Macroeconomic Determinants of the Demand for International Reserves and Monetary Disequilibrium in Namibia

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ABSTRACT

Following the extended version of the buffer stock model, this empirical analysis broadly focuses on assessing the macroeconomic determinants of the demand for international reserves in Namibia. The study employs the autoregressive distributed lag (ARDL) approach to cointegration, covering the period 2000q1 to 2021q4. Empirical results reveal the existence of a long-run relationship between reserve demand and the regressors, that is, broad money, foreign direct investment, real GDP and opportunity cost. The significant finding on opportunity cost is an indication that the accumulation of reserves is motivated by returns to assets in Namibia. Focusing on the main thrust of the study, we failed to validate the existence of the theory of the monetary approach to the balance of payment signified by the term monetary disequilibrium. Short-run results are corroborated by a negative and statistically significant error correction term. The CUSUM and CUSUMSQ tests suggest stability in Namibia's reserve demand function over the study period.

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Key words: buffer stock model, international reserves, ARDL, monetary disequilibrium

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CHAPTER 1: INTRODUCTION

Since the East Asian Financial Crisis (EAFC) of 1997–98, the increase in foreign currency reserves held by developing nations has prompted a surge in research into the drivers of foreign exchange reserves in advanced, emerging, and developing economies. With the ongoing globalisation of financial markets and financial innovation, the demand for International Reserves (IR) has gained momentum over the last two decades. As such, this study aims to answer the following questions: What are the macroeconomic determinants of the demand for international reserves in Namibia? And does the demand for reserves in the short run depend on the domestic money market disequilibrium?

Over the past decade, Namibia's stock of international reserves has experienced an unprecedented growth of 2875 percent, increasing from a record low of N$1.6 billion at the end of September 2005 to N$47.6 billion in 2022. In terms of reserves as a percentage of Gross Domestic Product (GDP), this translates into an increase from 4.1 percent to 23.1 percent between 2005 and 2022. Thus, against the backdrop of such a significant growth in foreign reserves, it is deemed necessary to investigate factors that have led to such a stockpile of reserves by the Bank of Namibia.

Figure 1 in the Appendix depicts the growth in average foreign reserves within the Common Monetary Area (CMA) countries from 2000 to 2021. Reserves in these countries have increased over the years, initially barely meeting the CMA import cover benchmark of four months during 2000–2006 but exceeding it in recent years. Namibia has experienced massive growth in foreign reserves, as alluded to earlier, coming from being unable to meet the CMA import cover benchmark during 2000–2016 except for 2009, where it recorded 5.1 months, to surpassing it in recent years.

It is widely accepted in the academic community that variables including foreign capital flows, precautionary measures against macroeconomic shocks, and the country's exchange rate system are common drivers of the need for international reserves (Ramachandran, 2004; Aizenman and Marion, 2003; Nayak and Baig, 2019). The sixth edition of the International Monetary Fund's (IMF) Balance of Payment Manual (BPM6) defines international reserves as "external assets that are readily available to and controlled by monetary authorities for meeting the balance of payment needs for intervention in foreign exchange markets to affect the movement of the exchange rate," among other things. They include providing a foundation for international borrowing and preserving confidence in the currency and the economy.

The country’s exchange rate structure has obvious consequences for its ability to amass foreign reserves. Countries with fixed exchange rates (also known as pegged exchange rates) tend to accumulate more reserves than those with flexible exchange rates (Nayak and Baig, 2019). This is mainly to intervene in the foreign exchange market to smooth out any exchange rate movements. This has led to a dilemma in macroeconomic frameworks, referred to as the impossible trinity. Namibia, a member of the CMA, is no stranger to the impossible trinity. As part of the CMA, Namibia has implemented a fixed currency rate system and is financially integrated with South Africa, the agreement's anchor nation. The Bank of Namibia (2008) claims that, because of this agreement, the Namibian government has given up control of its monetary policy to South Africa. However, the Bank of Namibia retains some discretion due to the stickiness of capital movements, capital controls, and other prudential requirements. The intermediate goal of CMA nations is the maintenance of the fixed peg; therefore, it makes sense that they would want to ensure that their circulating currency is backed by at least one-to-one in foreign reserves. For nations like Namibia, which use a "quasi-currency board" to manage their currency, this is a crucial non-precautionary reason to have a sizable reserve of foreign currency on hand. Having accumulated a massive stockpile of foreign reserves, be it for precautionary or non-precautionary purposes, it remains unclear how they are faring in terms of adequacy when measured against some of the commonly used conventional benchmarks.

The International Monetary Fund (IMF) introduced the concept of reserve adequacy to evaluate a country's international reserves, considering its prospective foreign currency liquidity requirements in times of crisis. With that said, the first adequacy measure is reserves as a percentage of GDP. According to the IMF’s (2016) metrics, the first adequacy measure should be in a range of 18–27 percent of GDP to be considered adequate. Looking at Figure 2 in the Appendix, we can safely say that Namibia has accumulated enough reserves to meet this measure, although this is on the back of increased foreign borrowing. The second measure, which is probably the most important for African economies, is the import coverage of international reserves. This measure is based on months of potential imports of goods and services, with a three-month coverage typically used by the IMF as a benchmark. Figure 2 in the Appendix shows that Namibia was unable to meet the three-month IMF yardstick during the period 2012–2015. However, since then, reserves have increased to 5.6 months of imports, boosted by the issuance of the Eurobond, improving the current account balance and foreign borrowing by both the government and private sector.

The Greenspan-Guidotti rule indicates that short-term debt should be no more than 100 percent of foreign reserves; this is the third metric that may be important for nations with extensive short-term cross-border financial operations. This means that a nation's reserves must be sufficient if it intends to pay off its foreign debt due within a year. Figure 2 in the Appendix indicates that Namibia has fared well by complying with the Greenspan-Guidotti rule, recording the highest level of 43 percent in the third quarter of 2019. Lastly, the reserves-to-monetary-base ratio, often denoted by M2, is widely used to reflect the risk of capital flight by residents via the sale of easily liquid domestic assets. According to the IMF (2016), a cautious ratio for this indicator is between 5 and 20 percent. Looking at Figure 2 in the Appendix, we can see that this ratio has constantly been above the upper end of 20 percent for the past five years, averaging 26 percent. The analyses of reserve adequacy have shown us that Namibia has done well in terms of meeting most of the traditional benchmarks, from being unable to meet the simple three-month import cover benchmark to doubling it in recent years. Considering this robust foreign exchange buffer, it is worthwhile to inquire into the causes responsible for this increase.

In empirical research, the drivers of international reserves are widely documented; however, the presence of the Monetary Approach to Balance of Payments (MABoP) is seldom highlighted, particularly in presenting evidence from a small, open economy in a fixed exchange rate regime. According to the MABoP, in the short term, if domestic credit remains constant and there is an excess supply of money, then foreign reserves will decrease. Conversely, if there is an excess demand for domestic money, then reserves will increase. This suggests that reserves only correct the imbalance in the domestic money market in the very short term. This study adds to the growing body of scholarship on the topic by investigating whether the MABoP holds in the specific context of Namibia. While discussions of foreign reserves are common on a global and regional scale, research focusing on Namibia is scarce. To the best of the authors knowledge, there is only one study by Manuel et al. (2021) that examined the nexus between government expenditure and foreign reserves in Namibia. Therefore, this study contributes to the literature in two respects. Firstly, we assessed Namibia's stance on reserve adequacy by employing some of the IMF's reserve adequacy metrics[1]. Secondly, we incorporated the money market disequilibrium in the short-run reserve demand function to capture the role of the monetary approach to the balance of payments. This aspect has received little to no attention in most of the studies conducted on African countries (e.g., Khomo et al., 2018; Manja et al., 2022; Elhiraika and Ndikumana, 2007;

[1] A reserve adequacy metric is a measure of a country's potential FX liquidity needs in adverse circumstances, against which reserves could be held as a precautionary buffer.

Molapoa and Thamaeb, 2015). Thus, this study fills a literature gap by presenting the case of a small open economy pegged to the South African rand.

Furthermore, using the extended version of the buffer stock model, this study employs the ARDL approach to cointegration for the Namibian economy and finds foreign direct investment, broad money supply, real GDP, and opportunity cost to be significant drivers of international reserves. However, we fail to find the existence of MABoP in Namibia.

The structure of the paper is as follows: the next section provides a review of relevant literature in the context of foreign reserves, followed by an overview of data and the methodology employed in the paper. The fourth section presents the findings, while concluding remarks and recommendations are left for section five.

CHAPTER 2: LITERATURE REVIEW

The literature on demand for international reserves has been ongoing since the 1960s (Prabheesh et al., 2007). There are three main approaches that theoretically link demand for foreign exchange reserves to macroeconomic variables.

