growth in a country (increasing demand) can lead to appreciation of the currency if not accompanied by a commensurate increase in supply (Mankiw, 2023; Mankiw, 2020). As such, this theory posits that inflation results from increased aggregate demand outpacing aggregate supply, often assuming that the economy operates under conditions where increases in demand lead directly to higher prices rather than output. The theory implies that strong economic growth can appreciate the currency if it leads to higher demand for the currency due to increased investment and consumption. In the CMA, demand-pull inflation can influence exchange rates by affecting the balance of payments and altering the competitiveness of domestic goods relative to imports (Mankiw, 2020; 2023). The essence of the latter statement, is that in the CMA, where economic synchronization impacts monetary policies, understanding demand-pull effects on inflation and, through it exchange rates can provide insights into intra-regional economic dynamics (Mankiw, 2023).

3.2.7. Interest Rate Parity (IRP) Theory

The Interest Rate Parity (IRP) theory, proposed by Keynes (1923) and further developed by Fisher (1930), posits that the difference in interest rates between two countries is equal to the expected change in exchange rates between their currencies. This theory assumes that arbitrage in international financial markets ensures equilibrium, aligning interest rate differentials with forward exchange rate premiums or discounts. The IRP suggests a relationship where currencies with higher interest rates tend to depreciate relative to those with lower interest rates due to anticipated capital outflows (Obstfeld & Rogoff, 1995). However, the theory assumes perfect capital mobility, risk neutrality, and no transaction costs, which are rarely observed in practice. Critics, such as Taylor (2006), argue that deviations from IRP often occur due to market imperfections, capital controls, or speculative activities. Despite these limitations, the IRP theory is relevant to this study as it highlights the significance of interest rate differentials, a macroeconomic fundamental, in exchange rate determination. For the CMA, where member countries align their interest rates with South Africa to maintain the currency peg, understanding IRP provides insights into how deviations could impact exchange rate stability.

3.2.8. International Fisher Effect (IFE)

The International Fisher Effect (IFE), introduced by Irving Fisher (1930), posits that nominal interest rate differentials between two countries reflect the expected change in their exchange rates. This theory is rooted in the Fisher hypothesis, which links nominal interest rates to expected inflation rates (Fisher & Barber, 2013). The IFE implies that currencies of countries with higher nominal interest rates will depreciate due to anticipated inflation. While the IFE provides a theoretical linkage between interest rates, inflation, and exchange rates, empirical evidence has been mixed. Studies, such as Chinn and Meredith (2004), have shown that short-term deviations from IFE are common due to speculative forces or other market factors. However, over the long term, the theory holds, especially in economies with transparent monetary policies. In the context of the CMA, the IFE underscores the importance of harmonizing inflation and interest rates with South Africa to avoid misalignment in exchange rate expectations.

3.2.9. Economic Theory of Exchange Rate Determination

The Economic Theory of Exchange Rate Determination synthesizes multiple macroeconomic variables, including trade balances, relative price levels, and capital flows, to explain exchange rate movements. Developed by Dornbusch (1976), this theory emphasizes the role of overshooting, where exchange rates temporarily deviate from their equilibrium due to capital market adjustments. The theory assumes rational expectations and instantaneous adjustment in financial markets but acknowledges slower adjustments in goods markets. Its primary limitation lies in its dependence on perfect information and rational behavior, which do not always hold in real-world markets. For the CMA, this theory is instrumental in analyzing how economic fundamentals like trade balances and capital flows influence the fixed exchange rate regime, particularly under external shocks or policy shifts.

3.2.10. Nominal Exchange Rate Targeting

Nominal Exchange Rate Targeting, advanced by Frankel and Rose (1996), is a policy framework wherein central banks adjust monetary policies to achieve a targeted exchange rate. This approach assumes a strong correlation between nominal exchange rates and macroeconomic stability, with the central bank intervening to stabilize currency fluctuations. While this method effectively anchors inflation and trade costs, it limits monetary policy independence, a notable criticism highlighted by Calvo and Reinhart (2002). In the CMA, nominal exchange rate targeting is inherently practiced through the peg to the South African Rand, demonstrating the critical interplay between exchange rate policies and macroeconomic fundamentals like inflation and money supply.

3.2.11. Robustness Analysis in Exchange Rate Models

Robustness analysis, introduced into exchange rate studies by Canova and Hansen (1995), evaluates the stability and reliability of exchange rate models under various economic conditions. This approach tests the sensitivity of exchange rate predictions to changes in assumptions, data, or model specifications. While it does not propose a direct relationship between fundamentals and exchange rates, it ensures that empirical findings remain valid across different contexts. For the CMA, robustness analysis is vital in assessing how structural breaks, such as policy shifts or external shocks, affect the link between macroeconomic fundamentals and exchange rates, ensuring that results are applicable across varying economic scenarios.

3.2.12. Currency Demand and Supply Model

The Currency Demand and Supply Model, rooted in classical economics, posits that exchange rates are determined by the interaction of currency demand and supply in international markets. The model assumes that higher demand for a currency, driven by exports or investment inflows, leads to appreciation, while increased supply, often due to capital outflows or trade deficits, results in depreciation (Mankiw, 2020). However, it oversimplifies the complexities of exchange rate dynamics, as it does not account for speculative activities or policy interventions. Within the CMA, this model helps explain how trade dynamics and capital flows influence exchange rate stability, particularly under conditions where external shocks impact demand and supply equilibrium.

These theories provide a comprehensive framework for analysing the relationship between macroeconomic fundamentals and exchange rates within the CMA, offering both theoretical and practical insights into the monetary dynamics and policy implications for Namibia and its partner states in the union. By applying these theoretical frameworks, the study can explore the impacts of economic policies, trade flows, and inflation differentials on the stability and performance of the CMA's unified exchange rate system.

3.3. Empirical Literature

The empirical literature review provides an examination of previous studies that have explored the relationship between macroeconomic fundamentals and exchange rates. This section synthesizes findings from various empirical analyses to understand how these variables interact in both long-term and short-term contexts. Specifically, section 3.3.1 will delve into the empirical evidence on the long run and short run linkages between macroeconomic fundamentals and exchange rates, highlighting key patterns and divergences observed in different economic environments. Following this, section 3.3.2 will focus on the causal relationship between these macroeconomic variables and exchange rates, evaluating the direction and strength of these interactions as established in previous research.

3.3.1. The Long Run Linkages and The Short Run Linkage Between Macroeconomic Fundamentals and Exchange Rate

Shumba and Mukorera (2023) conducted a study to assess the effects of unexpected changes in the monetary policy instrument of South Africa's central bank on the macroeconomic performance of the Common Monetary Area (CMA) region. The researchers employed a Panel Structural Vector Autoregressive (Panel-SVAR) model using annual data from 1980 to 2021. Their analysis indicated that an increase in the repo rate in South Africa, the anchor nation of the CMA, led to significant macroeconomic shifts across the region. Specifically, the study found that such an increase resulted in a decline in real GDP growth (RGDP_G), reduced inflation rates, decreased money supply, and higher lending rates throughout the CMA. These findings highlight the sensitivity of the CMA economies to monetary policy changes in South Africa and suggest a need for coordinated policy responses to manage these impacts effectively. The study utilized a lag duration of four, deemed optimal based on criteria including the Schwarz Criterion (SC), Final Prediction Error (FPE), Likelihood Ratio (LR), Akaike Information Criterion (AIC), and Hannan-Quinn Criterion (HQ). This comprehensive approach underscores the interconnectedness of the CMA's economies and the pivotal role of South Africa's monetary policy in influencing regional economic stability.

Similarly, the study conducted by Dlamini and Kunene (2023) calculates the equilibrium exchange rate for Eswatini using the Behavioural Equilibrium Exchange Rate technique. The study employs the Autoregressive Distributed Lags (ARDL) method and analyses annual data from 1990 to 2021. The empirical findings suggest that the country's real effective exchange rate is significantly influenced by the long-term changes in real GDP growth and real interest rate, both of which have a negative impact on the exchange rate. In the near term, it was seen that an increase in real GDP had a notable adverse impact on the country's real effective exchange rate and real interest rate. Additionally, certain macroeconomic factors had a large beneficial influence on the country's real effective exchange rate.

On another note, Thevakumar and Jayathilaka (2022) examined the feasibility of modelling the volatility of the USD/LKR exchange rate and assessed the impact of macroeconomic factors on the exchange rate in Sri Lanka. An empirical analysis was conducted using data collected from January 2010 to December 2017. The exchange rate volatility was modelled using a combination of Autoregressive Integrated Moving Average (ARIMA) and Generalised Autoregressive Conditional Heteroskedasticity (GARCH) family models. The ARDL model was employed to investigate dynamic short-term and long-term associations between the exchange rate and macroeconomic factors. The empirical findings of the ARDL model indicate that there is no long-term link between the analyzed macroeconomic variables and the exchange rate. Conversely, there is a temporary connection between exchange rate lag one, exchange rate lag two, and inflation. Therefore, according to the research, reducing inflation would also reduce fluctuations in the currency rate. This study's conclusions can be advantageous for all stakeholders, such as policymakers, importers, exporters, and financial institutions, who are affected by fluctuations in foreign exchange rates.

On the other hand, Cuestas et al. (2022) employed models that integrate structural breaks and nonlinearities to ascertain the actual exchange rate. All variables in the model exhibited integrated of order 1 (I (1)). The panel unit root tests conducted by Levin et al. (2002), Bai and Ng (2004), and Pesaran (2007) indicate that the variables are integrated of order 1 (I (1)). Additionally, the panel co integration tests performed by Kao (1999) and Westerlund (2007) reject the null hypothesis of no co integration. The researchers conducted co-integrated dynamic ordinary least squares (DOLS) regressions and quintile regressions to estimate the data. They discovered that the symmetrical long-term correlation between the exchange rate and economic growth across the entire period was statistically negligible and negative. Regarding the 2008 dummy variable, it was determined that the symmetrical long-term connection between the exchange rate and economic growth was not significantly negative prior to 2008Q1 and from 2008Q1 onwards. The analysis of the 2008 dummy variable revealed a highly negative asymmetric long-term association between the exchange rate and economic growth throughout the whole period, both before and after 2008Q1. The leads and lags for the DOLS calculations were determined using the Bayesian Schwarz Information Criteria. The DOLS equations were calculated using heteroskedasticity and autocorrelation corrected (HAC) Newey-West residuals.

Furthermore, Shukri et al. (2021) conducted a study to determine the equilibrium of currency rates and analyze the impact of macroeconomic fundamentals on exchange rates using data from Malaysia from 1970 to 2019. This study utilized the Autoregressive Distributed Lag model to analyze the long-term connections or co integration among variables and the immediate impact inside variables in the short term throughout the specified time frame. The findings indicate that the inflation rate and economic growth rate have significant impacts on the fluctuation of exchange rates, both in the short term and long term.

In addition, Fiaz et al (2021) examined the primary factors influencing the deviation of the exchange rate (RER) from its equilibrium value in Pakistan from 1991 to 2020, employing the BEER methodology. The Markov Regime-switching (MSM) technique was utilized to investigate the precise exchange rate misalignment and analyze the behaviour of variables that vary across different undervaluation and overvaluation regimes. The results demonstrated that MSM effectively detected exchange rate misalignment in both regimes, identifying distinct occurrences of overvaluation and undervaluation. The results also indicated that the misalignment of the Real Effective Exchange Rate (RER) was influenced by changes in the interest rate, which is one of the key macroeconomic factors.

Meanwhile, in their study, Fakher et al. (2021) investigated the relationship between macroeconomic fundamentals and exchange rate behaviour in advanced and least developed nations. The Pooled Mean Group regression, utilizing panel ARDL and Panel Granger Causality Test, is applied to annual panel data sets covering 1995 to 2015. The findings demonstrate a robust correlation between the macroeconomic factors of the inflation rate, economic growth, and exchange rate volatility in advanced countries, and a less pronounced correlation in least developed countries over a prolonged period. The Panel Granger Causality Test revealed that there was a one-way causal relationship from economic growth to exchange rates in advanced countries. However, no causal relationship was discovered between inflation and currency rates. For the least developed countries, the analysis revealed that there was a reciprocal relationship only between the level of exchange rates and inflation. In the scenario of unidirectional causality, the level of exchange rate was influenced by economic growth.
Moreover, Chahrour et al. (2021) examined the phenomenon of Exchange Rate Disconnect Redux. A VAR was employed utilizing Bayesian approaches to analyze quarterly data from 1976: Q1 to 2008: Q2 for G7 countries. Their research revealed a causal relationship between exchange rates and macroeconomic fundamentals such as interest rates and inflation. However, the causality was observed to flow from current exchange rates to future fundamentals, which is contrary to the forecasting relationship between current and past macro variables and exchange rates.

Additionally, Stavrakeva and Tang (2020) employ a decomposition-VAR methodology to uncover novel empirical observations about the connection between exchange rates and key macroeconomic indicators such as interest rates, inflation, and GDP. The study demonstrates that macroeconomic surprises account for around 70 percent of the fluctuations in nominal exchange rates at a quarterly frequency. The authors utilized a unique method of breaking down exchange rate movements into present value components, which was guided by survey forecast data. They also demonstrated that macroeconomic surprises have a significant role in determining the currency risk premia component, accounting for around 50 percent of its variability. These unexpected events possess enhanced explanatory capacity, particularly in times of economic recession and financial instability.

Likewise, Hadiwibowo and Yasni (2020) examined the process of determining the currency rate in Indonesia following the Asian financial crisis. The Monetary Model was employed to evaluate the forecast of the Indonesian Rupiah in relation to the United States Dollar and other currencies of Indonesia's major trading partners. The two models are the Flexible Price Monetary Model and the Sticky Price Monetary Model. The Error Correction Model is utilized to estimate both short-run and long-run relationships. The Monetary Model provides some explanation for the fluctuations in exchange rates; however, the anticipated relationship between money supply, economic growth, and exchange rates does not align as predicted. The Granger causality test indicated that there may be a causal relationship between the exchange rate to both money supply and inflation.

Conversely, In Chavez's (2020) study, the author examined the factors that influence the real exchange rate by analyzing macroeconomic data and assessing their ability to forecast it. The analysis utilizes panel data spanning from 1980 to 2019, employing the Generalized Method of Moments (GMM) technique to address endogeneity concerns associated with the variables. The authors employed Forward Orthogonal Deviations (FOD) and First Difference (FD) techniques to convert the variables, thereby eliminating time-invariant unobserved effects. To assess the reliability of the estimations, various time periods were employed, spanning from 1980 to 2019, 2000 to 2019, and 2010 to 2019. From 1980 to 2019, it has been observed that previous values of the real exchange rate, current levels of inflation, and economic growth have a positive influence on the current values of the real exchange rate in the short term. Conversely, the money supply has a negative impact on the real exchange rate in the short term

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Meanwhile, employing the Pedroni test to ascertain long-term associations, it was discovered that inflation had a long-term correlation with the exchange rate. From 2000 to 2019, there were consistent findings indicating that economic expansion has adverse effects on the real exchange rate in the short term. This trend was also observed specifically from 2010 to 2019. The Arellano-Bond test and the Sargan test are also introduced to estimate model over-identification.