2.1 Theoretical Framework

The first method that implies that changes in foreign currency reserves are caused by disparities between desired reserves and official reserves maintained by the monetary authorities is the buffer stock model. It is often held that reserves operate as a safety valve for financing international transactions. Heller (1966) invented the buffer stock model, which was subsequently improved by Frenkel and Jovanovic in the 1980s. The main rationale behind the model is to ensure that countries hold sufficient reserves to be able to balance out any payment disequilibria and to weather any costly financial readjustments, such as sharp capital outflows (Cifarelli and Paladino, 2009). When a country exports goods and services, it earns foreign exchange. Higher exports typically lead to an increase in international reserves as the country accumulates more foreign currency. Increased foreign reserves provide a buffer against economic shocks, such as sudden drops in export earnings. This helps maintain economic stability and confidence in the country's currency and financial system. The Asian financial crisis of 1997–1998 proved that countries that held enough reserves during the crisis survived better. For example, studies such as those by Rodrik and Velasco (2000) showed that by abiding by the Greenspan-Guidotti rule[2], countries would reduce the probability of experiencing severe capital outflows by 10 percent.

The second approach is the monetary approach to the balance of payments, which relates the holding of international reserves to the fluctuations in the domestic money market. The monetary approach puts emphasis on the asset side of financial institutions' statements of assets and liabilities, where the summation of foreign assets and domestic credit is considered your money supply (Huang and Shen, 1999). If domestic credit stays constant, an increase in foreign currency reserves corresponds to an increase in money demand, while a decrease in reserves corresponds to an increase in money supply (Prabheesh, Malathy and Madhumathi, 2007). Because of this, monetary theory considers the quantity of foreign exchange reserves to be a residual account

[2] This rule implies that countries should hold foreign reserves that are able to cover their short-term external debt.

(Huang and Shen, 1999). This study partially introduces the element of MABoP to capture the role of monetary disequilibrium in the short-run reserve demand function.

The third approach applied in this study is the Baumol-Tobin model of interest elasticity of transactions demand, which extends Keynes' notion that money is demanded for transactional, precautionary and speculative motives. The key concept in the Baumol-Tobin model is the idea that there is an optimal amount of money to hold for transactions. Holding more money than this optimal amount incurs opportunity costs in terms of foregone interest, while holding less money increases transaction costs because of the need to convert other assets into money more frequently. The theory postulates that brokerage costs increase the demand for cash balances. In relation to the demand for international reserves, if costs incurred in the investment of reserves are high, central banks will choose to hold more reserves and invest less. Additionally, it can be inferred that an increase in interest rates increases the opportunity cost of holding cash or foreign reserves, thereby reducing the corresponding demand. The model's emphasis on interest rates underscores its relevance to the current study, and its potential to address the study's objective is noteworthy.

This study follows the buffer stock model. However, it incorporates the extensions made by Flood and Marion (2002), Prabheesh et al. (2007), and others following the empirical analysis that will be discussed in the next section. The extended version of the buffer stock model groups the demand for holding reserves into five major categories, as highlighted in Table 1 in the Appendix.

2.2 Empirical Framework

As a result of the East Asian financial crisis during 1997–19998, scholars have paid more attention to the factors that affect foreign reserves in developed, emerging and developing countries. This increased focus came after a period of rapid reserve building, particularly in Asia, in the aftermath of the crisis. While the topic of foreign exchange reserves is widely debated internationally and regionally, there is no consensus in research regarding the factors that truly influence a country's reserves. This lack of agreement can be attributed, in part, to divergent views on the factors that should be considered when determining international reserve levels. For instance, trade has traditionally been used to explain fluctuations in foreign currency reserves, with factors such as import propensity, the unpredictability of international receipts and payments, and opportunity costs being just a few examples (see, e.g., Heller, 1966; Clark, 1970; Edwards, 1983; Frenkel, 1974; Streeter, 1970).

According to cost-benefit-based research, the opportunity cost of accumulating reserves and the relative risk aversion of domestic consumers are two covariates that impact the demand for reserves (see work by Dabla-Noris et al., 2011; Jeanne, 2007; and Jeanne, 2016). Others are based on the monetary approach to the balance of payments, which emphasises that the need for reserves will fluctuate with local money market variations (see, e.g., Badinger, 2004; Ford and Huang, 1994). Most of the recent research is based on an extended version of the buffer stock concept (see work by Flood and Marion, 2002; Prabheesh et al., 2007; Suvojit, Ram and Benito, 2008; Khomo et al., 2018). In most cross-country studies examining the demand for holding foreign reserves, the economic size, current account vulnerability, capital account vulnerability, exchange rate flexibility, and opportunity cost have been identified as the primary determinants of holding reserves (e.g., Flood and Marion, 2002; Gosselin and Parent, 2005; Elhiraika and Ndikumana, 2007; Sanusi, Meyer and Hassan, 2019; Eliza, Azali, Law and Lee, 2008).

Flood and Marion (2002), for instance, applied the extended version of the buffer stock model to a large panel of 122 emerging-market nations between 1980 and 1996 to examine the factors that determined their reserve holdings. Because of the critical nature of analysing the recent uptick in interest in foreign exchange reserves, they decided to zero in on this issue. Real GDP per capita, current account vulnerability, capital account vulnerability, exchange rate volatility, and opportunity cost are some of the factors considered in this article. They used a simple regression analysis to determine that real GDP per capita, the ratio of imports to GDP, exchange rate flexibility, and opportunity cost were all statistically significant determinants of demand for foreign reserves. Opportunity cost and capital account vulnerability, as measured by the difference between domestic and US interest rates on government bonds and the ratio of gross capital flows to GNP, respectively, were shown to be unimportant drivers of foreign reserves, but only in the multiple-variable fixed effect model. Lastly, Flood and Marion (2002) warned that the growing Asian countries should limit the rate at which they were amassing foreign reserves. Similar findings were discovered by Aizenman and Marion (2003) for the period 1980–1999 and Gosselin and Parent (2005) for the period 1980–2003 using the same cross-country panel data regression analysis for GDP per capita, the ratio of imports to GDP, and exchange rate flexibility.

Elhiraika and Ndikumana (2007) conducted panel analysis on yearly data sets for 21 African nations between 1979 and 2005 to investigate the factors that influence the need for reserves. Growth in gross domestic product, actual exports, the proportion of short-term debt to total debt as a stand-in for capital account vulnerability, and opportunity cost as measured by the spread between the real interest rate on US Treasury Bills and the real interest rate on domestic deposits were all used as covariates in the study. Long-term demand for foreign reserves was shown to be positively influenced by GDP growth and real exports by Elhiraika and Ndikumana (2007). Yet, when evaluating the short-term need for foreign reserves in Africa, they discovered negative and negligible values for opportunity cost and capital account vulnerability indicators. This means that low-income African nations cannot save up enough to protect themselves from the dangers of their excessively high levels of short-term debt and that reserve building is not driven by the potential for future returns on investment (Elhiraika and Ndikumana, 2007).

The empirical assessments of the demand for foreign reserves provided by these cross-country studies leverage both the time-series and cross-section features of the data, although they are typically plagued by econometric difficulties like dynamic heterogeneity (Demetriades and Andrianova, 2004). Because of variations in exchange rate policy, the external sector, and the economic structure, the best aggregate outcomes for economic policies across nations are not guaranteed. In addition to ensuring long-term economic stability and confidence, good and efficient macroeconomic policy creation and execution require a thorough grasp of the factors that shape a country's foreign reserves. Because of this, research tailored to individual nations is essential.

There are intrinsic costs and advantages to reserve accumulation, and several academic studies have investigated the elements that determine a country's reserve adequacy (e.g., Molapoa and Thamaeb, 2015; Sanusi, Meyer and Hassan, 2019). Holding reserves incurs a monetary penalty due to the loss of potential output that could have been invested in long-term financial assets with higher returns or used to purchase imported goods and services. However, it is crucial for the central bank to maintain an adequate level of foreign reserves. Sufficient reserves enable a nation to consistently meet its external debt obligations and avoid the costs and penalties associated with payment defaults (Osigwe, Okechukwu, and Onoja, 2015). Therefore, the central bank must ensure that it possesses enough foreign reserves to fulfil the country's international payment requirements and sustain its currency rate policy. In academic literature, three common markers of reserve adequacy have been presented. Among them are adhering to the Greenspan-Guidotti rule, keeping foreign reserves at a minimum ratio of one-to-one with broad money, and keeping reserves equivalent to three months of imports.

Most country-specific literature on the determinants of international reserves from studies such as Khan, Ahmed and Kazmi (2005), Afrin et al. (2014) and Prabheesh et al. (2007) relied on variables identified in Table 1 (see the Appendix) to explain the demand for international reserves. Furthermore, various econometric techniques have been adopted in the literature to determine the drivers of international reserves. For example, the Johansen cointegration technique and the Vector Error Correction Model (VECM) by Shegal and Chandan (2008) for India, Karfakis (1997) for Greece, Prabheesh et al. (2007) for India, Badinger (2004) for Austria, Khan, Ahmed and Kazmi (2005) for Pakistan, and Molapoa and Thamaeb (2015) for Lesotho.

Some studies estimate the model using the Ordinary Least Squares (OLS) method (see, e.g., Popovska-Kamnar, Nikolov and Sulejmani (2016) for the Republic of Macedonia and Romero (2005) for China and India). The key drawback with the use of OLS in these papers is that there seem to be issues with autocorrelation and endogeneity, implying that the model does not satisfy the asymptotic properties of OLS. Others have used the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model (see, e.g., Mishra and Sharma (2011) and Ramachandran (2006) for India). It is worth noting that these two papers employ weekly and monthly data, hence deeming it appropriate to use the GARCH model, which is designed for high-frequency data sets. And finally, some studies have employed the Autoregressive Distributed Lag (ARDL) cointegration approach (see, e.g., Suvojit, Ram and Benito (2008) for India; Abdourahmane et al. (2004) for Tunisia; Khomo et al. (2018) for Eswatini; Nayak and Baig (2019) for India and China; and Andriyani et al. (2020) for Indonesia). The ARDL approach was chosen for this study because of its many benefits. The ARDL's primary benefits lie in its ability to provide unbiased estimates of the long-run model even when regressors are endogenous, its general consistency, and its insensitivity to small samples. It is also applicable across I(0) and I(1) regressors (Inder, 1993; Harris and Sollis, 2003).

Empirical findings for these country-specific studies are discussed as follows: Prabheesh et al. (2007) employed quarterly data spanning from 1983–2005 and found that the ratio of real imports to GDP, the ratio of real money supply to GDP and the opportunity cost measured as the difference between the Indian call money rate and the US Fed rate are significant with theoretically expected signs in relation to foreign reserves. Similarly, Sehgal and Sharma (2008), analysing the same country, employed quarterly data from 1990–2006 and found that real GDP and broad money have a negative and significant relationship with reserves, while imports have a positive relationship. This contrasts with the findings of Prabheesh et al. (2007).

Empirical findings are ambiguous when assessing the impact of opportunity costs on foreign reserves. For instance, Islam (2021) found a positive effect, while Nayak and Baig, 2019; Afrin et al., 2014; and Abdourahmane et al., 2004 found a negative relationship. An important point to note about these studies is that neither of them found the opportunity cost variable significant, or rather, the bulk of empirical studies have found this variable to be insignificant, except for a few studies such as Badinger (2004), Edwards (1984) and Karfakis (1997). According to Ben-Bassat and Gottlieb (1992), measurement issues are associated with this variable, and if properly measured, it should be a significant predictor of foreign reserves with a negative coefficient.

Andriyani, Marwa, Adnan, and Muizzuddin (2020) examined the relationship between Indonesia's reserves and variables such as inflation, exports, debt, and the currency exchange rate. The study employed the ARDL method of cointegration, and the findings indicated a positive and substantial impact of exports and external debt on reserves, while the exchange rate had a negative and significant influence on foreign reserves. Additionally, no statistically significant relationship was observed between inflation and foreign exchange reserves. The study concluded that these results have policy implications, suggesting that governments should promote export development as it brings financial benefits and increases foreign reserve holdings.

The importance of monetary disequilibrium (MDE) in influencing reserves in the short run has been estimated by several studies (e.g., Ford and Huang, 1994; Islam, 2021; Nayak and Baig, 2019; Mishra and Sharma, 2011; Khan and Ahmed, 2005; and Badinger, 2004). However, studies that estimate the MDE are scarce in Africa, which further motivates this study to analyse this issue. Studies focused on other regions derive the MDE by first estimating the long-run money demand function. According to the MABoP, MDE determines foreign reserves only in the short run. Badinger (2004) and Mishra and Sharma (2011) discovered evidence that monetary disequilibrium with a one-quarter lag has a substantial effect on reserve in the short run.

In CMA, Khomo and others (2018) applied the ARDL approach to cointegration to study the performance of Eswatini’s foreign reserves over the period of 1990 to 2014. Reserves were shown to be positively correlated with GDP per capita and negatively correlated with government spending and the current account deficit as a percentage of GDP. Depreciation of the exchange rate was also shown to result in a significant rise in reserves when measured in domestic currency. Consequently, the findings suggest that authorities should be more aggressive in accumulating reserves for the sake of maintaining confidence in the currency peg and ultimately financial stability in the country. Similar to the findings of Abdourahmane et al. (2004), Molapoa and Thamaeb (2015) analysed annual data for Lesotho (a CMA member state) between 1981 and 2012 and discovered a negative relationship between reserves and measures of exchange rate flexibility and opportunity cost, while finding a positive relationship between reserves and average propensity to import, economic growth, and export volatility.

The reserve level in Namibia seems to be significantly affected by government spending. The Bank of Namibia used the ARDL method of cointegration on quarterly data from 2002–2020 to analyse the impact of government spending on foreign reserves in a working paper published in 2021. The findings indicate that higher levels of government spending result in lower levels of foreign reserves. The number of foreign reserves is also bolstered by the government's external debt, the current account balance, and M2, while reserves decline due to an increase in the nominal effective exchange rate. These results imply the central bank is losing its ability to protect foreign reserves, which threatens the future efficacy of monetary policy by keeping the value of the Namibian dollar pegged to that of the South African rand.

2.3 Conclusion of Literature Review

Section 2.1 linked existing economic theories to the demand for international reserves. Within the empirical literature in Section 2.2, evidence suggests that economic size and balance of payment susceptibility are two of the many elements that determine a country's foreign reserve levels. While the previous literature reviews have encompassed studies for the CMA region, Southern Africa, and emerging economies, our findings add to the existing body of knowledge in three keyways. To begin, we apply part of the IMF's reserve adequacy criterion to evaluate Namibia's current reserve position. Secondly, we deviate from the Bank of Namibia’s study by using the entire setup suggested by the IMF buffer stock model, which includes the model's recommended measures of opportunity cost and economic size. It is worth stating that, as much as countries need to follow the extended version of the buffer stock model, country-specific characteristics should not be overlooked, and the theoretical model of reserve demand may need to be somewhat adjusted (Khomo et al., 2018). This research incorporates net Foreign Direct Investment (FDI) inflows, which stands for the theory of capital flows, and takes into account the modifications. As a third component, the analysis captures the importance of the MABoP by including the money market imbalance in the short-run reserve demand function. Most research conducted in African nations has paid little, if any, attention to this. So, the purpose of this research is to address this knowledge gap.

CHAPTER 3. DATA, MODEL SPECIFICATION AND METHOD

3.1 Data Sources and Measurement of Variables

This study makes use of quarterly time-series data from 2000Q1 to 2022Q1. Data was sourced from the Bank of Namibia (BoN) and Namibia Statistics Agency (NSA). The sample size was determined by the availability of data on the dependent variable. The covariates used in the model were chosen based on articles published by Flood and Marion (2002) and Nayak and Baig (2019) to estimate the 1) reserve demand function and 2) money demand function, respectively. The variables and associated a priori predictions for the two models are discussed in further detail below.

The dependent variable in the reserve demand function is the log of foreign reserves, which are defined as official public sector foreign assets that are easily accessible to and controlled by the monetary authorities. It is composed of foreign currency reserves (in convertible foreign currencies), the IMF reserve position and special drawing rights.

According to Flood and Marion (2002), the size of the economy is often measured via real GDP, and it is expected that this measure will have a positive effect on the demand for reserves. Further on, reserves are anticipated to fund current account deficits; hence, from a demand perspective, the ratio of the current account deficit to GDP, which measures the current account vulnerability, is expected to be positively related to demand for reserves, as reserves are expected to finance these deficits. The impact is similar in the case of capital account vulnerability, which is represented by a broad money supply. As Namibia is in a pegged exchange rate system with South Africa, maintaining the Namibia dollar/rand currency peg requires that Namibia's currency in circulation be backed by foreign reserves at a minimum ratio of one-to-one.

To further take into consideration the impact of capital inflows on the reserve demand function, this research adjusts for net FDI inflows as a proportion of GDP. FDI refers to the net influx of capital used to acquire a controlling stake in a company (10 percent or more of the voting stock) in a foreign economy. Equity capital, reinvested earnings, other long-term capital, and short-term capital are the components that make up total capital as represented in the balance of payments. Many FDIs are denominated in foreign currencies; therefore, they should contribute positively to a country's foreign reserves.

Instead of using the standard deviation of exchange rates to characterise exchange rate flexibility, like Khomo et al. (2018) do, the author of this research uses the Nominal Effective Exchange Rate (NEER). The NEER compares the worth of one Namibian dollar to the sum of a basket of other currencies. An increase in the NEER suggests that the Namibian dollar has become more valuable in relation to a trade-weighted currency basket. Flood and Marion (2002) claim that reserve holding behaviour is affected by a country's exchange rate policy. According to research by Frenkel and Edwards (1983), governments that often intervene in the foreign currency market, such as via a fixed or intensively controlled exchange rate, maintain larger reserves than those who do not.