Meanwhile, Salim and Shi (2019) conducted an analysis of the cointegration between the exchange rate of the Indonesian Rupiah and the currencies of its main trading partners, as well as its macroeconomic fundamentals. The empirical findings, derived from the Autoregressive Distributed Lag (ARDL) and Nonlinear Autoregressive Distributed Lag (NARDL) models, demonstrate that the essential factors of inflation rate, interest rate, economic growth, and money supply consistently influence the exchange rate in both the long-term and short-term.
Meanwhile, the study conducted by Khan et al. (2019) examines the impact of macroeconomic factors on the exchange rate between the US dollar and the Chinese yuan. It utilizes yearly time series data for the Chinese economy from 1980 to 2017. The ARDL bounds test approach is utilized to examine the long-term relationship between the dependent and independent variables. The findings from the long-term autoregressive distributed lag (ARDL) analysis suggest that an increase in Gross Domestic Product (GDP) leads to a positive impact on the exchange rate between the United States dollar (USD) and the Chinese yuan (CNY). Conversely, higher interest and inflation rates are associated with a negative influence on the exchange rate. The study suggests that the Chinese government should adopt crucial monetary and fiscal policies to establish a stable and efficient exchange rate for China. This will help ensure sustainable economic growth in the long term, particularly in relation to its trading partners.

Also, in their study, Draz et al. (2019) analyzed the influence of macroeconomic fundamentals on the currency rates of several South Asian economies from 1981 to 2013. The authors employed two econometric methodologies to analyze the data. The pooled sample is analyzed using the EGLS and two-stage Least Square Method. The researchers employed panel GMM and OLS methods for the analysis of the panel data. The findings indicate that macroeconomic fundamentals, such as economic growth, interest rates, and inflation rate, exert a substantial influence on exchange rates, both in the short term and the long term.

Furthermore, Bosupeng, Dzator, and Nadolny (2019) employed the ARDL methodology to ascertain the degree of exchange rate misalignment in Botswana, with data spanning from 1980 to 2015. The empirical findings indicate that there is a statistically significant negative correlation between GDP and the real effective exchange rate in the long run. The real effective exchange rate had a negative and statistically significant correlation with GDP in the short term. This is why Arsanious and Mabrouk (2020) identified the primary factors that influence the nominal and real effective exchange rates in a dataset of 30 countries from 1977 to 2017 and employed multiple linear regression analysis using Fixed GLS AR1 and Pooled Mean Group (PMG) methods. The primary determinants of the nominal exchange rate over an extended period are identified as broad money, interest rate, and long-term inflation. In the short term, its performance is mostly influenced by changes in interest rates and inflation rates. More precisely, the nominal exchange rate was adversely affected by wide money, inflation rate, and interest rate, both in the short term and the long term.

Similarly, Karamcheti et al. (2018) conducted a study to assess the significance of the Flexible Price Monetary (FPM) Model in explaining the movement of the INR/USD exchange rate. The study focused on the period from April 1995 to December 2016 in India and analyzed the relationship between the exchange rate and macroeconomic factors such as relative money supply and relative interest rates. Before estimating the empirical model, a series of non-stationarity tests was used to determine the time series features of the data. Given that all the data series were determined to be integrated of order one, the multivariate co integration methodology was employed to assess the long-term validity of the model. The empirical findings provide evidence in favour of the FPM model's ability to determine the long-term INR/USD exchange rate. It was discovered that macroeconomic fundamental variables such as money supply and interest rate have a positive correlation with exchange rate patterns over a long period of time. However, these variables were found to be ineffective and insignificant in the short term. Therefore, they cannot be considered as a useful framework for explaining the fluctuations in the INR/USD exchange rate. The Granger causality test revealed the presence of unidirectional causality from money supply and interest rate differential to exchange rate.
In addition, Erdal (2018) empirically examines the flexible price monetary approach to determining exchange rates in Turkey within a flexible exchange rate system. The co-integration analysis and Error Correction Model (ECM) are utilized to examine the long-term relationship and short-term effects, respectively. The co integration study reveals a persistent connection between the nominal exchange rate, the difference in money supply, and the difference in nominal interest rates. The validity of the flexible price monetary model can be asserted in the long-term in Turkey, particularly under a flexible exchange rate regime. The discrepancy in money supply has a positive effect on the nominal exchange rate, whereas the

differential in nominal interest rates has a negative effect, as anticipated. Short-term nominal interest rates exhibit greater sensitivity in rectifying long-term imbalances in nominal exchange rates.

Furthermore, Raza and Afshan (2017) analyzed the factors influencing the exchange rate in Pakistan by utilizing time-series data spanning from 1972 to 2013. The findings from the Autoregressive Distributed Lag (ARDL) bound testing co-integration strategy, the Johansen and Juselius co-integration approach, and the Gregory and Hansen structural break co-integration approach validate the existence of a strong long-term link among the selected variables. The long-term estimates suggest a strong negative correlation between exchange rates and economic growth. Nevertheless, the relationship between money supply and, inflation rate and exchange rates is both positive and substantial. Nevertheless, all other variables are deemed inconsequential in the short term. The Granger causality test verified the existence of a reciprocal causal connection between the exchange rate and economic growth in Pakistan. Nevertheless, there is a one-way causal relationship between inflation and money supply, where the explanatory variable influences the exchange rate of the country. The research guide assists policymakers in creating definitive monetary and fiscal policies to determine a stable and productive exchange rate for Pakistan, to achieve long-term sustainable economic growth. Consequently, Zou et al. (2017) examined the fluctuating correlation between the price of commodities and the currency rate in Australia and New Zealand. The exchange rate and the commodity price index are monthly time series spanning from 1986 to 2010. The authors utilized country-specific commodity price indices to analyze the correlation between the deviation of currency value from its equitable value and essential macroeconomic factors such as GDP, employing an error correcting model. Empirical evidence has revealed a significant and resilient correlation between the exchange rate and the price of commodities. Findings suggest that incorporating the commodity price can enhance the predictive accuracy of future exchange rate forecasts. The macroeconomic fundamental, GDP, was observed to exhibit both positive and negative correlations with different exchange rates in both Australia and New Zealand.

Conversely, Adler and Grisse (2017) used panel data from advanced economies and chosen Euro countries to assess the BEER technique. They found that the magnitude and signs of the projected values are influenced by the exact mix of variables employed in the model specifications. The researchers discovered a strong and consistent relationship between the real interest rate and GDP with the real exchange rate, as observed in various model configurations. In their study, Alagidede and Ibrahim (2017) investigated the factors that contribute to exchange rate volatility and analyzed the impact of exchange rate variations on economic growth in Ghana. The time series data for all the variables extended from 1980 to 2013, encompassing 34 years. The Generalized Method of Moments (GMM) was employed as the analytical methodology. There was a notable and favourable correlation between the money supply and the exchange rate. Over time, it was determined that inflation had a substantial adverse impact on the exchange rate, while GDP has a big beneficial impact on the exchange rate.

Interestingly, Pozzi and Sadaba (2017) employed a Bayesian Gibbs sampling technique to calculate the various stages of the methodology for eight nations (five developed, three emerging) in comparison to the United States from 2002Q1 to 2014Q4. The macroeconomic factors considered are the growth rate of real GDP, the rate of inflation, the long-term nominal interest rate, and the ratio of the current account to GDP. The posterior probabilities of these macro fundamentals being scapegoats were estimated. In five out of eight countries, including the Anglo-Saxon economy, the probability for the inflation rate was significantly greater than the predetermined prior probabilities of 0.5. They discovered minimal evidence indicating that the other macro fundamentals they examined were being wrongly blamed.

On a similar note, Chen and Chou (2015) examined how permanent and transitory shocks contribute to the explanation of currency rates and economic fundamentals. Their findings indicate that, based on their analysis of six EU nations over a span of two centuries, temporary shocks have a greater influence on exchange rate fluctuations, whereas permanent shocks have a greater influence on changes in economic fundamentals, such as the impact of the 2008 and 2009 crises.

Meanwhile, Bhutt et al. (2014) examined the dynamic relationship between macroeconomic variables and the currency rate in Pakistan. The study examined quarterly time series data of the pertinent variables from the first quarter of 1998 to the fourth quarter of 2012. The study examines the proposed hypotheses using generally acknowledged and commonly used econometric models in academic research within the fields of economics and finance. Initially, the study examines whether all-time series variables, including the exchange rate and a collection of seven macroeconomic indicators, exhibit stationarity. Subsequently, the study examined the co-integration features of the variables being studied using a multivariate approach. The study used the multivariate form to examine the Granger-causality relationship between macroeconomic variables. In addition, the study used the Granger-causality test in the bi-variate form to examine the lead-lag connection and determine the direction of impact, specifically whether it is unidirectional. The study's findings indicate a significant long-term relationship between the exchange rate and inflation, with a significant level of 10%. The Granger-causality test indicated that the influence is mostly from inflation to exchange rate rather than from exchange rate to inflation. However, it is important to note that both relationships are statistically insignificant. The findings of the Granger-causality test indicate a unidirectional causality, with the money supply leading to the exchange rate. In other words, the money supply Granger causes the exchange rate.

Nonetheless, the study conducted by Chang and Su (2014) examined the connections between exchange rates and macroeconomic fundamentals to identify the long-term relationship, short-term dynamic adjustment, and causality direction for various Pacific Rim nations. The analysis employed monthly data from January 1986 to December 2011 for Canada, Chile, Indonesia, Japan, South Korea, Malaysia, the Philippines, Taiwan, and the United States. For Singapore, the data covered the period from January 1991 to July 2012, while for Thailand, it spanned from January 1987 to December 2006. The authors primarily incorporated structural breakdowns into the VECM model to examine the long-term equilibrium and short-term dynamic connections between the two variables, namely nominal exchange rates and money supply. The analysis revealed that the estimated Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) statistics were lower than their critical values, while the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) statistics were higher than their critical values for all series. This indicates that the variables in the levels were not stationary. The unit root tests for the first difference indicate that the variables in the first difference have an integration order of zero. The testing findings demonstrated that both the exchange rates and macroeconomic fundamentals series exhibited the same level of integration, specifically I (1). This finding confirms the appropriateness of employing co integration tests. The Narayan and Popp (2010) unit root test with structural breakdowns was used to analyze all variables. The results showed that for all analyzed nations, the variables exchange rates, and macroeconomic fundamentals did not provide enough evidence to reject the null hypothesis of a unit root in all circumstances (i.e. Model 0, Model 1, and Model 2). These results are notable because they indicate that both exchange rates and macroeconomic fundamentals at the levels being studied were not stable over time. The results of the Narayan and Popp (2010) unit root test corroborated the findings of the ADF, PP, and KPSS tests, indicating that all series are potentially integrated of order 1 (I (1)). This suggests that when currency rates and macroeconomic fundamentals are affected by external shocks, they cannot reach equilibrium values in the long term. It also suggests that they adhere to a stochastic process characterized by random movements. The findings from the VECM analysis, which accounted for structural breaks, indicated that exchange rates played a significant role in adjusting towards the long-term equilibrium in three nations under the floating exchange rate system. When the authors considered the structural break variables, they found that exchange rates and fundamentals were strongly co-integrated for Canada, Japan, South Korea, and Thailand in reference to the United States. This suggests that there was a structural change in the long-term equilibrium between the two investigating variables in these economies.

After accounting for structural breaks, it was discovered that there was a two-way causal relationship between South Korea and the United States. This suggests that exchange rates and monetary fundamentals have a mutual influence on one another. Nevertheless, there was a one-way causality in the country-pairs of Canada–U.S., Japan–U.S., and Thailand–U.S. The exchange rates of the Canadian dollar/dollar, yen/dollar, and baht/dollar provided information regarding future changes in macroeconomic fundamentals that aligned with the implications of the asset-pricing model of exchange rates.

A key policy conclusion is that the exchange rate reflects the relative economic situations of countries, as it signifies the share of currency transactions between them. Therefore, when there is a greater degree of dependency, economic development will have a direct effect on the exchange rate. Therefore, when the competent authority formulates monetary policy based on a country's own economic situation and objectives, it is also necessary to examine the current international circumstances.

Additionally, Twarowska and Kakol (2014) conducted an analysis to determine the factors that influence the exchange rate of the Polish zloty against the euro, with the aim of identifying the most significant factors affecting the value of the zloty. The study employed regression analysis utilizing data from the years 2000 to 2013. The results indicate a positive but statistically insignificant link between GDP, inflation rate, and exchange rates. The study revealed that interest rates had a negligible adverse correlation with currency rates. They suggested that the implementation of efficient and seamless fiscal and monetary policies is necessary to mitigate inflation and stimulate economic growth.

Moreover, Saha and Biswas (2014) analyzed the connection between the currency rate and fundamental macro-variables in India using the Vector Error Correction Model (VECM). They used monthly data from April 1993 to March 2012. Research has shown that over time exports, interest rates, and economic growth have a positive impact on the value of the exchange rate, whereas inflation has a negative impact on the exchange rate. In the short term, the exchange rate is adversely affected by its own delays and the interest rate. The researchers determined that the combination of macroeconomic trends and the proactive measures taken by the central bank, such as timely adjustments to monetary policy, successfully prevented significant fluctuations in the exchange rate. This was true even during challenging times like the East Asian currency crisis and the more recent global financial crisis. India has experienced a significant increase in foreign capital inflow following the implementation of major economic reforms. However, the currency rate has been carefully maintained to ensure that the actual exchange rate remains relatively stable, with just a few exceptions when fluctuations occur. Hence, it is aptly stated that the administration of exchange rates in India is more of an art than a science.

In their study, Sarno and Schmeling (2014) examined the accuracy of present-value models by analyzing a dataset of 35 currency pairs from 1900 to 2009. The researchers demonstrated a causal relationship between future macroeconomic factors and current exchange rates. They discovered that exchange rates possess robust and meaningful prediction capabilities for nominal fundamentals such as inflation, money balances, and nominal GDP.
Ebiringa and Anyaogu (2014) conducted a research study to examine the presence of co-integration between the exchange rate and inflation in Nigeria. They utilized time series data spanning from 1971 to 2010. It was noted that the inflation rate has a considerable beneficial impact on the exchange rate in Nigeria, both in the short term and the long term. The ARDL results demonstrated a positive relationship between inflation and exchange rate, as an increase in inflation rate supported an increase in the exchange rate.