The study also controls the opportunity cost, measured through the nominal interest rate differential between domestic and foreign currency denominated assets. We use the effective bond yield on a 10-year government bond to signify the domestic currency asset, while the US Fed Rate is used in the case of foreign currency-denominated assets. The justification for the use of the US Fed Rate is the fact that most empirical studies tend to use it as a benchmark for the offshore interest rate. The expected sign of the variable is ambiguous. According to Prabheesh et al. (2007), high opportunity costs result in a decline in reserve holdings as investments in alternative instruments become comparatively attractive. However, Flood and Marion (2002) cautioned that the decline in reserve holdings with increasing opportunity cost is not reliably negative and significant. Ben-Bassat and Gottlieb (1992) pointed out that there are measurement problems associated with this variable and argued that if properly measured, it should have a significant negative effect on foreign reserves. Manja et al. (2022) further support the latter point, as they found the variable to be a significant predictor of reserves by measuring it as the difference between the real US Treasury Bill rate and the domestic lending rate.

The study employs broad money stock, a proxy for money demand, as the dependent variable in a money demand function analysis. Concerning the measurement of money demand, the study uses broad money supply (M2), backed by the works of Irvin Fisher in 1911 in his Quantity Theory of Money (QTM) and several empirical studies, including those of Mbazima-Lando and Manuel (2020), Manuel et al. (2020), and Shidhika (2015). M2 comprises a narrow money supply (which is the sum of domestic currency in circulation outside depository corporations and transferable deposits) and time deposits of the money-holding sectors with the depository corporations (Bank of Namibia, 2021).

Furthermore, we also control for Real Gross Domestic Product (RGDP) as a proxy for current income, chiefly due to the availability of data. Moreover, in terms of the expected sign, RGDP is expected to have a positive influence on the level of money demanded. With respect to the measurement of inflation, the study uses the Namibian Consumer Price Index (CPI), which is expected to have a negative effect on money demand. The study employs the three-month Treasury Bills (RTB3) effective yield, an opportunity cost for holding money balances, as used by Manuel et al. (2020). The attractiveness of money balances is predicted to decrease when the Treasury Bill rate rises; hence, a negative association is anticipated.

Moving on to the exchange rate as measured by the bilateral exchange rate, which is the unit of NAD per unit of US dollar, an increase represents a depreciation of the exchange rate. As far as the impact of the coefficient on the exchange rate is concerned, empirical findings are ambiguous. According to Bahmani-Oskooee and Poorheydarian (1990), the coefficient on the exchange rate will be negative if an increase in the exchange rate is anticipated to be followed by a depreciation. This is on the premise that an expectation of depreciation induces the public to substitute domestic currency in favour of holding foreign currency (Nayak and Baig, 2019). Nonetheless, the coefficient is anticipated to be positive if an increase in the exchange rate results in an increase in foreign assets. Haider et al. (2017) summarised these findings on the exchange rate as dependent on the currency substitution or wealth effect.

Table 2 shows the descriptive statistics of the money demand function, and we can see that variables are not following a normal distribution. This is shown by kurtosis, which is nowhere close to three for an indication of a normal distribution within the variables. Similarly, Table 3 shows the reserve demand function, and the same can be said with respect to kurtosis in this case too. Table 3 also shows a large variation between the maximum and minimum values of the current account balance. We can see that over the observed period, Namibia, on average, has reported a current account deficit.

We will restrict our analysis of the correlation matrix to the reserve demand function shown in Table 3. This table shows that foreign reserves (LRESERVES) are evenly correlated with all the explanatory variables in terms of the sign of correlation. Reserves are mostly correlated with the money supply, followed by real GDP. As predicted, reserves positively correlate with the money supply and real GDP. Contrary to intuition, the higher the current account deficit, the lesser the foreign reserves. This is contrary to our a priori expectations mentioned earlier in the paper.

Table 2: Summary Statistics and Correlations for Money Demand Equation

	Mean	Maximum	Minimum	Std dev	Skewness	Kurtosis
LRM2	10.8267	6.7935	5.8586	0.2808	-0.3573	-1.0195
LRGDP	10.2424	10.5296	9.7380	0.2376	-0.4910	-1.0370
LEXTR	2.2569	2.8876	1.7915	0.3181	0.2915	-1.3558
LCPI	4.4668	5.0122	3.7565	0.3647	-0.1994	-1.2015
RTB3	1.8388	6.1607	-1.5284	1.8609	0.2079	-0.7309
Correlations	**LRM2**	**LRGDP**	**LCPI**	**LEXTR**	**RTB3**	
LRM2	1					
LRGDP	0.9336	1				
LCPI	0.9639	0.9527	1			
LEXTR	0.7369	0.6844	0.7925	1		
RTB3	0.0034	0.0136	0.0088	-0.0106	1	

Source: Author's computation (2022) using Microfit 5.0. Note: LRM2 denotes the log of real money supply; LRGDP signifies the log of real GDP; LEXTR denotes the log of bilateral exchange rate; LCPI represents the log of the Namibian Consumer Price Index; and finally, RTB3 denotes the real 3-month Treasury Bill rate.

Table 3: Summary Statistics and Correlations for Reserve Function

	Mean	Maximum	Minimum	Std dev	Skewness	Kurtosis	
LRESERVES	9.1154	10.7337	7.3885	1.0992	-0.3451	-1.3469	
LM2	10.8267	11.7749	9.6579	0.6398	-0.2481	-1.1513	
CABR	-0.0047	0.0445	-0.0507	0.0220	0.0943	-0.3963	
OC	8.7374	12.5098	3.5936	1.8626	-1.0577	1.2580	
LRGDP	10.2424	10.5296	9.7380	0.2376	-0.4901	-1.0370	
NEER	111.2611	131.9371	89.5796	12.1958	-0.2007	-1.3877	
FDI	1.2417	4.9266	-0.9705	1.2273	0.7992	0.9511	
Correlations	**LRESERVES**	**LM2**	**CABR**	**OC**	**LRGDP**	**NEER**	**FDI**
LRESERVES	1						
LM2	0.9610	1					
CABR	-0.5894	-0.5487	1				
OC	0.0966	0.0109	-0.3523	1			
LRGDP	0.9075	0.9528	-0.6115	-0.0423	1		
NEER	-0.8532	-0.8600	0.5111	-0.2832	-0.7875	1	
FDI	-0.2203	-0.2972	0.0019	-0.0524	-0.2426	0.2753	1

Source: Author’s computation (2022) using Microfit 5.0. Note: LRESERVES denotes the log of foreign reserves, LM2 signifies the log of money supply, CABR denotes the current account deficit to GDP ratio, OC represents opportunity cost, LRGDP signifies the log of real GDP, NEER represents the nominal effective exchange rate, and finally FDI denotes net FDI inflows as a proportion of GDP.

Prior to estimating the empirical model, to ensure stationarity, tests were conducted using the Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) tests. This study compared the alternative hypothesis of stationarity with the null hypothesis of no stationarity at the five percent significance level. Inflation (LCPI), current account deficit (CABR), and foreign direct investment (FDI) are found to be stationary at levels (i.e., I(0)), while the other variables are shown to be stationary after the first difference (i.e., I(1)), as shown in Tables 4 and 5. As a result, the ARDL estimating method may be used to estimate both the long-run and short-run coefficients, which is a practical consequence of the observed mixed order of integration. When using OLS to analyse data with variables of varying orders of integration, it is possible to get spurious results. After confirming the stationarity properties of all the covariates, we move on to specify the money and reserve demand functions in detail.

Table 4: Unit Root Test Results

	ADF Test			PP Test			Order of integration
Variables	**Levels**	**First diff**	**5% CV**	**Levels**	**First diff**	**5% CV**	**Decision**
LRM2	-1.3374	-7.6485***	-3.4639	-1.7209	-14.5403***	-3.4608	I(1)
LRGDP	-1.8219	-10.1415***	-3.4639	-2.9407	-18.5296***	-3.4608	I(1)
LEXTR	-2.4012	-6.2350***	-3.4639	-2.1174	-7.2969***	-3.4608	I(1)
LCPI	-3.4938**	-5.7616***	-3.4639	-2.8609	-6.6086****	-3.4608	I(0)
RTB3	-3.1220	-5.0051***	-3.4639	-2.6391	-5.8045***	-3.4608	I(1)

*Note: ***, **, * denotes significance at 1%, 5%, and 10% level, respectively. CV stands for critical values.*

Table 5: Unit Root Test Results

	ADF Test			PP Test			Order of integration
Variables	**Levels**	**First diff**	**5% CV**	**Levels**	**First diff**	**5% CV**	**Decision**
LRESERVES	-1.7705	-7.1010***	-3.4639	-2.1838	-10.2080***	-3.4608	I(1)
LM2	-1.3374	-7.6485***	-3.4639	-1.7209	-14.5403***	-3.4608	I(1)
CABR	-5.2099**	-9.6670***	-3.4639	-5.8316**	-19.7464***	-3.4608	I(0)
OC	-2.3269	-5.3120**	-3.4639	-2.1516	-6.2927***	-3.4608	I(1)
LRGDP	-1.8219	-10.1415***	-3.4639	-2.9407	-18.5296***	-3.4608	I(1)
NEER	-2.4028	-5.7994**	-3.4639	-2.3744	-7.1171***	-3.4608	I(1)
FDI	-4.4591**	-10.4659***	-3.4639	-6.9533***	-25.5139***	-3.4608	I(0)

*Note: *** indicates significance at 1%, ** significance at 5% and * significance at 10%. CV stands for critical value.*

3.2 Monetary Disequilibrium and Money Demand Function

Estimating the long-run money demand function is a prerequisite to studying the effect of MDE on the short-run reserve function. The generic theoretical money demand function may include the variables real money balance, real income, interest rate, exchange rate, and inflation. Inflation is added as a new covariate to the approach developed by Nayak and Baig (2019) to estimate the long-run money demand function. The following is the equation to be estimated:

$$lnM2_t = \lambda_0 + \lambda_1 \ln Y_t + \lambda_2 r_t + \lambda_3 lnER_t + \lambda_4 lnCPI_t + \varepsilon_t \quad (1)$$

Where $M2_t$ is defined as the real money supply measured in millions of Namibian dollar (NAD), Y_t is the real GDP measured in millions of NAD, r_t is the domestic interest rate, ER_t represents the bilateral exchange rate (units of NAD per unit of US dollar), and inflation is represented as CPI_t. The stochastic error term is signified by ε_t. Except for the domestic interest rate, represented by the prime rate, all the covariates are in logarithmic form. A more comprehensive discussion of the variables and their a priori expectations was discussed earlier under the data section.

The next step entails the calculation of MDE using Equation 1. Following Nayak and Baig (2019) and Badinger (2004), we estimate the monetary disequilibrium (M_t^{Dis}) as follows:

$$M_t^{Dis} = M2_{t-1} - M2_t^* \quad (2)$$

Where M_t^{Dis} is the monetary disequilibrium measured by the term ($M2_{t-1} - M2_t^*$) of which $M2_t^*$ is the equilibrium value proxied by the fitted values obtained from Equation 1. It would then follow that positive values of M_t^{Dis}, which are associated with excess supply of money, while negative values signify excess demand for money. This coefficient of monetary disequilibrium is the one we incorporate in the short-run reserve demand function and expect to have a negative effect on reserves in the short run.

3.2 Reserves Demand Function

Following the review of theoretical and empirical literature surrounding the topic of international reserves, this study follows the extended version of the buffer stock model based on Flood and

Marion (2002) and Nayak and Baig's (2019) guidelines to estimate the determinants of reserves, although with two alterations to fit Namibia's economic structure.

First, this study includes foreign direct investment, which represents capital inflow in the reserve demand function. Second, following Khomo et al. (2018), this paper employs the Nominal Effective Exchange Rate (NEER) instead of the standard deviation of the exchange rate to measure the exchange rate flexibility category. With that said, the empirical reserve function employed in this paper is specified as follows:

$$lnRes_t = \beta_0 + \beta_1 lnY_t + \beta_2 Cabr_t + \beta_3 lnM2_t + lnExr_t + \beta_5 FDI_t + \beta_6 OC_t + \varepsilon_t \tag{3}$$

In Equation 3, β_0 is the intercept, while Res_t represents the stock of foreign reserves, Y_t represents the real GDP, the current account deficit to GDP ratio is signified by $Cabr_t$, the broad money supply is denoted by $M2_t$, Exr_t is the nominal effective exchange rate, FDI_t is foreign direct investment as a percentage of GDP, OC_t shows opportunity cost, and finally the error term is signified by ε_t. Except for the current account deficit, foreign direct investment and the measure of opportunity cost, all the covariates are in logarithmic form. A more comprehensive discussion of the variables and their a priori expectations was discussed earlier under the data section.

3.3 Method of Estimation

3.3.1 The ARDL Approach to Cointegration

Below, we provide further detail on the estimating method used to arrive at the estimates for Equations 1 and 3. Cointegration techniques are a popular tool used to study a variable's long-term and short-term dynamics in a single framework. There are several ways to test for cointegration in the published literature, but the Johansen cointegration test has been used by a great number of researchers in this area.

In contrast to previous research, this one uses the ARDL method of cointegration that was developed by Pesaran, Shin, and Smith (2001). This method is a workhorse for analysing dynamic single-equation models and has several benefits. Before anything else, the ARDL has a significant benefit over other cointegration approaches since it may be used whether the regressor variables are I (1), I (0), or mutually integrated. Second, this method works better when dealing with limited data sets, as is the situation in the present investigation. Thirdly, the ARDL cointegration approach is dynamic because it permits the combination of short-run dynamics and long-run equilibrium analysis without losing long-run information. Even when regressors are endogenous, unbiased estimates of the long-run model may be obtained using this method, provided the specification is correct (Inder, 1993; and Harris and Sollis, 2003).

3.3.2 The Empirical Model

Below, we respecify Equations 1 and 3 in a manner consistent with the ARDL approach to cointegration given by Equations 4 and 5, respectively.

Model 1: Money Demand Function

$$\begin{aligned}\Delta \ln M_t \;=\; & \beta_0 + \gamma_1 \ln M_{t-1} + \gamma_2 \ln Y_{t-1} + \gamma_3 r_{t-1} + \gamma_4 \ln ER_{t-1} + \gamma_5 \ln CPI_{t-1} + \sum_{i=1}^{a} b_i \,\Delta \ln M_{t-1} \\ & + \sum_{i=0}^{b} c_i \,\Delta \ln Y_{t-1} \sum_{i=0}^{c} d_i \,\Delta r_{t-1} + \sum_{i=0}^{d} e_i \,\Delta \ln ER_{t-1} + \sum_{i=0}^{e} f_i \,\Delta \ln CPI_{t-1} \\ & + \nu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)\end{aligned}$$

Model 2: Reserve Demand Function

$$\begin{aligned}\Delta \ln Res_t \;=\; & \beta_0 + \gamma_6 \ln Res_{t-1} + \gamma_7 \ln Y_{t-1} + \gamma_8 Cabr_{t-1} + \gamma_9 \ln M2_{t-1} + \gamma_{10} \ln Exr_{t-1} + \gamma_{11} FDI_{t-1} \\ & + \gamma_{12} OC_{t-1} + \sum_{i=1}^{a} b_i \,\Delta \ln Res_{t-1} + \sum_{i=0}^{b} c_i \,\Delta \ln Y_{t-1} \sum_{i=0}^{c} d_i \,\Delta Cabr_{t-1} \\ & + \sum_{i=0}^{d} e_i \,\Delta \ln M2_{t-1} + \sum_{i=0}^{e} f_i \,\Delta \ln Exr_{t-1} + \sum_{i=0}^{f} g_i \,\Delta FDI_{t-1} + \sum_{i=0}^{g} h_i \,\Delta OC_{t-1} \\ & + \xi_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)\end{aligned}$$

In both models 1 and 2, β_0 is the intercept, while the difference operator used to depict the short-run dynamics is represented by Δ. The long-run parameters are signified by $\gamma_1 - \gamma_{12}$. The error term is represented by ν_t in the case of the money demand function, while ξ_t represents the reserve function. Equations 4 and 5 have been estimated by employing the ARDL bounds testing approach to cointegration.

The next step is to use the F-statistics from the ARDL bound testing process to estimate whether the variables are related in the long run. Cointegration is assessed by comparing the null hypothesis (that there is no cointegration) with the alternative hypothesis (that there is cointegration). Two critical limits, a lower and an upper, are used in the bounds test introduced by Pesaran et al. (2001). The null of the two models cannot be rejected if the estimated F-statistic is below the lower critical limit.

Nonetheless, if the F-statistic is larger than the upper critical limit, we may conclude that there is a long-run relationship between these variables and reject the null of no cointegration relationship. If the estimated F-statistic falls in the middle of the two limits, the test results are inconclusive. The null hypothesis of the money demand function can be specified as: ($\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$) against the alternative hypothesis: ($\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$). While the null hypothesis of the reserve determinants model can be formulated as: ($\gamma_6 = \gamma_7 = \gamma_8 = \gamma_9 = \gamma_{10} = \gamma_{11} = \gamma_{12} = 0$) against the alternative hypothesis: ($\gamma_6 \neq \gamma_7 \neq \gamma_8 \neq \gamma_9 \neq \gamma_{10} \neq \gamma_{11} \neq \gamma_{12} \neq 0$).