Namjour et al. (2014) did a study to investigate the correlation between the inflation rate and exchange rate in Iran. They indicated that the correlation and least square estimation results demonstrate a negative variable link between inflation and exchange rate in the short term. They highlighted that higher inflation rates lead to an appreciation of the domestic currency, resulting in a fall in the value of the domestic currency compared to other countries' currencies. Namjour et al. (2014) demonstrated that the inflation rate has varying impacts on the currency rate in different countries' economies with distinct economic systems.

In their study, Bacchetta and Van-Wincoop (2013) examined the volatile correlation, known as the scapegoat effect, between exchange rates and macroeconomic fundamentals. The researchers used data on 5 currencies in relation to the U.S. dollar: Swiss Franc, British pound, Canadian dollar, Japanese yen, and German mark (Euro since 1999). The data consisted of monthly observations from September 1975 to September 2008. The macro fundamentals refer to the changes in money supply growth, industrial output growth, and unemployment rate growth compared to the United States. It also includes the growth in oil prices and the lagged interest rate differential compared to the United States. These factors were analyzed using a stochastic difference equation. The available information indicates that the connection between the exchange rate and macro fundamentals is exceedingly volatile. To elucidate this, the authors constructed a model in which the structural parameters are unspecified. The study demonstrates that the connection between a predictive variable such as the exchange rate and macroeconomic factors is influenced not by the inherent characteristics of these factors but rather by the anticipated values of these characteristics. Expectations can change greatly over time due to rational scapegoat effects, as agents struggle to differentiate between unobserved fundamentals and unseen structural characteristics. The authors suggest that these effects will likely apply more widely in macro and finance models beyond just the specific view of exchange rates.

Danmola (2013) conducted a study that examined the influence of the Real Effective Exchange Rate (REER) on several macroeconomic indicators in Nigeria. The study focused on the time frame from 1980 to 2010. The study utilized the Correlation Matrix, Ordinary Least Square (OLS), and Granger Causality test to examine the relationship between exchange rate volatility and economic indicators. The findings revealed a considerable positive impact of exchange rate volatility on Gross Domestic Product (GDP), while also indicating a negative influence on the inflation rate in the country. The Granger Causality analysis revealed a unidirectional connection between exchange rate volatility and GDP, indicating that changes in exchange rate volatility influence GDP. However, the impact of currency rate volatility on the inflation rate is not considerable in the short term. The author proposed that the government should enhance its revenue base by increasing the quantity of exportable goods and reducing its dependence on the petroleum sector. Additionally, the author indicated that the country should decrease the importation of non-essential items in order to improve its terms of trade. Furthermore, a rise in local output will mitigate the issues arising from the volatility of the Real Effective Exchange Rate (REER).

Obansa et al. (2013) conducted a study to empirically determine the relationship between the exchange rate, interest rate, and economic development in the Nigerian economy from 1970 to 2010. The study employed the vector auto regression (VAR) technique, focusing specifically on the Impulse Response function and the Forecast Error Variance Decomposition. The findings revealed that the exchange rate has a more pronounced influence on economic growth compared to the interest rate. Specifically, the study discovered that the influence of interest rates was initially beneficial but gradually decreased as the time lengthened. The impact on economic growth during the period of regulation was quite little compared to the age of deregulation. The study's result indicates that the liberalization of the exchange rate has had a positive impact on the Nigerian economy by fostering economic growth. Interest rate liberalization, however, has little effect on economic growth as it weakens the motivation for investment. The article suggests replacing interest rate liberalization and deregulation with interest rate regulation, as was practiced in the 1970s and early 1980s.

Sarno and Schmeling (2013) conducted a study that investigated the factors that influence exchange rates from a cross-sectional perspective. Applying conventional regression methods to investigate data from a sample of 35 currency pairs spanning the years 1900 to 2009. It was discovered that exchange rates possess robust and noteworthy forecasting ability for macroeconomic fundamentals such as inflation, money supply, and GDP growth. In summary, they discovered abundant evidence that future macroeconomic factors influence current exchange rates.

Umoru (2013) employs time series data to estimate three distinct monetary models of exchange rate determination in the Nigerian economy. The models that are included are the Monetary Flex-Price Model, Sticky Price Model, and the Hybrid [Flex-Sticky Price] Models. Our analysis indicates that the Monetary Flex-Price Model is superior to other models in predicting the exchange rate in Nigeria. The model demonstrates that the Naira-US dollar exchange rate may be more accurately predicted by considering the relative money supplies, income levels, and real interest rate differentials. The empirical validity of our MFPM estimates is supported by the fact that the coefficient of the difference between the domestic and foreign money supply is nearly equal to one. Therefore, a 1% increase in the currency supply of the country leads to a 1.242% increase in the nominal exchange rate, resulting in depreciation. The empirical evidence clearly shows that if a domestic economy increases its money supply at a higher rate than its trade partner, it can anticipate its currency to depreciate externally. Therefore, each alteration in the money supply has a corresponding impact on the exchange rate and, consequently, on the price level. Therefore, it is crucial for the money supply process to remain consistent to maintain stability in the country's exchange rate system. The policy's significance lies in the positive prediction of monetary policy.

In a study by Wong (2013), the focus was on investigating the relationship between real exchange rate misalignment and economic growth in Malaysia. The study's findings were derived using the autoregressive distributed lag (ARDL) method and the generalized forecast error variance decomposition. The data used for the study spanned from 1971 to 2008. The ARDL technique demonstrates that a rise in the real interest rate will result in a long-term appreciation of the real exchange rate. The outcome of the comprehensive forecast error variance decomposition demonstrates that the real interest rate has a significant role in determining the real exchange rate. Furthermore, the outcome of the ARDL technique indicates that a rise in real exchange rate misalignment will result in a decline in economic growth. To be more precise, devaluation will stimulate economic growth, whereas appreciation will hinder economic growth. Avoiding actual exchange rate misalignment is advised to ensure that resources in the economy are allocated based on basic factors. In the short term, the real interest rate plays a significant and beneficial role in determining the real exchange rate.

Jager (2012) employed a Vector Error Correction Model (VECM) methodology to examine the determinants of the real exchange rate in South Africa. The study used quarterly data from 1982Q2 to 2012Q1. The findings from the long-term analysis indicated that an increase in the interest rate would lead to an appreciation of the Rand. The lagged GPD had a dual impact on the real exchange rate, resulting in depreciation.

The study conducted by Udoh et al. (2012) aimed to investigate the effects of certain macroeconomic factors on the volatility of the currency rate in Nigeria, both in the short term and in the long term. The study employed co-integration and error correction model estimation techniques to ascertain the short-run and long-run elasticities of exchange rate volatility in relation to important macro-economic variables. The empirical findings indicated that the coefficients of inflation rate and interest rate had a substantial impact in the short term.

Beckmann et al. (2011) examined the consistency over time of the correlation between the exchange rate of the Deutschmark against the US dollar and macroeconomic factors. The authors utilized monthly data spanning from January 1975 to December 2007. Employing a new method called FM-OLS, we apply an estimating strategy that considers time-varying coefficients. The study revealed that the aberrations arising from the stepwise co-integrating relationship serve as a key error-correction mechanism. The authors demonstrated that variables such as money supply, national real income, Consumer Price Index (CPI), and interest rates have a considerable influence on the exchange rate. However, the extent of their impact varies considerably across different periods. The variables of money supply, national real income, Consumer Price Index (CPI), and interest rates were determined to be stationary after undergoing first-order differencing, indicating the absence of a unit root.

In a multicounty framework, Yin (2011) examined the collective behaviour of several nominal exchange rates. Empirical analysis employed Bayesian filtering methods, notably the nonlinear Kalman filters. The countries encompassed in the group are Germany/euro area, the UK, Japan, and the US. The initial three are regarded as foreign nations, whereas the United States is considered the domestic country. The data is collected at monthly intervals and covers the period from January 1985 to May 2009. The macroeconomic fundamentals considered are the rates of production growth, inflation, and real interest. The nominal exchange rates refer to the market rates at the end of a specific period. The nonlinear Kalman filters revealed that the interest rate had the most significant impact on exchange rate dynamics in the short term, while inflation played a major role in the long term.

In their study, Yuan (2011) employed the maximum likelihood estimation technique to analyze quarterly observations of four bilateral nominal exchange rates: the Australian dollar (AUD), the Canadian dollar (CAD), the British pound (GBP), and the Japanese yen (JPY). Therefore, five sets of macroeconomic indicators are used to investigate these four countries along with the United States. These indicators include money supply, real gross domestic product, consumer price index, short-term and long-term interest rates, and trade balance (or current account balance). Hence, the sample comprises 138 observations at the end of each quarter during the post Bretton-Woods period, spanning from the first quarter of 1973 to the second quarter of 2007. The coefficients of the macro factors were mostly not significant, except for the relative money supply's impact on the Japanese yen.

3.3.2. The Causal Relationship Between Macroeconomic Fundamentals and Exchange Rates

In exploring the complexities of exchange rate dynamics, Chahrour et al. (2021) focused on the concept of Exchange Rate Disconnect Redux. Their study utilized a Vector Autoregressive (VAR) model with Bayesian approaches to examine quarterly data from 1976: Q1 to 2008: Q2 across G7 countries. The research identified a causal relationship between exchange rates and macroeconomic fundamentals, such as interest rates and inflation. Notably, the study found that this causality predominantly flowed from current exchange rates to future macroeconomic fundamentals, a finding that challenges the traditional expectation of forecasting relationships based on past macroeconomic variables and their impact on exchange rates.

Similarly, in their study, Fakher et al. (2021) investigated the relationship between macroeconomic fundamentals and exchange rate behaviour in advanced and least developed nations. Panel Granger Causality Test is applied to annual panel data sets covering the period from 1995 to 2015. The Panel Granger Causality Test revealed that there was a one-way causal relationship from economic growth to exchange rates in advanced countries. However, no causal relationship was discovered between inflation and currency rates. For the least developed countries, the analysis revealed that there was a reciprocal relationship only between the level of exchange rates and inflation. In the scenario of unidirectional causality, the level of exchange rate was influenced by economic growth.

That is also to say, Hadiwibowo and Yasni (2020) examined the process of determining the currency rate in Indonesia following the Asian financial crisis. The Monetary Model was employed to evaluate the forecast of the Indonesian Rupiah in relation to the United States Dollar and other currencies of Indonesia's major trading partners. The two models are the Flexible Price Monetary Model and the Sticky Price Monetary Model. The Granger causality test indicated that there may be a causal relationship from the exchange rate to both money supply and inflation.

Moreover, Karamcheti et al. (2018) conducted a study to assess the significance of the Flexible Price Monetary (FPM) Model in explaining the movement of the INR/USD exchange rate. The study focused on the period from April 1995 to December 2016 in India and analyzed the relationship between the exchange rate and macroeconomic factors such as relative money supply and relative interest rates. The Granger causality test revealed the presence of unidirectional causality from money supply and interest rate differential to exchange rate.

Meanwhile, Raza and Afshan (2017) analyzed the factors influencing the exchange rate in Pakistan by utilizing time-series data spanning from 1972 to 2013. The findings from the Autoregressive Distributed Lag (ARDL) bound testing co-integration strategy, the Johansen and Juselius co-integration approach, and the Gregory and Hansen structural break co-integration approach validate the existence of a strong long-term link among the selected variables. The Granger causality test verified the existence of a reciprocal causal connection between the exchange rate and economic growth in Pakistan. Nevertheless, there is a one-way causal relationship between inflation and money supply, where the explanatory variable influences the exchange rate of the country. The research guide assists policymakers in creating definitive monetary and fiscal policies to determine a stable and productive exchange rate for Pakistan, to achieve long-term sustainable economic growth.

Additionally, Bhutt et al. (2014) examined the dynamic relationship between macroeconomic variables and the currency rate in Pakistan. The study examined quarterly time series data of the pertinent variables from the first quarter of 1998 to the fourth quarter of 2012. The study examines the proposed hypotheses using generally acknowledged and commonly used econometric models in academic research in economics and finance. The study used the multivariate form to examine the Granger-causality relationship between macroeconomic variables. In addition, the study used the Granger-causality test in the bi-variate form to examine the lead-lag connection and determine the direction of impact, specifically whether it is unidirectional. The study's findings indicate a significant long-term relationship between the exchange rate and inflation, with a significant level of 10%. The Granger-causality test indicated that the influence is mostly from inflation to exchange rate, rather than from exchange rate to inflation. However, it is important to note that both relationships are statistically insignificant. The findings of the Granger-causality test indicate that there is a unidirectional causality, with the money supply leading to the exchange rate. In other words, the money supply Granger causes the exchange rate.

Remarkably, the study conducted by Chang and Su (2014) examined the connections between exchange rates and macroeconomic fundamentals to identify the long-term relationship, short-term dynamic adjustment, and causality direction for various Pacific Rim nations. The analysis used monthly data from January 1986 to December 2011 for Canada, Chile, Indonesia, Japan, South Korea, Malaysia, the Philippines, Taiwan, and the United States. For Singapore, the data covered the period from January 1991 to July 2012, while for Thailand, it spanned from January 1987 to December 2006. The study found that there was bi-directional causality in the S. Korea–U.S. pair. This implied that exchange rates and monetary fundamentals contributed to explaining each other. However, there was a unidirectional causality in the Canada–U.S., Japan–U.S., and Thailand–U.S. country-pairs. That is, the Canadian dollar/dollar, yen/dollar, and baht/dollar exchange rates contained information about future changes in macroeconomic fundamentals which corresponded to the implications of the asset-pricing model of exchange rates.

Likewise, Saha and Biswas (2014) analyzed the connection between the currency rate and fundamental macro-variables in India using the Vector Error Correction Model (VECM) and VEC Granger Causality/Block Exogeneity Wald Tests. They used monthly data from April 1993 to March 2012. The VEC Granger Causality/Block Exogeneity Wald Tests indicated the presence of a bi-directional causal relationship between economic growth and interest rate in the short run. The VEC Granger Causality/Block Exogeneity Wald Tests indicated the presence of a unidirectional causality between interest rate and inflation, namely from interest rate to inflation. The researchers determined that the combination of macroeconomic trends and the proactive measures taken by the central bank, such as timely adjustments to monetary policy, successfully prevented significant fluctuations in the exchange rate. This was true even during challenging times like the East Asian currency crisis and the recent global financial crisis. India has experienced a significant increase in foreign capital inflow following the implementation of major economic reforms. However, the currency rate has been carefully maintained to ensure the actual exchange rate remains relatively stable, with just a few exceptions when fluctuations occur. Hence, it is aptly stated that the administration of exchange rates in India is more of an art than a science.

Conversely, in their study, Sarno and Schmeling (2014) examined the accuracy of present-value models by analyzing a dataset of 35 currency pairs spanning from 1900 to 2009. The researchers demonstrated a causal relationship between future macroeconomic factors and current exchange rates. They discovered that exchange rates possess robust and meaningful prediction capabilities for nominal fundamentals such as inflation, money balances, and nominal GDP.