Next, we discuss the specification of the short-run reserve model and the important role played by the monetary disequilibrium. It is worth reiterating that the ultimate purpose of the money demand function is to help in the computation of monetary disequilibrium (M_t^{Dis}), which is important in the short-run reserve model. As a result, the calculation of the short-run money demand model is not of importance in this study. According to the MABoP, monetary disequilibrium is essential in determining reserves only in the short run, hence its exclusion from the long-run reserves demand function.

To capture the role of monetary disequilibrium, we follow Nayak and Baig (2019) in departing from existing literature (see, for example, Afrin et al., 2014; Mishra and Sharma, 2011; and Badinger, 2004) in utilising the traditional ECM approach of Johansen (1990) and Eagle and Granger (1987). Utilising the unrestricted error correction model (UECM), we incorporate M_t^{Dis} as an exogenous variable in the UECM, which combines short-run dynamics with long-run equilibrium without sacrificing long-run information. In Equation 6, the UECM is stated as follows:

$$\Delta \ln Res_t = \beta_0 + \sum_{i=1}^{a} b_i \Delta \ln Res_{t-1} + \sum_{i=0}^{b} c_i \Delta \ln Y_{t-1} + \sum_{i=0}^{c} d_i \Delta Cabr_{t-1} + \sum_{i=0}^{d} e_i \Delta \ln M2_{t-1} + \sum_{i=0}^{e} f_i \Delta \ln Exr_{t-1} + \sum_{i=0}^{f} g_i \Delta FDI_{t-1} + \sum_{i=0}^{g} h_i \Delta OC_{t-1} + \psi z_{t-1} + \phi M_t^{Dis} + \eta_t \quad \ldots (6)$$

Where the first lag of the error correction term (ECM) is signified by z_{t-1} computed from the long-run reserve function specified in Equation 6. The monetary disequilibrium signified by M_t^{Dis} enters Equation 6 after being computed from Equation 5 using a relatively simple formula following (Badinger 2004).

To ensure the fitness and stability of the estimated model, it is typical when dealing with time-series models such as the ARDL to carry out numerous diagnostic tests (Pesaran and Shin, 1999). As a consequence, this research includes a number of diagnostic tests, including the Lagrange Multiplier test for serial correlation, Ramsey's RESET test for functional form misspecification, and Jacque-Bera test for regression residual normality. The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares (CUSUMSQ) plots are also used to verify model stability. The tests depict the cumulative sum along with the five percent critical limits and determine if the model is stable if the results fall within these critical boundaries.

CHAPTER 4. RESULTS AND DISCUSSION

4.1 Money Demand Function

As previously shown in Tables 4 and 5, all the variables are a mixture of I(0) and I(1); this implies we can proceed to use the ARDL cointegration given that it works with a mixture of I(0) and I(1) variables and does not work with I(2) variables. However, prior to conducting the bounds test for cointegration, it is vital to determine the optimal lag length to be included in the model, especially in cointegration analysis, according to Yesigat et al. (2018). Very often, in time-series data, the lags of the dependent and independent variables have an influence on the dependent variable since the latter rarely responds to the former instantaneously. Moreover, the addition of lags removes the autocorrelation that may be present in the residuals of cointegrated variables. The lag length selection criteria, presented in Table 6, provide conflicting results. Denoted by the asterisks in Table 6, the lag length chosen by two of the four criteria is 1, while the other two go for 5. Nonetheless, the optimal lags were chosen using the Akaike Information Criterion (AIC) criteria where we chose 5 lags.

Table 6: Optimal Lag Length Criteria Results

Lag	AIC	HQ	SC	FPE
1	-2.800386e+01	-2.758875+01*	-2.696922e+01*	6.902692e-13
2	-2.791432e+01	-2.720270e+01	-2.614066e+01	7.616118e-13
3	-2.772163e+01	-2.671351e+01	-2.520894e+01	9.427502e-13
4	-2.825117e+01	-2.694654e+01	-2.499945e+01	5.768091e-13
5	-2.902952e+01*	-2.742838e+01	-2.503877e+01	2.819305e-13*
6	-2.888797e+01	-2.699032e+01	-2.415819e+01	3.571054e-13
7	-2.889829e+01	-2.670414e+01	-2.342949e+01	4.054740e-13
8	-2.901284e+01	-2.652218e+01	-2.280501e+01	4.387212e-13

Source: Author’s own construct.

Note: the selected lag order by the criterion is shown by the asterisk (*)

After determining the optimal lag length, we conducted a bounds test for cointegration to examine the existence of a long-run relationship among variables. The results of the bounds test, presented in Table 7, indicate the presence of a long-run relationship between money demand and its confounders. This is evident from the F-statistics value, which exceeds the upper and lower critical bounds at all levels of significance, as specified by Pesaran et al. (2001).

Table 7: Bounds Test Results for Money Demand Model

Test statistics	Value	Lag		
F-statistic	6.2217**	5		
Bounds Test Critical Value: Case 5 – Unrestricted Intercept and Unrestricted Trend				
Significance level	Lower bound	Upper bound		
5%	3.6805	4.8444		
10%	3.1404	4.2082		K = 4

Author's computation using data from the Bank of Namibia and employing the Microfit software.

Having confirmed the existence of a long-run relationship in the model, we can use the ARDL approach to cointegration to estimate the long-run money demand function. At this juncture, it is worth reiterating that the main interest in the estimation of the money demand function is the results from long-run estimates and not the short run, as mentioned earlier. However, to prove that the ECM coefficient is correctly signed and significant, we report the short-run results (see Table 8 in the Appendix), although the paper will not be analysing the short-run results.

In this regard, the ARDL model estimated took the form ARDL (5,1,0,1,1), with respective long-run results presented in Equation 7. Overall, the covariates accord with the a priori expectations as highlighted earlier on, except for the real interest rate.

LRM2 = 6.0522* + 1.44LRGDP** - 3.56LCPI** - 0.32LEXTR* + 0.03RTB3 + 0.05T**..................(7)

[1.76] [2.03] [-2.00] [-1.85] [1.05] [2.49]

*Note: ***,**,* denote significance at 1%,5%,and 10% level, respectively . The T-Ratios are in parenthesis. T signifies the trend in Equation 7.*

These results show that real GDP has a significant positive effect on the money demand. This greater than unity effect is found to be statistically significant at 5 level. According to Equation 7, a one percent increase in real GDP raises money demand by 1.44 percent in the long run. These findings on real GDP accord with findings by (e.g., Islam, 2021; Nayak and Baig, 2019; Mishra and Sharma, 2011). This finding further supports those by Ikhide and Katjomuise (1999), Dlamini and Mabuza (2020), Tsheole (2006), who also suggested that the demand for money was an increasing function of the real GDP in Namibia, Eswatini and Botswana, respectively.

Regarding the role of inflation as measured by the Consumer Price Index in Namibia, Equation 7 suggests that in the long run it has a significant negative effect on money demand. This result, which is in line with our a priori expectation supports the finding by Manuel et al. (2020).

The coefficient of the three-month Treasury Bill rate (RTB3) variable is found to be in contradiction with the a priori expectations, although it is not statistically significant. This may suggest that agents are insensitive to increases in the three-month Treasury Bill rate attributable to an underdeveloped domestic capital market. Regarding the sign and magnitude of the coefficient, the results are similar to the findings by Afrin et al. (2014), who suggested that short-term interest rates were not significant regressors for the broad money supply in Bangladesh.

An appreciation of the domestic currency by one percent reduces money demand by a magnitude of 0.32 percent over the long run, implying the existence of the wealth effect, as highlighted by Bahmani-Oskooee and Poorheydarian (1990). When the value of the local currency appreciates, agents require fewer local currency units to afford the same quantity of foreign goods, resulting in a reduction in their demand for the Namibian dollar. The appreciation of the local currency may be interpreted as a reduction in the value of an individual's wealth abroad, thereby reducing their demand for money in Namibia. These results on the exchange rate have a strong support in several previous studies, such as those of Nayak and Baig (2019) in the case of China, Mishra and Sharma (2011) for India, and Islam (2021) in the case of Bangladesh.

To assess the validity and reliability of the empirical analysis presented above, the statistical properties of the model are examined. In this regard, certain residual diagnostic checks are carried out, including normality, based on a test of skewness and kurtosis of residuals; heteroscedasticity, based on the regression of squared residuals on squared fitted values; serial autocorrelation; and misspecification. Figure 3, under the Appendix for model stability, presents the CUSUM and CUSUMSQ of the plots of the recursive residuals.

Table 9: Diagnostic Tests for Money Demand Function

Test	Test Statistic	Probability Value
Normality	1.0569	0.590
Heteroscedasticity	0.0792	0.778
ARCH LM (χ^2)	3.8768	0.423
Serial Correlation (Breusch-Godfrey LM Test)	6.4198	0.170
RAMSEY	2.4344	0.119
CUSUM	Stable	
CUSUMSQ	Stable	

Source: Author's own construct

The results shown in Table 9 indicate that the model passes all the residual diagnostic tests, as the probability values of all the tests' statistics are above five percent. It is thus concluded that the model's residuals are normally distributed, homoscedastic, serially uncorrelated, and that the model is correctly specified.

4.2 Reserve Demand Function and Monetary Disequilibrium

The study estimated the reserve demand function controlling for money demand, real GDP measuring economic size, current account deficit as a ratio of GDP, exchange rate, foreign direct investment and opportunity cost. Optimal lags were selected using the Akaike Information Criteria (AIC) where we chose 4 lags following the literature. The study then proceeds to the bounds test for the existence of a long-run relationship.

Table 10: Bounds Test Results for Reserves Demand Model

Test statistics	Value	Lag	
F-statistic	9.2618**	4	
Bounds Test Critical Value: Case 3 – Unrestricted Intercept and Restricted Trend			
Significance level	Lower bound	Upper bound	
5%	2.5934	3.8499	
10%	2.2438	3.3604	K = 6

Author's computation using data from the Bank of Namibia and employing the Microfit software.

The bounds test results for the determinants of foreign reserves are presented above in Table 10. The results indicate the rejection (at five and 10 percent) of the null hypothesis of no co-integrating relationship among the variables as signified by the F-statistic, strongly confirming the presence of a long-run relationship in the model. Considering this empirical evidence, the long- and short-run dynamics of the model are estimated and presented in the following sections.

4.2.1 ARDL Long- and Short-run Model Estimation Results and Discussion

Given the confirmation of a level relationship between foreign reserves and its explanatory variables, the study estimated the long-run ARDL coefficients presented in Table 11. Overall, the results of the capital account vulnerability indicator (LM2), current account vulnerability indicator (CABR), foreign direct investment, opportunity cost and exchange rate flexibility indicator (NEER) align with our a priori expectations. However, the same cannot be said about our economic size indicator (LRGDP), as it contributes to rare findings in the literature.

Table 11: Long-run Results of the Reserves Demand Model

Regressor	Coefficient	Std. Error	t-Statistic	Prob.
Long-run results of ARDL (2,2,2,4,0,0), Dependent Variable is LRESERVES				
LM2	2.5422***	0.5033	5.0510	0.000
CABR	-7.9965	7.9559	-1.0051	0.319
OC	-0.2290**	0.1079	-2.1218	0.038
LRGDP	-2.9961*	1.5311	-1.9568	0.055
NEER	-0.0193	0.0161	-1.1933	0.237
FDI	0.4239***	0.1526	2.7776	0.007
C	16.2128	13.3610	1.2134	0.229

*Note: ***,**,* indicate significance at the 1%, 5%, 10% level.*

For example, these results show that there is a positive and highly significant long-run relationship between broad money (LM2) and foreign reserves. Accordingly, a one percent increase in broad money leads foreign reserves to increase by 2.5 percent. This result is consistent with our a priori expectations and an indication that Namibia has consistently abided by the CMA agreement, which requires Namibia's currency in circulation to be backed by foreign reserves to a minimum ratio of one-to-one. This result on broad money supply is further supported by Manja et al. (2022), who found that membership in the CMA increases reserve demand by 40 percent.

Another important result from Table 11 is the opportunity cost. According to Ben-Bassat and Gottied (1992), the significance of this variable is solely dependent on the accuracy of the measurement process embedded in the variable. We find opportunity cost with a correctly signed coefficient and significant at the one percent level of significance in the case of Namibia. This implies that a one-unit change in opportunity cost leads to a 23 percent decline in foreign reserve holdings. Our findings are in line with a few empirical studies that found this variable to be a significant determinant of foreign reserves. For example, Badinger (2004) in the case of Austria, Mishra and Sharma (2011), Prabheesh et al. (2007) and Ramachandran (2006) for India, Ford and Huang (1994) in the case of China, and Molapoa and Thamaeb (2015) for Lesotho. However, we contradict those findings by Elhiraika and Ndikumana (2007), who found the opportunity cost to be insignificant and led to the conclusion that accumulation of reserves is not motivated by returns to assets in African countries.

Moving on to the current account deficit as a ratio of GDP, an indicator of current account vulnerability. We found this variable to be an insignificant driver of foreign reserves, implying that capital account vulnerability is more important for the Bank of Namibia as opposed to current account vulnerability. This should not be surprising given that Namibia finds itself in a CMA agreement, and the significance of the capital account vulnerability indicator was explained earlier. However, this finding is in contraction with those by Khomo et al. (2018), who found a negative and significant association between the current account deficit and foreign reserves in Eswatini, which is also part of the CMA agreement.

In terms of real GDP as a determinant of reserves, we found it to be a weakly significant driver of reserves in Namibia. The results indicate that a one percent increase in real GDP translates to a 2.9 percent decline in foreign reserves, holding all other factors constant. This is in contradiction with our a priori expectations; however, it is in line with the square root rule of transaction demand as proposed by (Baumol's, 1952). The square root rule postulates that foreign reserves increase with the square root of their level of economic transactions. Our results on real GDP are consistent with those findings by Cheung and Ito (2009) and Manja et al. (2022), which found a negative association between reserves and real GDP.

In line with our a priori expectations, the coefficient of FDI turned out to be a positive and significant driver of reserves in the long run. This means that when FDI inflows increase, foreign reserves also increase, as these FDI inflows are mainly denominated in foreign currency, which provides foreign exchange to the country. Suman and Aman (2021) noted that direct investment inflows help to offer foreign reserves a boost to maintain liquidity in the event of an economic shock. This finding on FDI concurs with a recent study by Khoirunnisa and Oktavilia (2022).

To assess the validity and reliability of the empirical analysis of the reserve demand model, the statistical properties of the model are examined, as highlighted earlier. The results in Table 12 show that the model passes all the residual diagnostic tests, as indicated by the probability values of the tests' statistics which are below five percent. It is thus concluded that the model's residuals are normally distributed, homoscedastic, serially uncorrelated, and that the model is correctly specified. The next and final step in the ARDL model is the estimation of the short-run results, where the role of MDE plays an important part.

Table 12: Diagnostic Tests for Reserves Demand Model

Test	Test Statistic	Probability Value
Normality	0.9029	0.637
Heteroscedasticity	0.0345	0.853
ARCH LM (χ^2)	8.7468	0.068
Serial Correlation (Breusch-Godfrey LM Test)	3.5218	0.475
RAMSEY	0.2749	0.600
CUSUM	Stable	
CUSUMSQ	Stable	

Source: Author's own construct.

As for the short-run results, we examine the influence of the MDE, which is the variable of interest, alongside the other long-term factors. As previously stated in the data section, MABoP presupposes that MDE only impacts reserves in the short term, thereby its inclusion in our error correction model. The outcomes of the short-run error correction model are shown in Table 13, which provides substantial evidence in favour of short-run effects. Overall, the diagnostic test of the model suggests that it is free from serial correlation and heteroskedasticity.

Table 13: Error Correction Model

Variables	Estimated Coefficients	T-Ratio
$\Delta LReserves_{t-1}$	-0.3762***	[-3.2410]
$\Delta LM2_t$	1.0708	[0.5846]
$\Delta LM2_{t-1}$	2.0920	[1.4966]
$\Delta LM2_{t-2}$	2.4757***	[2.7240]
$\Delta CABR_t$	2.9163***	[2.6537]
$\Delta CABR_{t-1}$	3.0508***	[2.7971]
ΔOC_t	0.02768	[0.9724]
ΔFDI_t	0.0828***	[6.2874]
ΔFDI_{t-1}	-0.0690***	[-2.5234]
ΔFDI_{t-2}	-0.0441**	[-2.0301]
$\Delta LRGDP_t$	-0.5263*	[-1.7373]
$\Delta NEER_t$	0.0127	[1.2189]
$\Delta NEER_{t-1}$	0.0199**	[2.2168]
ΔM_t^{Dis}	-1.6382	[-0.8792]
ECM_{t-1}	-0.1632***	[-2.8886]

Test	Test Statistic	Probability Value
R-squared	0.7284	
Heteroscedasticity	0.2409	0.624
ARCH LM (χ^2)	0.8777	0.928
Serial Correlation (Breusch-Godfrey LM Test)	6.2315	0.183
CUSUM	Stable	
CUSUMSQ	Stable	

Source: Author's own construct.

Notes: The asterisks (***, **, *) indicate significance at 1, 5 and 10 percent levels, respectively.