On the other hand, Danmola (2013) conducted a study that examined the influence of Real Effective Exchange Rate (REER) on several macroeconomic indicators in Nigeria. The study focused on the time frame from 1980 to 2010. The study used the Grange Causality test to examine the relationship between exchange rate volatility and economic indicators. The Granger Causality analysis revealed a unidirectional connection between exchange rate volatility and GDP, indicating that changes in exchange rate volatility influence GDP. However, the impact of currency rate volatility on the inflation rate is not considerable in the short term. The author proposed that the government should enhance its revenue base by increasing the quantity of exportable goods and reducing its dependence on the petroleum sector. Additionally, the author indicated that the country should decrease the importation of non-essential items in order to improve its terms of trade. Furthermore, a rise in local output will mitigate the issues arising from the volatility of the Real Effective Exchange Rate (REER).

The empirical literature reveals a gap in studies specifically examining the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA), especially considering structural breaks in the analysis. Most studies focus on individual countries or broader regions without addressing the unique dynamics of the CMA or the potential impact of structural breaks on the long-run and short-run relationships between macroeconomic variables and exchange rates. This study fills this gap by incorporating structural breaks into the analysis, providing practical contributions through evidence of the long-run and short-run relationships, and offering methodological contributions by employing panel ARDL and Dumitrescu and Hurlin (2012) test for detecting Granger causality in panel datasets. This approach contrasts with the study by Shumba and Mukorera (2023), which did not explore these relationships within the CMA using panel ARDL or examine causality with techniques accounting for structural breaks. By addressing these limitations, the current study sought to enrich the literature with a more varied understanding of the dynamics between macroeconomic fundamentals and exchange rates in the CMA, contributing both practically and methodologically to the field.

3.4. Chapter Summary

Chapter 3 provided a comprehensive review of the theoretical and empirical literature related to the study of macroeconomic fundamentals and exchange rates. The chapter first explored key theoretical frameworks, including the Flexible-Price Monetary Model (FPMM), Real Interest Differential Monetary Model (RIDMM), Purchasing Power Parity (PPP), Mark's specification, The Portfolio Balance Model, and the Demand-pull Theory, highlighting their relevance to understanding the dynamics of exchange rates within the Common Monetary Area (CMA). These theories emphasize the critical role of factors such as money supply, interest rates, inflation, and economic growth in influencing exchange rates.

The empirical literature review focused on long-run and short-run linkages between macroeconomic fundamentals and exchange rates, as well as the causal relationships between these variables. Studies from diverse economic contexts, including works by Udoh et al. (2012), Chang and Su (2014), Salim and Shi (2019), and Shukri et al. (2021), were examined. These studies consistently demonstrate the significance of inflation, interest rates, and economic growth in determining exchange rate movements, both in the long and short term. Furthermore, research by Chang and Su (2014) and Fakher et al. (2021) highlighted the complexity of causal relationships, showing varying directions of influence between economic fundamentals and exchange rates.

A critical gap identified in the literature pertains to the CMA, particularly the need to account for structural breaks in the analysis. This study aims to fill this gap by employing panel ARDL and Panel Granger causality tests, providing a nuanced understanding of the dynamic interactions between macroeconomic fundamentals and exchange rates in the CMA. This approach contrasts with previous studies, such as Shumba and Mukorera (2023), by offering a more comprehensive analysis that includes the consideration of structural breaks. Through this, the study contributes both practically and methodologically to the existing body of knowledge, enhancing our understanding of exchange rate dynamics in the CMA.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1. Introduction

Chapter Four outlines the research methodology employed in this study, which investigates the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA). The chapter begins with Section 4.3., detailing the research design. This section also explains the rationale behind adopting a quantitative methodology for modelling numerical data to analyse these relationships.

Subsequent sections provide a thorough description of the research process: Section 4.4. elaborate on the variables used in the study, including their definitions and the methods of measurement. Section 4.5., discusses the data sources utilized to gather the required information. Section 4.6., focuses on the estimation process, detailing various statistical tests and models employed to analyse the data.

4.2. Model Specification

Hadiwibowo and Yasni (2020) avail a more recent and updated economic model which this study employed. The specification of the model is:

$$\boldsymbol{NOEX_{it} = f(REMS_{it}, NOIN_{it}, REGDP_{it}, INCPI_{it}) \ldots\ldots (4.1.)}$$

In equation 4.1. NOEX is Nominal exchange rates; NOIN is nominal interest rate (NOIN); REMS is Relative Money supply; REGDP is economic growth; and INCPI is Inflation.

4.3. Research Design

Longitudinal and causal-effects designs were adopted for this investigation, deemed most appropriate due to its premise that changes in macroeconomic fundamentals precede alterations in exchange rate determination outcomes. According to Mankiw (2020), asserting a causal effect implies recognizing that the outcomes on the dependent variable would differ from their state had there been no changes in the independent variable. Furthermore, the analysis was guided by a quantitative approach, chosen primarily because it involves modelling the chosen variables using numerical data (Salim& Shi, 2019; Fakher et al. (2021).

4.4. Variables Explanation and Measurement

4.4.1. Variables

The selection of variables for the current study is informed by the foundational research conducted by several scholars in the field of economic studies. Specifically, the studies of Chang and Su (2014), Karamcheti et al. (2018), Mogaji (2018), and Hadiwibowo and Yasni (2020) have been instrumental in shaping the analytical framework of this research. These prior investigations have robustly utilized Nominal exchange rates (NOEX) as the dependent variable, alongside Relative Money Supply (REMS), Real Economic Growth (REGDP), Inflation (INCPI), and Nominal Interest Rate (NOIN) as independent variables. This alignment with established research enhances the empirical rigor of the current study and ensures consistency with established economic models (Chang & Su, 2014; Karamcheti et al., 2018; Mogaji, 2018; Hadiwibowo & Yasni, 2020). Therefore, the study employs the same set of variables—Nominal exchange rates (NOEX), Relative Money supply (REMS), Real Economic Growth (REGDP), Inflation (INCPI), and Nominal Interest Rate (NOIN)—across all the CMA countries. Each country within the CMA, namely South Africa, Namibia, Lesotho, and Eswatini, provides its own data for these variables. This approach ensures a consistent and comparative analysis of the macroeconomic factors influencing exchange rates within the region. The selection of these variables is grounded in their relevance to the CMA's economic context and is informed by established studies, enhancing the validity and comparability of the findings across the member states (Chang & Su, 2014; Karamcheti et al., 2018; Mogaji, 2018; Hadiwibowo & Yasni, 2020). This consistency allows for a robust analysis of how these macroeconomic fundamentals affect exchange rates within the fixed exchange rate regime characteristic of the CMA.

4.4.2. Explanation and Measurement

Nominal Exchange Rates (NOEX) - This variable represents the price of one country's currency in terms of another country's currency. It is usually measured as the domestic currency units required to purchase a unit of foreign currency (Karamcheti et al., 2018; Mogaji, 2018). For instance, if the exchange rate between the Namibian Dollar and the US Dollar is 15, it means 15 Namibian Dollars are needed to buy one US Dollar (Hsing, 2008). In essence, the measurement of exchange rates for each CMA country in this study considers their fixed peg to the South African Rand. For Namibia, Eswatini, and Lesotho, the exchange rates against the US Dollar (USD) are utilized as these countries' currencies are not independently traded on the global forex market. The Namibian Dollar, Lesotho Loti, and Swazi Lilangeni are pegged at a 1:1 ratio to the South African Rand, making the exchange rate against the USD a reliable proxy for their currency valuation. For South Africa, the nominal exchange rate used in this study is the ZAR/USD rate, which reflects its value in global markets. The choice of the USD as the benchmark foreign currency is due to its status as the primary reserve currency and its widespread use in international trade and finance (Mankiw, 2020). This approach ensures comparability across all CMA member countries while maintaining relevance to global macroeconomic interactions.

Nominal Interest Rate (NOIN) - The nominal interest rate refers to the percentage increase in money the borrower pays to the lender, not adjusting for inflation (Ekong&Onye, 2013; Mogaji, 2018). It is the stated rate on the financial instrument or bank account. For monetary models within the CMA, this variable often represents the domestic interest rate compared to the foreign interest rate to gauge the interest differential (Karamcheti et al., 2018).

Relative Money Supply (REMS) - This variable measures the total amount of money available in an economy at a specific time, adjusted for the size of the economy or in comparison to another country's money supply (Mogaji, 2018). It is often measured as M2 or a broader definition that includes cash, checking deposits, and easily convertible near money (Cupidon & Hyppolite, 2016).

Gross domestic product (GDP) is a precise metric that quantifies the whole worth of all products and services generated within an economy during a specific time frame, often a year, while accounting for the effects of inflation (Mankiw, 2023). It serves as a gauge of the overall well-being of an economy and assists policymakers in fine-tuning fiscal and monetary measures to attain economic goals (Mankiw, 2020).

Expected Effects/Signs of Independent Variables on the Dependent Variable

In the FPMM, an increase in the Relative Money Supply (REMS) is expected to depreciate the domestic currency, leading to a higher nominal exchange rate (NOEX), as more domestic currency is needed to purchase a unit of foreign currency (Umoru, 2013). Similarly, as per demand pull theory, higher domestic Inflation (INCPI) relative to a foreign country is expected to depreciate the domestic currency (Mankiw, 2023). Higher REGDP domestically compared to abroad is theorized to appreciate the domestic currency due to increased demand for domestic goods and services (Mankiw, 2023).

In the RIDMM, the nominal interest rate (NOIN) differential that favours the domestic currency typically leads to an appreciation of the domestic currency due to higher returns on investments denominated in the domestic currency (Mogaji, 2018). Therefore, the effect/sign of NOIN on NOEX is expected to be negative, implying that higher domestic interest rates (relative to foreign rates) would lead to an appreciation of the domestic currency (Frankel, 1979).

4.5. Data and Data Sources

The research primarily employed a secondary time series data sourced from the central banks of the CMA member countries, the International Monetary Fund's International Financial Statistics (IMF IFS), and the World Bank. The sample period will be 1991 to 2022.

4.6. Estimation Process

The study is empirically estimated by taking various steps like panel unit root, the Gregory Hansen Co integration test, the Panel ARDL, the model selection using the Hausman test, the Dumitrescu and Hurling test for co integration and the diagnostic test. The steps are presented and discussed below.

4.6.1 Panel Unit Root Test

This research examined the stationarity of macroeconomic variables within the Common Monetary Area (CMA) using two prominent tests: the Im-Pesaran-Shin (IPS) and Levin, Lin, and Chu (LLC) tests. The choice of these tests is grounded in their appropriateness for the panel data structure of this study, which encompasses multiple countries within the CMA over time (Chang & Su, 2014).

Introduced by Im, Pesaran, and Shin in 2003, the IPS test is designed for panel data to determine the presence of a unit root. It allows for heterogeneity across different cross-sections, acknowledging that individual series within the panel can have different autoregressive coefficients (Im et al., 2003). This test computes an average of the individual Augmented Dickey-Fuller (ADF) statistics for each cross-section and tests the null hypothesis that each time series has a unit root against the alternative hypothesis that at least one time series is stationary (Im, Pesaran, & Shin, 2003). For IPS test, the decision criterion involves comparing the computed IPS statistic with the critical values for a given significance level. If the IPS statistic is less than the critical value, the null hypothesis of unit root presence is rejected, indicating stationarity in at least one panel series (Im et al., 2003).

Levin, Lin, and Chu introduced their unit root test in 2002, making it one of the first-panel unit root tests developed specifically for panel data. Unlike the IPS test, the LLC test assumes homogeneity across cross-sections regarding the autoregressive coefficient in the unit root testing equation. The test evaluates the null hypothesis of a unit root against the alternative of stationarity for the entire panel (Levin, Lin, & Chu, 2002). For the LLC test, the null hypothesis of a unit root is rejected if the test statistic is smaller than the critical value at the chosen significance level, suggesting that the panel data series is stationary (Levin et al., 2002).

The IPS and LLC tests were chosen over other unit root tests like the Fisher-type ADF and Phillips-Perron (PP) tests due to their specific applicability and advantages in panel data analysis. The IPS test's allowance for heterogeneity among cross-sections makes it particularly suitable for the CMA setting, where economies may exhibit distinct dynamic behaviours. The LLC test's efficiency in cases of cross-sectional homogeneity provides a complementary perspective, ensuring robustness in the face of different stationarity conditions across the panel.

4.6.2 Gregory-Hansen (1996) Co integration Test for Structural Breaks

This research employed the Gregory-Hansen (1996) Co integration Test for Structural Breaks to assess the presence of structural breaks within the data. Introduced by Robert Gregory and Bruce Hansen in 1996, this method is designed to test for co integration in the presence of a potential structural break in time series data. The test adjusts the standard co integration analysis to accommodate a single structural break, reflecting shifts in the relationship between the variables under study.

The Gregory-Hansen test offers three different models to accommodate potential structural breaks:

1. **Level Shift (LS) Model** - Assumes a shift in the intercept of the co integration equation. This model is useful when the change due to the structural break is perceived as a level shift in the series without altering the slope or the dynamics of the relationship (Gregory & Hansen, 1996).
2. **Level Shift with Trend (LST) Model -** Includes both a shift in the intercept and a change in the slope of the trend component of the co integration equation. This model is applied when the structural break might affect both the level and the growth path of the series (Gregory & Hansen, 1996).
3. **Regime Shift (RS) Model -** Allows for changes in both the intercept and the slope of the co integration relationship at the break point. This model is the most flexible, accommodating more complex structural changes where both the level and dynamic responses of the series are affected by the break (Gregory & Hansen, 1996).

The decision criteria for the Gregory-Hansen test involve comparing the test statistics against critical values derived from their tables, which depend on the size of the sample and the chosen significance level. The null hypothesis of no co integration is rejected if the computed test statistic is more negative than the critical value, indicating the presence of co integration with a structural break. This test is crucial as it helps to ensure that any long-term equilibrium relationship considered in the analysis remains valid even when structural changes occur in the underlying data.

The Gregory-Hansen test is widely acknowledged for its robustness in economic research, particularly when investigating relationships affected by policy changes, economic crises, or other external shocks that can lead to structural changes in economic relationships. Its application in examining the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA) is particularly pertinent given the potential for policy shifts and economic integration effects within the union (Gregory & Hansen, 1996). The choice of the Gregory-Hansen test over other tests like the Narayan and Popp (2010) unit root test for structural breaks was strategic. The Narayan and Popp test is specifically designed to identify unit roots in the presence of structural breaks in a univariate setting. In contrast, the Gregory-Hansen test is specifically crafted for detecting co integration in the presence of structural breaks in bivariate or multivariate systems, making it more suitable for analysing the long-run relationships among variables while accounting for potential regime shifts.

4.6.3. The Panel Autoregressive Distributed Lag (PARDL)

This study adopted the methodology of Fakher et al. (2021) by utilising a Panel ARDL technique. Essentially, this study utilised the Panel Autoregressive Distributed Lag (PARDL) technique for econometric analysis. The decision was informed by the ARDL model's ability to handle data series integrated at multiple orders, specifically I (0) and I (1), as determined in this work and as mentioned in other publications (Fakher et al., 2021; Shukri et al., 2021; Salim & Shi, 2019). The distinctive characteristic of the ARDL model is its capacity to estimate both short- and long-term dynamics concurrently, without the need for pre-testing unit roots. The PARDL model is described in depth below.

$$\Delta LnNOEX_{i,t} = \omega_0 + \omega_1 LnNOEX_{i,t-1} + \omega_2 LnREMS_{i,t-1} + \omega_3 NOINI_{i,t-1} + \omega_4 INCPI_{i,t-1} + \omega_5 REGDP_{i,t-1} + \sum_{i=1}^{n} \rho_i LnNOEX_{i,t-1} + \sum_{i=1}^{n} \gamma_i \Delta LnREMS_{i,t-1} + \sum_{i=1}^{n} \delta_i \Delta NOINI_{i,t-1} + \sum_{i=1}^{n} \vartheta_i \Delta INCPI_{i,t-1} + \sum_{i=1}^{n} \sigma_i \Delta REGDP_{t-1} + \varepsilon_t \text{.........} \quad (4.2)$$

In equation 4.2., $\omega_1, \omega_2, \omega_3, \omega_4, and\ \omega_5$ are the long run parameters, and γ_i, $\delta_i, \rho_i, \vartheta_i$, and σ_i are the short run parameters; n is the maximum lag length. Where i, $_t$ represents country at time t; $\omega_0$is the constant, and ε_t is the error term.

Once the presence of a PARDL is confirmed, the study employs the ARDL model to establish the Error Correction Model (ECM). The ARDL-UECM, derived from the ARDL model, measures the speed at which the variables return to equilibrium after a shock. In contrast, the Engel-Granger approach to ECM involves a two-step process that begins with Ordinary Least Squares (OLS) estimation and then incorporates error terms as the ECM term. The ARDL-UECM, on the other hand, incorporates error correction dynamics within its framework, providing a more efficient approach and avoiding the limitations of the traditional ECM approach.

The ARDL-UECM framework is given as equation 4.3. and equation 4.4. which follow as.

$$\Delta LnNOEX_{c,t} = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta LnNOEX_{c,t-i} + \sum_{j=1}^{m} \gamma_{2j} \Delta MAECFU_{c,t-j} + \lambda EC_{t-1} + \epsilon_t \dots \dots .. (4.3.)$$

$$\Delta MAECFU_{c,t} = \delta_0 + \sum_{i=1}^{n} \delta_{1i}\Delta MAECFU_{c,t-i} + \sum_{j=1}^{m} \delta_{2j}\Delta LnNOEX_{c,t-j} + \emptyset EC_{t-1} + \mu_t \dots \dots (4.4.)$$

In these equations (equation 4.3. and equation 4.4.), γ_0, γ_{1i}, γ_{2j}, δ_0, δ_{1i}, and δ_{2j} are coefficients to be estimated. The variable $MAECFU_{c,t}$ represents macroeconomic fundamentals such REMS, NOINI, INCPI, and REGDP at county c at time t. The terms ϵ_t andμ_t are error terms. The coefficients λ and ϕ (typically negative) represent the speed of adjustment back to the long-run equilibrium. These ECM equations capture both the short-term dynamics (through the changes in the variables) and the long-term equilibrium relationship (through the error correction term). This setup allowed the researcher to use the adjustment process when the variables deviate from their long-term relationship. In the equations (equation 4.3. and equation 4.4.), Δ represents the difference operator, and EC_{t1} represents a one-period-lagged error correction term recorded by the co-integration regression. According to Fakher et al. (2021), the conclusion of causality can be derived from the relevance of λ and ϕ, but further testing is required to determine the direction of causality.

Consequently, the choice of the general Panel ARDL (Pooled Mean Group - PMG, Mean Group - MG, and Dynamic Fixed Effects - DFE) methodology is motivated by its ability to accommodate dynamic panel data settings where variables may exhibit heterogeneity in the short run while maintaining homogeneity in the long-run equilibrium relationships. Pesaran and Smith (1995) and Pesaran et al. (1999) emphasized that the MG estimator allows for complete heterogeneity across panel units, making it useful when substantial variability exists in the short-run dynamics across countries. Conversely, the PMG estimator strikes a balance by permitting heterogeneity in the short run while constraining homogeneity in the long-run coefficients, which aligns with the integrated monetary policies within the CMA. The DFE estimator, on the other hand, assumes complete homogeneity in both short- and long-run relationships and is appropriate when the panel is considered a single entity with common behaviors.

The general Panel ARDL methodology is preferred over cross-sectional ARDL in this study due to the findings of the cross-sectional dependence tests. Specifically, the absence of significant cross-sectional dependence, as indicated by the results of the Pesaran CD test, suggests that general panel ARDL is suitable since it does not require modeling interdependencies explicitly. For regions like the CMA, where fixed exchange rate arrangements minimize capital flow discrepancies across member states, the lack of strong cross-sectional dependence validates the application of general Panel ARDL over the cross-sectional ARDL approach (Pesaran et al., 2004). In essence, the choice of the general Panel ARDL methodology over cross-sectional ARDL is further supported by its suitability for panels with mixed integration orders (I(0) and I(1)) and its ability to estimate both short- and long-run relationships simultaneously. The cross-sectional ARDL approach, while effective in handling cross-sectional dependence explicitly, is less applicable here due to the CMA's integrated monetary framework, which reduces the likelihood of strong interdependencies among member states. Additionally, the general Panel ARDL's compatibility with small sample sizes and its robustness to heterogeneity make it a superior choice for this study, as evidenced in previous research by Salim and Shi (2019) and Fakher et al. (2021).

The application of diagnostic checks, such as the Pesaran CD test for cross-sectional dependence and the Hausman test for model selection, ensures the validity and reliability of the chosen methodology. These checks align with best practices in econometric literature, providing a robust framework for analyzing the relationship between macroeconomic fundamentals and exchange rates in the CMA.

4.6.4. Estimation of Panel ARDL Using Three Estimators: Mean Group, Pooled Mean Group, and Dynamic Fixed Effects

This research estimated the Panel ARDL using three distinct estimators: the Mean Group (MG), the Pooled Mean Group (PMG), and the Dynamic Fixed Effects (DFE). Each estimator serves a specific purpose in handling data and econometric challenges, providing robust results under varying panel data conditions.

4.6.4.1. Mean Group (MG) Estimator

The MG estimator was developed by Pesaran and Smith in 1995. It is used to estimate heterogeneous panel data models where the coefficients are allowed to vary across groups. The MG estimator involves estimating separate time series regressions for each panel group and then averaging the coefficients (Pesaran & Smith, 1995). The MG estimator is particularly useful when there is significant cross-sectional heterogeneity in the data, which could distort the pooled estimates. It does not impose any restrictions on the long-run coefficients across groups, making it flexible in capturing individual group dynamics (Pesaran & Smith, 1995).

4.6.4. 2. Pooled Mean Group (PMG) Estimator

Pesaran, Shin, and Smith in 1999 introduced the PMG estimator as an extension of the MG approach. The PMG estimator also estimates time series regressions for each group but constrains the long-run coefficients to be the same across groups while allowing short-run coefficients and error variances to differ (Pesaran et al., 1999).

This estimator is suitable when researchers believe that the long-run equilibrium relationship is the same across groups, but short-run dynamics differ, providing a balance between homogeneity and heterogeneity (Pesaran et al., 1999).

4.6.4.3. Dynamic Fixed Effects (DFE) Estimator

Fully homogeneous panel data estimators like DFE have been used extensively when panel data exhibits strong cross-sectional dependence and when the focus is on analysing dynamic relationships (Pesaran et al., 1999). The DFE estimator imposes homogeneity on both long-run and short-run coefficients across all groups in the panel, essentially treating the panel as a single entity with common dynamic processes (Pesaran et al., 1999). It provides efficient estimates under conditions of cross-sectional dependence and when the theoretical model suggests common behaviours across groups (Pesaran et al., 1999).

To interpret the result, results from the MG estimator would reflect the average effects but allow for individual-specific heterogeneity. It is particularly insightful when exploring how different countries or groups respond on average to changes in explanatory variables over time (Pesaran & Smith, 1995). The PMG results provide insights into the common long-run equilibrium relationship while respecting short-term variations (Pesaran et al., 1999). It is useful for policy analysis where long-term goals are aligned but short-term tactics vary. Further, results from the DFE model are useful when the focus is on understanding the common dynamic responses across the entire panel. This is particularly applicable in tightly integrated regions or sectors where policies or shocks are expected to have uniformly distributed effects (Pesaran et al., 1999).

Compared to Pooled OLS, these estimators (MG, PMG, DFE) account for dynamic panel-specific idiosyncrasies and endogeneity better than Pooled OLS, which typically provides biased results in dynamic settings due to ignoring the lagged dependent variable's impact

(Pesaran et al., 1999). Also, compared to Random and Fixed Effects**,** both Random Effects and traditional Fixed Effects estimators do not typically handle dynamic and long-run relationships well. Random Effects assume that individual-specific effects are uncorrelated with the regressors, which is often unrealistic in dynamic models. Fixed Effects, while controlling unobserved heterogeneity, do not efficiently estimate long-term relationships and dynamic adjustments (Pesaran et al., 1999).

4.6.5. Model Selection Using the Hausman H Test (1978)

This research chose the best model among the Mean Group (MG), Pooled Mean Group (PMG), and the Dynamic Fixed Effects (DFE) using the Hausman H Test, introduced in 1978 by economist Jerry Hausman. The test is a fundamental tool in econometrics, used to determine the most appropriate estimation method based on the consistency of estimators.

Jerry Hausman introduced the Hausman test in his seminal paper published in 1978. The test is primarily designed to address the issue of estimator choice in the presence of potential endogeneity and omitted variable bias (Hausman, 1978). The test compares two estimators to ascertain if they are consistent. Typically, one estimator is efficient under the null hypothesis (no endogeneity) but inconsistent under the alternative (presence of endogeneity), while the other is consistent under both (Hausman, 1978).

Rationally, the Hausman test is chosen for its ability to discern models based on the consistency of their estimators. In Panel ARDL models, this test helps determine whether more efficient but potentially inconsistent estimators (like DFE) should be favoured over less efficient but consistent estimators (like MG and PMG) (Hausman, 1978). For this study, the test is crucial in deciding which estimator most reliably captures the dynamics and interactions of macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA), considering the potential heterogeneity and cross-sectional dependence among the member countries.

The Hausman test involves estimating the same equation via two different methods and then comparing the coefficient estimates through a specially computed test statistic. The test statistics are calculated as:

$$H = (b - B)\,'[Var(b) - Var(B)]\ - 1(b - B)]$$

Where b and B are the vectors of coefficients obtained from the efficient and consistent estimators, respectively, and Var(b) and Var(B) their variance matrices.

The test statistic follows a chi-square distribution with degrees of freedom equal to the number of coefficients in regression. A significant test statistic (typically, a p-value below 0.05) leads to the rejection of the null hypothesis, favouring the consistent estimator over the efficient but potentially inconsistent one (Hausman, 1978).

Therefore, for the Hausman test employed to determine the appropriate estimator between MG, PMG, and DFE, the hypotheses are defined as follows:

- **Null Hypothesis (H0):** The PMG estimator is efficient and consistent, implying homogeneity in long-run relationships across panel units.
- **Alternative Hypothesis (H1):** The MG estimator is consistent but inefficient, indicating heterogeneity in long-run relationships across panel units.

The decision rule for the Hausman test is based on the comparison of the test statistic with the critical values. If the p-value associated with the test statistic is less than the chosen significance level (typically 0.05), the null hypothesis is rejected, favoring the MG estimator. If the null hypothesis is not rejected, the PMG estimator is preferred for its efficiency and balance between short-run heterogeneity and long-run homogeneity (Hausman, 1978).

4.6.6. The Dumitrescu and Hurlin (2012) Test for Granger Causality

This research utilized the Dumitrescu and Hurlin (2012) Test for Granger non-causality in heterogeneous panels to test Granger non-causality. This method is essential for evaluating causality relationships in panel data that exhibit heterogeneity across cross-sectional units.

The test was introduced by Dumitrescu and Hurlin (2012). It is specifically designed to detect Granger causality in panel data models that account for cross-sectional independence and heterogeneous dynamics across groups or individuals. Unlike traditional Granger causality tests which assume homogeneity across panel units, the Dumitrescu-Hurlin test allows for varying causal relationships, which is critical in diverse economic settings where economic interactions or policy impacts may differ significantly across entities (Dumitrescu & Hurlin, 2012).

Given that the research involved panel data, this test was preferable because it robustly handles heterogeneity among panel units—each unit (e.g., country within the CMA) can have unique time dynamics and causal relationships (Dumitrescu & Hurlin, 2012). The test is particularly suited for macroeconomic research where economic variables are observed over time across different countries, allowing researchers to ascertain if past values of one variable can predict another across the panel without assuming uniform relationships (Dumitrescu and Hurlin, 2012).

The test statistics are computed using an average of individual Wald statistics of Granger non-causality for each cross-section in the panel. It assesses the null hypothesis that variable X does not Granger-cause variable Y in any of the panel groups (Dumitrescu & Hurlin, 2012). It involves estimating simple panel regressions with the independent variable and testing for zero coefficients on these lags in each cross-section separately, then averaging the results (Dumitrescu & Hurlin, 2012).

The test statistics follow a standard normal distribution under the null hypothesis due to its construction as an average of individual Wald statistics. A statistically significant result (typically with a p-value less than 0.05) indicates rejection of the null hypothesis, suggesting the presence of Granger causality in at least one of the panel units (Dumitrescu & Hurlin, 2012).

4.6.7. Diagnostic Examination

4.6.7.1. Heteroscedasticity

Wooldridge (2015) defines heteroscedasticity as the phenomenon in statistics where the variability of a variable is not constant across different levels of another variable. During the study of regression models, the idea of heteroscedasticity is encountered. Heteroscedasticity refers to the occurrence of error words that have a varying variance (Wooldridge, 2015). The Breusch-Pagan test is a commonly employed method for determining whether the errors in a model exhibit homoscedasticity or heteroscedasticity. This test examines the null hypothesis that assumes the errors have equal variances, against the alternative hypothesis that assumes the errors have different variances (Breusch & Pagan, 1979). The White test, introduced by White in 1980, is a comprehensive test for heteroscedasticity that is not contingent on any specific form of heteroscedasticity. When assessing these tests, it is crucial to consider the comparison between the critical value and the test statistic (t-stat). According to Woolridge (2015), if the t-statistic is greater than the crucial value for homoscedasticity, then the null hypothesis is rejected.

4.6.7.2. Serial correlation

This research utilized the Wooldridge test for autocorrelation in panel data to examine serial correlation (autocorrelation) issues within the dataset. The Wooldridge test, introduced by economist Jeffrey M. Wooldridge in his seminal works on econometrics, specifically in his 2002 book "Econometric Analysis of Cross Section and Panel Data," is designed to detect first-order autocorrelation in panel data models. This test is particularly advantageous because it accommodates the unique structure of panel data, which involves multiple observations over time for the same cross-sectional units (Wooldridge, 2015).

The choice of the Wooldridge test over other traditional tests, such as the Durbin-Watson test, is informed by several factors. Primarily, the Durbin-Watson test is typically used for time series data and may not be suitable for panel data settings where multiple entities are observed through time. In contrast, the Wooldridge test is tailored specifically for panel data, handling the processes of observing multiple entities across multiple periods, thereby providing more reliable results in this view (Wooldridge, 2015).

The testing procedure for the Wooldridge test involves estimating a regression model that includes the lag of the dependent variable as a regressor to test for first-order autocorrelation. The null hypothesis of this test states that there is no autocorrelation in the panel data (Wooldridge, 2015). A rejection of the null hypothesis indicates the presence of autocorrelation, suggesting that the residuals from one period are correlated with residuals from another period, which can affect the consistency and efficiency of the estimates if not addressed (Wooldridge, 2015).

The decision criteria for the Wooldridge test typically rely on the significance of the test statistic derived from the regression model. If the test statistic falls beyond a critical value (usually determined by the significance level of the test, such as 0.05), the null hypothesis of no autocorrelation is rejected. This result would imply the need for adjustments in the econometric model to correct autocorrelation, potentially using methods such as generalized estimating equations or robust standard errors to account for the detected serial correlation (Wooldridge, 2015).

This focus on appropriate testing for serial correlation is crucial in ensuring the robustness of econometric analyses, particularly in panel data applications common in macroeconomic and financial research. The choice of the Wooldridge test for this research aligns with best practices in the field, ensuring that the estimates produced are both consistent and reliable for inference about the relationship between macroeconomic fundamentals and exchange rates in the Common Monetary Area (CMA).

4.6.7.3. Cross sectional dependence test

Cross-sectional dependence refers to the interdependence or correlation between different cross-sections or units of analysis in a dataset. Cross-sectional dependence occurs when the error terms of distinct cross-sectional units in a panel dataset are correlated. The Pesaran CD test is a frequently employed method for assessing cross-sectional dependence. This test evaluates the null hypothesis of cross-sectional independence, as proposed by Pesaran in 2004. Another examination to consider is the Breusch-Pagan LM test, which also assesses the absence of cross-sectional dependence (Breusch & Pagan, 1980; Tjivera, 2023). Assessing the t-statistic and the critical value is a crucial aspect of the choice criterion. If the t-statistic exceeds the critical value, it indicates that the null hypothesis of cross-sectional independence should be rejected (Pesaran, 2004).

4.6.7.4. Normality

According to Jarque and Bera (1987), normality refers to the state of being normal or conforming to a standard or norm. Normality tests evaluate the distribution of residual terms in a regression model. The Jarque-Bera test, developed by Jarque and Bera in 1987, is commonly employed as a statistical test to assess the normality of a sample, considering both skewness and kurtosis (Jarque & Bera, 1987). The Shapiro-Wilk test is another frequently employed test. The study investigates the null hypothesis of normalcy as opposed to the alternative hypothesis of non-normality (Said et al., 2024). An important stage in the decision criteria is to compare the t-statistic with the crucial value (Said et al., 2024). When the measured value of the test exceeds the initial value, the assumption that it follows a normal distribution is considered invalid (Said et al., 2024; Shapiro &Wilk, 1965).

3.7. Conclusion

This chapter outlined the methodological framework employed to investigate the relationship between macroeconomic fundamentals and exchange rates in the CMA. The study adopts a general Panel ARDL methodology due to its ability to accommodate mixed integration orders and capture both short- and long-run dynamics. The absence of significant cross-sectional dependence, as confirmed by the Pesaran CD test, justifies the choice of general Panel ARDL over cross-sectional ARDL. Key variables, including nominal exchange rates, relative money supply, inflation, real GDP growth, and nominal interest rates, were measured in the context of each CMA country's economic framework. Exchange rates for Namibia, Lesotho, and Eswatini were measured against the USD due to their fixed peg to the South African Rand, which is traded on global forex markets. Finally, the study employs rigorous diagnostic tests, such as the Hausman test, to ensure the robustness of the estimation methodology, contributing to the reliability and validity of the research findings.

4.6.8 Ethical Consideration

Ethical clearance certificate was obtained from the University of Namibia decentralized ethics committee.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1. Introduction

Chapter Five presents the results and discusses the findings of the empirical analysis conducted to examine the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA). This chapter is structured to sequentially address the different phases of the analytical process. Section 5.2 provides descriptive statistics that summarize the central tendencies and dispersions of the data. Section 5.3 details the Unit Root Test results to assess the stationarity of the data series. Section 5.4 focuses on the Gregory Hansen Co integration Test for Structural Breaks, respectively, to examine the long-term relationships between variables. Sections 5.5 and 5.6 focus on the estimation results from the Mean Group, Pooled Mean Group, and Dynamic Fixed Effect models and the subsequent selection of the best-fit model using the Hausman Test. Section 5.7 establishes the Pooled Mean Group model as the optimal estimator for this study. The three tests are all based on Panel Autoregressive Distributed Lag (PARDL). Section 5.8 investigates causality through the Granger Causality tests, and Section 5.9 addresses various diagnostic tests to validate the robustness of the regression models.

5.2. Descriptive Statistics

In examining the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area, descriptive statistics provide an initial insight into the behaviour of key economic variables over the study period. The inclusion of descriptive statistics in this study is justified as they offer a foundational understanding of the data distribution, central tendencies, and variability of key economic variables, which are critical for analysing macroeconomic trends and exchange rate dynamics within the Common Monetary Area (CMA) (Pesaran et al., 2014; Alagidede & Ibrahim, 2017)). Descriptive statistics help in identifying patterns, outliers, and anomalies in the data, providing context for more complex econometric analyses. This preliminary analysis is crucial for validating the dataset's integrity and ensuring that subsequent modelling and hypothesis testing are grounded in an accurate representation of the underlying economic conditions in the CMA region (Pozzi & Sadaba, 2017). By summarizing the essential characteristics of the data, descriptive statistics enable a clearer interpretation of how variables like relative money supply, real GDP growth, inflation, and nominal interest rates interact with nominal exchange rates, thus setting the stage for deeper exploration in subsequent sections of the study (Zou et al., 2017). The results can be seen in Table 1.

Table 1: Macroeconomic fundamentals and exchange rates within the CMA Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
log_NOEX	overall	4.7243	.4224	4.0969	6.0616	N = 128
	between		.2604	4.5572	5.1124	n = 4
	within		.3566	4.0140	5.6734	T = 32
log_REMS	overall	20.4635	6.7527	6.2324	29.1849	N = 128
	between		7.6280	9.7158	27.7452	n = 4
	within		1.2713	16.9802	23.8927	T = 32
INCPI	overall	6.8722	4.8057	-16.8597	33.8126	N = 128
	between		.3672	6.4181	7.2241	n = 4
	within		4.7951	-16.7246	33.9477	T = 32
NOINI	overall	12.0779	6.1053	-6.4489	36.3545	N = 128
	between		.4986	11.4971	12.5315	n = 4
	within		6.0899	-6.9024	35.9010	T = 32
REGDP	overall	2.8594	2.9084	-8.1014	12.3	N = 128
	between		.6270	2.1341	3.6145	n = 4
	within		2.8568	-8.8564	11.5450	T = 32

Author's work with Stata Output

The mean nominal exchange rate (log_NOEX) across the sample is approximately 4.7243, with a standard deviation that suggests moderate volatility (0.4224). This volatility is particularly notable within the group variance, implying that fluctuations in exchange rates are more pronounced within individual time periods than across different countries in the CMA.

Relative money supply (log_REMS) exhibits a substantial overall mean (20.4635) and a higher degree of variability (6.7527 standard deviations), indicating significant differences in money supply dynamics among the countries. The considerable between-country variation (7.6280) in log_REMS indicates diverse monetary conditions and possibly differing monetary policy effectiveness across the CMA. Inflation (INCPI) further complicates the economic landscape, with a mean of 6.8722 and a wide standard deviation (4.8057), reflecting periods of both inflationary spikes and deflationary troughs within the dataset. The extreme values observed in inflation suggest episodes of economic instability, which could significantly impact exchange rate movements through changes in purchasing power and investment flows.

The nominal interest rate (NOINI), with a mean of 12.0779 and a standard deviation of 6.1053, highlights the variability in monetary policy stances among CMA countries. Such differences likely influence capital flows and exchange rate trends, given that higher interest rates typically attract foreign capital, appreciating the domestic currency. Real GDP growth (REGDP), mean of 2.8594 and a variability of 2.9084, provides insights into the economic vitality of the region. Fluctuations in GDP growth could signal varying economic conditions that impact exchange rate stability through trade balances and foreign investor confidence.

5.3. Unit Root Test

The panel unit root tests employed in this study, namely the Fisher-ADF and Fisher-PP tests, provide significant insights into the stationarity properties of the series under investigation, namely Nominal Exchange Rates (NOEX), Relative Money Supply (REMS), Inflation (INCPI), Nominal Interest Rates (NOINI), and Real GDP Growth (REGDP). These tests help determine the order of integration of each series, which is crucial for selecting the appropriate econometric approach for further analysis. The result can be seen in Table 2.

Table 2: Panel Unit Root Test Using the Fisher-ADF and Fisher PP test

	Level: Constant and Trend	First Difference: Constant and Trend	Order of Integration
Series	Fisher-ADF Unit Root Test Outcome		
NOEX	0.8177	0.0000***	**I (1)**
REMS	0.7724	0.0000***	**I (1)**
INCPI	0.0000***		**I (0)**
NOINI	0.000***		**I (0)**
REGDP	0.000***		**I (0)**
	Fisher-PP Unit Root Test Outcome		
NOEX	0.4655	0.0000***	**I (1)**
REMS	0.8466	0.0000***	**I (1)**
INCPI	0.0000***		**I (0)**
NOINI	0.000***		**I (0)**
REGDP	0.000***		**I (0)**

*Author's work with Stata Output. The significance level is indicated by *** and is 5%.*

Starting with the Nominal Exchange Rates (NOEX) and Relative Money Supply (REMS), both variables show non-stationarity at levels with p-values exceeding the 5% significance level in the Fisher-ADF tests. However, they turn stationary upon first differencing, indicated by p-values of 0.0000, which are significant at the 5% level. This suggests that both NOEX and REMS are integrated of order one, I (1). Similarly, the Fisher-PP test results corroborate these findings, with NOEX and REMS displaying stationarity only in their first differences. This pattern highlights a typical characteristic of financial time series, where raw data often require differencing to achieve stationarity. The decision criterion (rule) involves comparing the computed IPS statistic with the critical values for a given significance level. If the IPS statistic is less than the critical value, the null hypothesis of unit root presence is rejected, indicating stationarity in at least one of the panel series (Levin et al., 2002).

In contrast, Inflation (INCPI), Nominal Interest Rates (NOINI), and Real GDP Growth (REGDP) all exhibit stationarity at levels in both Fisher-ADF and Fisher-PP tests with p-values of 0.0000, significantly at the 5% level, suggesting that these variables are integrated of order zero, I (0). This indicates that these variables do not require differencing to achieve stationarity, simplifying the modelling process as they can be used in levels without concerns about non-stationarity.

Given these integration orders, where NOEX and REMS are I (1) and INCPI, NOINI, and REGDP are I(0), the mixed integration orders suggest the appropriateness of an Autoregressive Distributed Lag (ARDL) approach for modelling the relationships among these variables. The ARDL approach is particularly suited for such an element because it can handle regressors that are integrated of different orders, thus providing a flexible framework for estimating both short-run dynamics and long-run equilibrium relationships without the need for pre-testing variables for unit roots (Pesaran et al., 2014).

5.4. The Gregory Hansen Co integration Test for Structural Breaks

The Gregory-Hansen test for co-integration with structural breaks across the Level Shift (LS), Level Shift with Trend (LST), and Regime Shift (RS) models yields critical insights into the structural dynamics within the macroeconomic frameworks of the CMA countries: Lesotho, Namibia, Eswatini, and South Africa. Notably, the test statistics across all models for each country are consistently below the corresponding critical values at the 5% significance level, suggesting a failure to reject the null hypothesis of no co-integration with structural breaks. The results are presented in Table 3 to Table 5.

5.4.1. Level Shift (LS) Model results:

Table 3: Gregory Hansen Co integration test for structural breaks: Level Shift (LS) Model results

	Test	Test Statistic	Breakpoint	Date	Asymptotic critical values 5%
Lesotho					
	ADF	-4.25	8	1998	-5.56
	Zt	-4.32	8	1998	-5.56
	Za	-24.60	8	1998	-59.40
Namibia					
	ADF	-5.02	15	2005	-5.56
	Zt	-5.33	16	2006	-5.56
	Za	-26.77	16	2006	-59.40
Eswatini					
	ADF	-5.49	15	2005	-5.56
	Zt	-5.69	16	2006	-5.56
	Za	-29.27	16	2006	-59.40
South Africa					
	ADF	-4.41	13	2003	-5.56
	Zt	-4.48	13	2003	-5.56
	Za	-25.23	13	2003	-59.40

Author's work with Stata Output

In the LS model, for Lesotho, Namibia, Eswatini, and South Africa, the ADF and Zt statistics do not surpass their respective critical values, indicating no significant level shifts at the identified breakpoints. This result suggests that major policy changes or economic shocks that might have caused level shifts at these points did not permanently alter the long-term equilibrium relationship among the studied variables (Arsanious & Mabrouk, 2020).

5.4.2. Level Shift with Trend (LST) Model results

Table 4: Gregory Hansen Co integration test for structural breaks - Level Shift with Trend (LST) Model results

	Test Statistic	Breakpoint	Date	Asymptotic critical values 5%

Lesotho	ADF	-4.78	5	1995	-5.83
	Zt	-3.90	6	1996	-5.83
	Za	-19.28	6	1996	-65.44
Namibia					
	ADF	-5.17	24	2014	-5.83
	Zt	-5.25	24	2014	-5.83
	Za	-29.82	24	2014	-65.44
Eswatini					
	ADF	-5.53	15	2005	-5.83
	Zt	-6.35	22	2012	-5.83
	Za	-31.43	22	2012	-65.44
South Africa					
	ADF	-4.64	9	1999	-5.83
	Zt	-4.72	9	1999	-5.83
	Za	-26.60	9	1999	-65.44

Author's work with Stata Output

Similarly, the results for the LST model, which accommodates both level and trend shifts, do not provide sufficient statistical evidence to confirm the presence of co-integration with structural breaks. Despite economic events that could theoretically induce such shifts, the test statistics for all countries remain below the necessary thresholds to affirm significant changes (Bosupeng et al., 2019).

5.4.3. Regime Shift (RS) Model results

Table 5: Gregory Hansen Co integration test for structural breaks - Regime Shift (RS) Model results

	Test	Test Statistic	Breakpoint	Date	Asymptotic critical values 5%
Lesotho	ADF	-4.02	9	1999	-6.41
	Zt	-4.08	9	1999	-6.41
	Za	-23.49	9	1999	-78.52
Namibia					
	ADF	-7.08	12	2002	-8.41
	Zt	-7.44	11	2001	-8.41

	Za	-36.78	11	2001	-78.52
Eswatini					
	ADF	-5.53	15	2005	-6.41
	Zt	-5.75	16	2006	-6.41
	Za	-30.39	16	2006	-78.52
South Africa					
	ADF	-4.52	13	2003	-6.41
	Zt	-4.60	13	2003	-6.41
	Za	-25.87	13	2003	-78.52

Author's work with Stata Output

The RS model, designed to capture more profound structural changes, also shows test statistics below critical values across all CMA countries. This model's results further reinforce the finding that no regime shifts have sufficiently altered the co integration relationships among the macroeconomic variables considered in this study.

The uniformity of these findings across different models and countries within the CMA indicates a robustness in the macroeconomic relationships against potential structural breaks up to the specified dates. It suggests that while the CMA economies have experienced various economic shocks and policy shifts, these have not led to permanent changes in the long-term relationships of key economic indicators with exchange rates. Thus, in line with results by Draz et al. (2019), the Gregory-Hansen co integration tests indicate a lack of structural breaks in the long-run relationships among macroeconomic fundamentals and exchange rates in the CMA countries.

5.5. Empirical Results: Mean Group, Pooled Mean Group and Dynamic Fixed Effect

In the analysis of macroeconomic fundamentals and their impact on nominal exchange rates within the Common Monetary Area (CMA), the models Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effects (DFE) provide different results in the long-term and short-term dynamics. The results are presented in Table 6.

Table 6: Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE)

		Mean Group (MG)	Pooled Mean Group (PMG)	Dynamic Fixed Effect (DFE)

		Coef.	P>t	Coef.	P>t	Coef.	P>z
Long Run							
	LogREMS	-0.207	0.000***	-.1305	0.000***	-.1064	0.098**
	INCPI	0.006	0.210	.0043	0.475	.0085	0.708
	NOINI	-0.003	0.643	.0024	0.570	.0109	0.566
	REGDP	0.022	0.171	.0090	0.207	-.0082	0.751
Short Run							
	ec	-.3558	0.001***	-.3068	0.004***	-.1325	0.000***
	logREMS D1.	-.0892	0.247	.0130	0.826	.0048	0.854
	INCPI D1.	-.0143	0.042***	-.0144	0.043***	-.0051	0.015***
	NOINI D1.	.0016	0.626	.0010	0.670	-.0011	0.534
	REGDP D1.	.0033	0.261	.0055	0.004***	.0076	0.003***
	_cons	2.9405	0.000***	2.1291	0.006***	.8570	0.023***

*Author's work with Stata Output. Where ***, ** denote 5% and 10% significance levels respectively.*

Beginning with the long-run coefficients, the Relative Money Supply (REMS) exhibits a negative effect across all three models, aligning with the theoretical expectation that an increase in REMS leads to a depreciation of the domestic currency (Mankiw, 2023). The magnitude of this effect diminishes from MG (-0.2072) to PMG (-0.1305) and is least in DFE (-0.1064), suggesting a more pronounced impact in individual country models compared to pooled models. The significant negative relationship between Relative Money Supply (log_REMS) and nominal exchange rates (log_NOEX) in the long-run, as shown in the Pooled Mean Group (PMG) model, is consistent with the Flexible-Price Monetary Model (FPMM), which posits that an increase in money supply leads to currency depreciation (Frenkel, 1976). This aligns with the empirical work of Mankiw (2020), who demonstrated that an increase in domestic money supply relative to a foreign currency typically depreciates the domestic currency. The results of this study corroborate the theoretical framework provided by FPMM, highlighting the direct influence of money supply dynamics on exchange rate movements in the context of the CMA's fixed exchange rate system.

Regarding Inflation (INCPI), the coefficients are positive across all models but not statistically significant at the conventional levels, indicating a weak or inconsistent impact of inflation on the exchange rate in this sample. This contradicts some demand-pull inflation theories, which might expect a depreciation effect. Similarly, Nominal Interest Rates (NOINI) display varied and statistically insignificant effects across the models, contradicting the expectation that higher domestic interest rates should appreciate the currency (Mankiw, 2023). This aligns with Mogaji (2018), who stated that this might indicate other overriding economic factors or model specification issues.

Real GDP Growth (REGDP) shows a positive coefficient in MG and PMG but is negative in DFE, though none are significant at the 5% level except for the short-run PMG and DFE models. This inconsistency, as Mankiw (2023) puts it, might reflect differing economic conditions and model sensitivities across the CMA countries. In the short run, the error correction term (ec) is significant across all models, indicating a substantial adjustment back towards equilibrium after short-term shocks, with the strongest adjustment seen in MG (-0.3558) compared to PMG (-0.3068) and DFE (-0.1325).

Essentially, the findings related to inflation (INCPI), nominal interest rates (NOINI), and real GDP growth (REGDP) in the long-run diverge from some of the expectations laid out by other theoretical models such as the Real Interest Differential Monetary Model (RIDMM). According to Frankel (1979), higher domestic interest rates should attract foreign capital, leading to an appreciation of the currency. This study's finding of insignificant results for NOINI challenges the assumptions in the RIDMM, where interest rate differentials are expected to be a critical factor in determining exchange rate movements. A possible justification for this discrepancy lies in the CMA's unique monetary arrangement, where countries such as Namibia, Lesotho, and Eswatini align their interest rates with South Africa to maintain the peg, possibly reducing the variation in interest rate differentials and their impact on exchange rates (Bank of Namibia, 2023).

The first differences of the independent variables generally show weaker and less consistent impacts, highlighting the predominance of longer-term factors in influencing exchange rate dynamics (Umoru, 2013). However, the short-run dynamics of REGDP are notably significant in PMG and DFE, suggesting a more immediate response of exchange rates to changes in economic growth within these models.

Furthermore, the short-run dynamics show a significant negative impact of inflation on exchange rates, suggesting that inflation expectations may have a more immediate effect on exchange rate depreciation, which aligns with the Demand-Pull Theory of Inflation (Mankiw, 2020). However, the theory suggests that inflation caused by strong demand could lead to currency appreciation, a relationship not fully observed in the CMA context. This discrepancy may arise due to the fact that the CMA's countries are bound by a fixed exchange rate regime, where exchange rate adjustments may be less responsive to inflationary pressures compared to economies with more flexible exchange rate systems.

In the context of the Portfolio Balance Model (Hooper & Morton, 1982), the findings also suggest that financial asset flows and investor preferences may play an indirect role in shaping exchange rate movements. The PMG results point to the insignificance of interest rates, but the significant changes in short-run dynamics, particularly in GDP, suggest that capital flows might be indirectly influencing exchange rates, especially in the context of cross-border investments within the CMA.

The study's results thus engage with multiple theoretical perspectives, both supporting and challenging certain aspects. The findings emphasize that the relationship between macroeconomic fundamentals and exchange rates in the CMA is nuanced and affected by both long-term theoretical expectations and the short-term realities of the fixed exchange rate system.

Overall, while the MG model tends to show stronger and more significant coefficients, suggesting country-specific heterogeneities are essential in understanding the exchange rate dynamics, the PMG model balances long-term homogeneity with short-term flexibility, often providing a middle ground in coefficient magnitude. The DFE model typically shows the least magnitude, potentially indicating averaging out of individual effects across the panel.

5.6. Hausman Test

The Hausman test results in Table 7 are crucial in determining the best-fit model for investigating the relationship between macroeconomic fundamentals and exchange rates in the Common Monetary Area. The test is utilized to compare the Mean Group (MG) and Pooled Mean Group (PMG) models, as well as the PMG and Dynamic Fixed Effects (DFE) models, to ascertain which model best suits the panel data without bias while capturing individual specific effects efficiently (Pomuti, 2021).

Table 7: Hausman Test

	MG and PMG	PMG and DFE
chi2(4)	3.33	0.01***
Prob>chi2	0.260	1.000

*Author's work with Stata Output. Where *** denotes 5% significance level.*

According to the Hausman test results, the chi-square values for the MG vs. PMG comparison are 3.33 with a probability value of 0.260, and for the PMG vs. DFE comparison, the chi-square value is 0.01 with a probability value of 1.000. These probability values, being significantly above the conventional threshold of 0.05, suggest no statistical evidence to reject the null hypothesis. The null hypothesis, in the view of the Hausman test, posits that the preferred model assumes random effects—that is, the differences in coefficients between the models are not systematic (Hausman, 1978).

Given these results, both tests indicate no significant difference in the coefficients provided by the more restrictive models (PMG and DFE) compared to the less restrictive MG model (Pomuti, 2021). This implies that the PMG model, which balances individual effects with pooled long-run relationships, could provide an adequate fit without the biases associated with omitted variable effects that might affect the fixed effects model (Adler and Grisse, 2017). The PMG model, therefore, represents a suitable compromise between capturing cross-sectional heterogeneity and allowing for homogeneity in long-run coefficients, which is particularly beneficial for analysing macroeconomic interactions within the CMA setting where countries share some common economic policies and structures due to their monetary union.
Therefore, based on the Hausman test results, the PMG model stands out as the most appropriate for the entire study, balancing the need for individual country dynamics with the efficiency of pooled analysis, thus providing a robust framework for exploring how macroeconomic fundamentals influence exchange rates across the Common Monetary Area. This finding supports the utilization of the PMG estimator in subsequent analyses, particularly in settings where both country-specific variations and common long-term equilibria are of interest.

5.7. Pooled Mean Group

In the analysis of the relationship between macroeconomic fundamentals and exchange rates within the Common Monetary Area (CMA), the Pooled Mean Group (PMG) estimator (results presented in Table 8) provides long-run and short-run dynamics.

Table 8: Pooled Mean Group (PMG) Results

	Pooled Mean Group (PMG)	
	Coef.	P>t
Long Run		
log_REMS	-.1305	0.000***
INCPI	.0043	0.475
NOINI	.0024	0.570
REGDP	.0090	0.207
Short Run		
ec	-.3068	0.004***
log_REMS D1.	.0130	0.826
INCPI D1.	-.0144	0.043***
NOINI D1.	.0010	0.670
REGDP D1.	.0055	0.004***
_cons	2.1291	0.006***

*Author's work with Stata Output. Where *** denotes 5% significance level.*

For the long-run coefficients, the PMG results reveal that Relative Money Supply (log_REMS) is significantly and negatively associated with the Nominal Exchange Rate (log_NOEX), indicating that an increase in money supply tends to depreciate the domestic currency, in line with theoretical expectations (Umoru, 2013). This result aligns well with empirical findings like those of Alagidede and Ibrahim (2017), who found a significant positive relationship between money supply and exchange rate, reflecting depreciation when money supply increases.

Conversely, the coefficients for Inflation (INCPI), Nominal Interest Rate (NOINI), and Real GDP Growth (REGDP) in the long run are not statistically significant, suggesting that these variables do not have a discernible impact on the exchange rate in this model set. This observation contrasts with other studies where inflation and GDP have been found to influence exchange rates significantly (Ebiringa & Anyaogu, 2014; Raza & Afshan, 2017). The insignificant results for NOINI are particularly interesting given the expected negative relationship theorized in the RIDMM, where higher domestic interest rates are supposed to appreciate the domestic currency (Frankel, 1979).

In the short run, the error correction term (ec) is negative and significant, confirming the presence of a correction mechanism that adjusts deviations from long-run equilibrium. This supports the model's validity in capturing the dynamics between the exchange rate and the macroeconomic variables over time. Short-run dynamics also show that past inflation rates (INCPI D1) significantly and negatively affect the exchange rate, consistent with findings from other studies that inflation in the short run leads to currency depreciation (Bhutt et al., 2014). Conversely, short-run changes in GDP (REGDP D1) show a positive and significant impact on the exchange rate, suggesting that in the immediate term, economic growth may lead to an appreciation of the domestic currency, aligning with the positive impact observed by Bosupeng, Dzator, and Nadolny (2019) in Botswana.
Noticeably, in the short run, the study observes a negative sign for Real GDP Growth (REGDP) in certain models. This might seem counterintuitive at first, as economic growth is often expected to appreciate the currency due to increased demand for domestic goods and services (Mankiw, 2020). However, this result can be justified through the lens of short-run economic dynamics within the CMA. Moreover, in the short-run, economic growth can lead to higher inflationary pressures, particularly if it outstrips the economy's capacity to supply goods and services. According to the Demand-Pull Theory of Inflation (Mankiw, 2023), such growth could result in domestic inflation, which, in turn, depreciates the currency. Furthermore, higher growth can increase imports as domestic income rises, leading to a worsening of the trade balance and a subsequent depreciation of the currency in the short term. Additionally, the fixed exchange rate system of the CMA may limit the immediate response of exchange rates to domestic growth. The long-run equilibrium, however, ensures that growth is likely to have a positive effect on exchange rates over time as productivity and investor confidence rise, aligning with the theoretical framework of Mark's (1995) specification, which allows for both short-run and long-run equilibrium adjustments.

These findings have significant implications for the CMA's macroeconomic policy framework, especially in understanding the dynamics of exchange rate movements in response to changes in fundamental economic indicators. Policymakers might consider focusing on controlling money supply and monitoring inflation rates as strategies to stabilize and predict movements in the exchange rate effectively. Moreover, considering the significant role of GDP in the short run, measures aimed at boosting economic growth could potentially strengthen the domestic currency, enhancing the region's economic stability.

The empirical literature provides a backdrop against which these results can be evaluated. For instance, the findings by Chang and Su (2014) regarding the impact of structural breaks on the relationship between exchange rates and fundamentals and the results by Wong (2013) emphasizing the role of interest rates in the short run offer insights into the complex interactions between economic indicators and exchange rates. These variations in results across different studies underline the complexity of exchange rate dynamics and the influence of localized economic conditions and methodological differences on empirical findings.

As such, while the PMG model shows certain theoretical expectations about the impact of macroeconomic fundamentals on exchange rates, the absence of significant effects from some variables suggests that external factors and market conditions within the CMA might also play critical roles in shaping exchange rate dynamics. These findings encourage a different approach to economic policy in the CMA, where both economic theory and empirical evidence are considered in decision-making processes.

5.8. Granger Causality

The results from the Dumitrescu and Hurlin (2012) Granger causality test presented in Table 9 provide varying insights into the dynamic interplay between macroeconomic fundamentals and the nominal exchange rates within the Common Monetary Area (CMA). This analysis crucially informs the causal relationships integral to understanding the forces shaping exchange rate movements in response to changes in macroeconomic variables.

Table 9: Granger Causality using Dumitrescu and Hurlin (2012) Test for Granger non-causality in heterogeneous panels

Null Hypothesis	z-bar tilde	p-value
REMS does not Granger-cause NOEX	5.0820	0.0000***
INCPI does not Granger-cause NOEX	3.9756	0.0001***
NOINI does not Granger-cause NOEX	1.4231	0.1547

REGDP does not Granger-cause NOEX	0.6399	0.5223
NOEX does not Granger-cause REM	0.0891	0.9290
NOEX does not Granger-cause INCPI	3.3187	0.0009***
NOEX does not Granger-cause NOINI	3.9161	0.0001***
NOEX does not Granger-cause REGDP	1.2515	0.2108

*Source: Author's compilation. NOTES: *** indicate rejection of null hypothesis at 5%.* Natural Logs were taken for the multivariate model *for NOEX and REMS were taken*

A statistically significant result (typically with a p-value less than 0.05) indicates rejection of the null hypothesis, suggesting the presence of Granger causality in at least one of the panel units (Dumitrescu & Hurlin, 2012).

Starting with the Relative Money Supply (REMS), the study observes a significant causality with the Nominal Exchange Rate (NOEX), as indicated by a z-bar tilde value of 5.0820 and a p-value of 0.0000. This compelling evidence leads to the rejection of the null hypothesis that REMS does not Granger-cause NOEX, suggesting that fluctuations in REMS are predictive of subsequent movements in NOEX. This finding aligns with theoretical expectations and empirical observations in the literature, such as those noted by Bhutt et al. (2014), who reported a unidirectional causality from money supply to exchange rate. The causality indicates that changes in the money supply can indeed lead to adjustments in the exchange rate, likely due to the impact of money supply on inflationary pressures and economic expectations.

Inflation (INCPI) also shows a significant Granger causality with NOEX, with a z-bar tilde value of 3.9756 and a p-value of 0.0001. This result also supports rejecting the null hypothesis and confirms that inflation rates are predictive of changes in the exchange rate. This outcome corroborates findings from other studies, such as Sarno and Schmeling (2013), which emphasized the predictive power of inflation on exchange rates. Inflation impacts exchange rate movements, possibly due to the direct effect on the purchasing power parity between the CMA countries.

Conversely, the Nominal Interest Rate (NOINI) and Real GDP Growth (REGDP) do not show significant causality with NOEX, as evidenced by their p-values of 0.1547 and 0.5223, respectively. These results suggest no rejection of the null hypotheses, indicating that neither nominal interest rates nor GDP growth Granger caused the nominal exchange rate within the

CMA in this study period. These findings contradict some empirical results, such as those of Raza and Afshan (2017), who found a bidirectional causality between economic growth and exchange rates in Pakistan. The lack of causality in the CMA setting could be attributed to the relatively stable interest rate policies and synchronized economic growth patterns among the CMA countries, which may diminish the isolated impact of these variables on exchange rates. Additionally, the causality from NOEX to other macroeconomic variables like REM and INCPI is noteworthy. The significant causality from NOEX to INCPI (p-value of 0.0009) suggests that exchange rate movements could anticipate changes in inflation, aligning with Chahrour et al. (2021) findings on the forecasting relationship between exchange rates and future macroeconomic fundamentals. This could imply that exchange rate adjustments are a leading indicator of inflationary pressures within the CMA, potentially due to the imported inflation through trade channels.

5.9. Diagnostic Tests

The suite of diagnostic tests conducted as part of the analysis offers a comprehensive examination of the model's assumptions, specifically focusing on heteroscedasticity, normality, serial correlation, and cross-sectional dependence. The results from these tests, as presented in Table 10 – Table 12 provide essential findings into the validity and reliability of the econometric model employed in the study.

5.9.1. Heteroscedasticity and Normality

Table 10: Diagnostic Tests: Heteroscedasticity and Normality

Cameron &Trivedi's decomposition of IM-test			
Source	Chi2	df	p
Autocorrelation at Lag 1	6.54	14	0.4020
Skewness	9.41	4	0.1517
Kurtosis	3.807	1	0.3840
Total	19.76	19	0.9377

Author's work with Stata Output.

Cameron &Trivedi's decomposition of the IM-test suggests that the model does not suffer from heteroscedasticity or issues related to the normal distribution of residuals. Specifically, the tests for skewness (Chi2 = 9.41, p = 0.1517) and kurtosis (Chi2 = 3.807, p = 0.3840) indicate that the null hypotheses of non-skewness and appropriate kurtosis cannot be rejected, suggesting that the residuals are symmetrically distributed and conform to the normal kurtosis assumption required for classical linear regression models. The overall test combining autocorrelation, skewness, and kurtosis results in a Chi2 value of 19.76 with a p-value of 0.9377, confirming the absence of heteroscedasticity and supporting the assumption that the residuals are well-behaved and the model is specified correctly.

5.9.2. Serial Correlation Test

Table 11: Diagnostic Test: Wooldridge test for autocorrelation in Panel Data

H0: no first-order autocorrelation
F (1, 3)= 9.220
Prob>F=0.8200

Author's work with Stata Output.

The Wooldridge test for autocorrelation in panel data, which tests the null hypothesis of no first-order autocorrelation, yields an F-statistic of 9.220 with a p-value of 0.8200. This high p-value leads to the non-rejection of the null hypothesis, indicating no evidence of first-order serial correlation. This result is vital as it suggests that the residuals of the model are independent over time, which is crucial for the validity of standard errors and, thus, the inferential statistics of the regression coefficients.

5.9.3. Cross-sectional Dependence

Table 12: Diagnostic Tests: Pesaran Test, Friedman test, and Frees test of cross-sectional Independence

	Test statistic	Pr
Pesaran's test of cross-sectional independence	1.44	0.1044
Friedman's test of cross-sectional independence	0.103	0.438
Frees' test of cross-sectional independence	0.332	0.230

Author's work with Stata Output.

The tests for cross-sectional independence, including Pesaran's test (p = 0.1044), Friedman's test (p = 0.438), and Frees' test (p = 0.230), all indicate that the null hypothesis of cross-sectional independence cannot be rejected at conventional significance levels. These results suggest that there is no significant cross-sectional dependence present in the panel data used in this analysis. This absence of cross-sectional dependence is significant for panel data studies as it implies that the idiosyncratic errors across cross-sections (countries within the CMA) do not influence each other.

Notably, this study makes a significant contribution to the existing literature by providing a comprehensive analysis of the relationship between macroeconomic fundamentals and exchange rates within the CMA. While previous research on the CMA has focused primarily on the impact of money supply and inflation on exchange rates, this study broadens the scope by incorporating a range of macroeconomic variables such as nominal interest rates and real GDP growth in a unified model. Furthermore, the study highlights the distinct dynamics of the CMA's fixed exchange rate regime, offering new insights into how harmonized monetary policies across member states influence exchange rate movements. By employing a robust econometric methodology, including the Panel ARDL approach, the Gregory-Hansen co-integration test, and Granger causality tests, the study also adds to the methodological literature on the modeling of exchange rate dynamics in the presence of mixed integration orders. The findings have important policy implications for the CMA countries, suggesting that while macroeconomic fundamentals like money supply and inflation are critical in shaping exchange rates, the fixed exchange rate system and synchronized economic policies play a significant role in buffering the impact of these variables. This contribution helps bridge the gap in understanding the complexities of exchange rate determination in regions with currency peg arrangements, offering valuable insights for policymakers in similar economic unions.

5.10. Conclusion

This chapter reported the comprehensive results from the empirical analysis. Descriptive statistics provided foundational insights into the dataset's characteristics. Correlation analysis revealed initial relationships among the study variables, while the Unit Root and Panel Cointegration tests confirmed the integrative properties and long-term relationships of the macroeconomic factors. The Gregory Hansen Test extended this analysis by identifying structural breaks within the series. Substantial focus was given to the comparative evaluation of the Mean Group, Pooled Mean Group, and Dynamic Fixed Effects models, culminating in the selection of the Pooled Mean Group as the most suitable for this study's view through the Hausman Test. Granger Causality tests further explored the directional influences among variables, and a series of diagnostic tests ensured the statistical integrity of the findings. The chapter discussed the implications of these results for understanding the dynamics of exchange rates in the CMA. Looking ahead, Chapter Five will synthesize these insights into a cohesive summary, draw conclusions, and outline recommendations based on the findings.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

On the Long and Short Run Relationships, the PMG model highlights a significant long-run relationship where an increase in the Relative Money Supply (log_REMS) leads to a depreciation of the domestic currency, evidenced by a negative and statistically significant coefficient. This aligns with the monetary approach to the exchange rate, where higher money supply relative to demand results in currency depreciation (Alagidede & Ibrahim, 2017). Although inflation, nominal interest rates, and real GDP growth showed no significant impact in the long run, the error correction term's significance highlights a robust adjustment back to equilibrium when deviations occur, thus validating the model's effectiveness in capturing these dynamics. In the short run, inflation negatively influences the exchange rate, suggesting immediate depreciatory effects following inflation surges, which is consistent with the findings of Bhutt et al. (2014). The positive impact of GDP growth in the short run indicates that short-term economic expansions can appreciate the currency, supporting observations by Bosupeng et al. (2019) in Botswana. These findings imply that while some fundamental forces may not exert long-term pressures on exchange rates within the CMA, their short-term effects are real and influential. Therefore, the empirical findings from the PMG analysis robustly challenge and lead to the rejection of Hypothesis H01, which posited that macroeconomic fundamentals have no long-run and short-run linkage with the exchange rate in the CMA. The significant long-run negative relationship between Relative Money Supply (log_REMS) and the Nominal Exchange Rate (log_NOEX) indicates a definitive linkage, where an increase in money supply is associated with the depreciation of the domestic currency. Furthermore, the significant short-run dynamics, highlighted by the negative impact of past inflation rates and the positive impact of GDP growth on the exchange rate, reinforce both long-run and short-run relationships. These results are consistent with theoretical expectations and supported by empirical literature, suggesting that changes in macroeconomic fundamentals directly influence exchange rate movements within the CMA, thereby necessitating the rejection of H01.

On the Causal Relationships, the results from the Dumitrescu and Hurlin Granger causality test elucidate significant causality from relative money supply and inflation to the nominal exchange rate, indicating that these variables predict future exchange rate movements. This causality indicates the responsiveness of exchange rates to changes in money supply and inflation, which can be instrumental for policymakers focusing on exchange rate stability through monetary and fiscal policies. The absence of causality from nominal interest rates and GDP growth suggests that these variables, under the current economic settings and policy frameworks within the CMA, do not independently predict exchange rate movements, which could reflect synchronized economic policies or similar economic cycles among CMA countries. Consequently, the results from the Dumitrescu and Hurlin Granger causality test provide sufficient evidence to reject Hypothesis H02, which stated that macroeconomic fundamentals do not Granger-cause exchange rates in the CMA. The significant causality from Relative Money Supply (REMS) and Inflation (INCPI) to the Nominal Exchange Rate (NOEX), with p-values of 0.0000 and 0.0001 respectively, clearly demonstrates that these macroeconomic fundamentals are predictive of subsequent movements in the exchange rate. This causality indicates an active influence where changes in money supply and inflation precede and are likely to cause adjustments in the exchange rate. Conversely, the lack of causality from nominal interest rates and GDP growth does not entirely support H02 since other variables did exhibit significant causal effects. Therefore, the empirical evidence compels the rejection of H02 as well, affirming that at least some macroeconomic fundamentals, specifically money supply and inflation, do play a causative role in determining exchange rate dynamics within the CMA.

6.2. Recommendations

Given the results of the PMG analysis, the following recommendations are directed at central banks, policymakers, economists, researchers, and academic institutions within the CMA:

6.2.1. Central Banks and Policymakers

It is imperative that central banks maintain stringent controls over the money supply to mitigate abrupt exchange rate fluctuations. Monetary policies should be carefully calibrated to manage inflation levels that could lead to rapid changes in exchange rates. Additionally, considering the significant short-run impacts of GDP growth, economic policies should also aim to foster stable economic growth that contributes to currency appreciation and macroeconomic stability. Furthermore, central banks in member states like Namibia, Eswatini, and Lesotho should coordinate inflation thresholds with South Africa to minimize inflationary discrepancies that could disrupt the currency peg.

6.2.2. Economists and Academic Institutions

Economists should look at the underlying mechanisms through which GDP growth impacts exchange rates in the short run and explore the potential buffering effects of economic expansion on currency stability. Academic institutions should focus on developing more different and distinct econometric models that integrate the complexities of CMA's economic environment, improving the predictive accuracy of macroeconomic impacts on exchange rates. Further, an establishment of regional research collaborations among academic institutions within the CMA to analyze cross-border economic phenomena, such as trade balances and capital flows, which disproportionately affect smaller member states. These collaborations can produce contextually relevant models that reflect the fixed exchange regime and shared monetary policy dynamics.

6.2.3. Recommendations for Future Research

Future research should explore the integration of additional macroeconomic variables that might interact with the established fundamentals to influence exchange rates, such as capital flows, trade balances, and political stability, which could provide a more comprehensive understanding of the dynamics at play. Further studies could also employ different econometric models or methodologies to validate the robustness of the PMG model's findings and extend the analysis to different time frames or additional monetary arrangement countries to generalize the results. Further, research could explore how geopolitical stability within the CMA contributes to investor confidence and exchange rate resilience.

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APPENDICES

Appendix 1: Ethical Clearance

UNAM
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ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: DEC FOC/20/06/10 **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 RELATIONSHIP BETWEEN MACROECONOMIC FUNDAMENTALS AND EXCHANGE RATES: EVIDENCE FROM THE COMMON MONETARY AREA (CMA)

Student: MELVILINO LESLEY KHARON

Student Number: 201211104

Supervisor(s): Dr. S.A. KALUMBU

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)

Appendix 2: Editorial Certificate

TRANSCRIBER'S CERTIFICATE

I, the undersigned, hereby certify that insofar as it is legible, the aforegoing are true and correct.

A research thesis submitted in partial fulfilment of the requirements for the degree Master of Science in Economics

Date	June 2024
Document	Examining the relationship between macroeconomic fundamentals and exchange rates: evidence from the Common Monetary Area (CMA) University of Namibia by Melvilino Lesley Kharon 201211104
Date of Completion	31 October 2024
Total Number of audio recordings	129 (Including certificate)

TRANSCRIBER'S NOTES

1. These notes are clear and legible and correct.

NC Maischatz

PROOFREADER / EDITOR AND: NATALE C MAISCHATZ
TRANSCRIBER
DATE: 31 October 2024

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