These results show that the main variable of interest, which is monetary disequilibrium, signified by ΔM_t^{Dis} in this short-run reserve function, is found to be correctly signed (negative), albeit insignificant. This is a very important contribution found by our study, as no other study done for any African country has so far considered the role of domestic money market disequilibrium in the reserve demand function (see, for example, Khomo et al., 2018; Manja et al., 2022; Elhiraika and Ndikumana, 2007; Molapoa and Thamaeb, 2015). The coefficient on the domestic money market disequilibrium shows that excess demand for (supply of) money translates into an increase (decrease) in the stock of foreign reserves with an elasticity of 1.6. According to Badinger (2004), a coefficient greater than one indicates that changes in reserves eliminate any disequilibrium in the domestic money market. Furthermore, Frenkel and Johnson (1976) noted that the insignificance of the coefficient is an indication that demand for money is not stable in the short run, there are market imperfections, full employment is not possible, and the law of one price is invalid. One of these is most likely to be the case for an African economy, as also highlighted by Manja (2020).

Our findings on monetary disequilibrium differ with those found by Nayak and Baig (2019), Mishra and Sarma (2011), Badinger (2004), and Afrin et al. (2014) in India and China, India, Austria and Bangladesh, respectively. However, the negative coefficient and insignificance concur with the findings by Islam (2021). Monetary disequilibrium is left to the mercy of market forces, according to the overall result, which suggests that the Central Bank of Namibia's monetary policy instruments (interest rates) are ineffective in clearing money market disequilibrium.

The results also show that, in the short run, the lagged reserves have a negative and significant effect on reserves. This indicates a degree of persistence in foreign reserves. Once again, GDP is found to affect reserves negatively in the short run. The finding on real GDP is counterintuitive as we expected it to have a positive impact on reserves in the short run.

More importantly, we found the second lag of broad money ($\nabla LM2_{t-2}$) to be a highly significant driver with a positive impact on reserves in the short run. This is an indication that capital account vulnerability plays an important role in the demand for reserves for countries such as Namibia that find themselves in a pegged exchange rate system with South Africa. FDI is also found to have a positive and significant effect on reserves in the short run.

Furthermore, unlike in the long run, we found current account vulnerability to be a significant and positive driver of reserves in the short run. Additionally, the results reveal that the coefficient of the speed of adjustment term was negative and statistically significant, hence suggesting model convergence in the long run. Accordingly, the model indicates that roughly 16 percent of the deviation from equilibrium was corrected within one quarter. The correct sign for the ECM (-1) term confirms the existence of a long-run relationship between reserves and their determinants. The results seem to confirm the proposition of Clark (1970), which states that a nation with a large stock of foreign reserves would also have a low speed of adjustment to equilibrium.

4.3 Robustness Checks

The robustness test used in the study compares the original model's conclusions by including government expenditure into the reserve demand function as well as using alternative metrics of capital account and current account vulnerability. As such, Model 1 integrates the role of government expenditure in the reserve demand function to investigate how this influences the overall findings. Additionally, following Flood and Marion (2002), we use the ratio of imports to GDP (API) to examine the resilience of current account vulnerability rather than the current account deficit to GDP (CABR). This is shown by the findings in Model 2 in Tables 14 and 15. Similarly, for the measure of capital account vulnerability, we use total external debt (DEBT) in Model 3 as an abstraction from the standard measure, broad money. In model 4, we employ a different measurement technique for the opportunity cost variable than the one described before in the data section. Having stated that, we used the prime rate as the domestic interest rate while keeping the international rate as a metric to observe how this affected the opportunity cost findings.

Overall, the results of the bounds test as shown in Table 14 indeed confirm the existence of long-run relationships between reserves and the covariates in all the four models.

Table 14: Bounds Test Results

Variables	Model 1		Model 2		Model 3		Model 4	
F-statistics	8.3485**		7.1662**		8.2652**		7.1137**	
Significance	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
5%	2.4562	3.7296	2.5934	3.8499	2.5934	3.8499	2.5934	3.8499
10%	2.1118	3.2881	2.2438	3.3604	2.2438	3.3604	2.2438	3.3604

Source: Author's own construct.

Notes: The asterisks (***, **, *) indicate significance at 1, 5 and 10 percent levels, respectively.

Following the inclusion of government expenditure in the reserve demand function, we still find capital account vulnerability, opportunity cost, real GDP and FDI to be significant drivers of reserves in the long run, as shown in Table 15. This is consistent with the results reported in Table 11. We find government expenditure to be having a negative effect on reserves, and this is consistent with the finding by Manuel et al. (2021) and Khomo et al. (2018). In Model 2, we still find the measure of current account vulnerability to have an insignificant negative effect on reserves, while that of capital account vulnerability still maintains its significant and positive effect on reserves, as shown in Model 3. The findings of opportunity cost presented in Model 4 supports the argument made by Ben-Bassat and Gottlieb (1992) that the measurement process of the variable is key as it's shown to have a positive and insignificant effect on reserves, which is in contradiction with our earlier results.

Table 15: Robustness Checks: Long-run Results for the Reserves Demand Model

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
LM2	2.5024***	2.3553***		2.9430***
DEBT			9.0152***	
CABR	-8.4929		4.0678	7.8370
API		-3.5633		
OC	-0.2094*	-0.2054*	-0.3266**	
OC1				0.0286
LRGDP	-2.7463*	-1.9227	0.0932	-1.6723*
NEER	-0.0211	-0.0270	0.0245	-0.0590
FDI	0.4145***	0.5808***	1.0950***	0.6731***
GRN	-1.5038			
Constant	14.6267	8.1603	4.3184	-6.3998
Diagnostic tests				
Serial Correlation	3.8274 [0.430]	0.5148 [0.972]	3.8902 [0.421]	0.9452 [0.918]
Heteroskedasticity	0.0910 [0.763]	0.0033 [0.954]	0.3334 [0.563]	0.9081 [0.341]
Ramsey	0.4560 [0.500]	1.9246 [0.165]	4.0768 [0.053]	1.2062 [0.272]
CUSUM	Stable	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable	Stable

Source: Author's own construct.

Notes: The asterisks (***, **, *) indicate significance at 1, 5 and 10 percent levels, respectively. The values in [] represent probabilities.

Table 16 displays the findings of the short-term analysis. Except for monetary disequilibrium, none of the models exhibited substantial changes in the estimations seen in Table 13, indicating the robustness of the results. When we incorporate government spending, the only substantial departure from the original findings is that the money market disequilibrium becomes significant.

Like Table 13, Table 16 demonstrates a negative association between reserves and monetary disequilibrium, but with highly significant coefficients and greater magnitudes. Now, the coefficient indicates that an extra demand for (supply of) money results in a 4.1% rise (reduction) in the stock of foreign reserves. In addition, the coefficient of ECM stays negative and significant in all four models, ranging from -0.06 to -0.32. This indicates that the speed with which the system reacts to departures from the cointegration relationship in the previous period is low to moderate. It demonstrates the robustness of the regression findings.

Table 16: Robustness Checks: Error Correction Model

Variables	Model 1	Model 2	Model 3	Model 4
$\Delta LReserves_{t-1}$	-0.3172***	-0.4254***	-0.3691***	-0.2686**
$\Delta LM2_{t}$	3.5905***	-0.4149		2.8370**
$\Delta LM2_{t-1}$	2.7807***	0.0665		2.0032***
$\Delta LM2_{t-2}$	1.9355***	3.4618***		0.9827*
$\Delta Debt_{t}$			0.7976***	
$\Delta CABR_{t}$	3.0835***		1.0182	3.3539***
$\Delta CABR_{t-1}$	3.5747***		3.4292***	2.9431***
ΔAPI_{t}		-0.2529		
ΔOC_{t}	-0.0031	-0.0268	-0.0232	
$\Delta OC1_{t}$				0.0255*
ΔFDI_{t}	0.0898***	0.0735***	0.0524***	0.0803***
ΔFDI_{t-1}	-0.0865***	-0.0264*		-0.1000***
ΔFDI_{t-2}	-0.0578***			-0.0717***
$\Delta LRGDP_{t}$	-0.6167**	-0.7318***	-0.5412**	-0.5728**
$\Delta NEER_{t}$	0.0214**	-0.0060	-0.0024	0.0164*
$\Delta NEER_{t-1}$	0.0181***	0.0135		0.0157**
ΔGEX_{t-1}	2.4118**			
Robustness checks				
ΔM_{t}^{Dis}	-4.1326***	-0.2647	-0.6749	-3.0298**
ECM_{t-1}	-0.1596**	-0.1059*	-0.0677*	-0.3198***
R-squared	0.7406	0.6789	0.6047	0.7187

Source: Author’s own construct.

Notes: The asterisks (***, **, *) indicate significance at 1, 5 and 10 percent levels, respectively.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

With its catastrophic impact on the Asian economies, the 1997–98 East Asian financial crisis has drawn increasing interest from scholars and policymakers studying the factors that determine foreign reserves. As such, this study focuses on Namibia while looking at the factors that influence foreign reserves over the period 2000Q1–2021Q4. The study contributes to the existing literature in three distinct ways. First, it assesses Namibia's foreign reserve adequacy by employing some of the traditional benchmarks used in the literature. Secondly, the paper attempts to investigate the macroeconomic determinants of reserves in Namibia. And lastly, whether there is a link between domestic money market disequilibrium and the demand for reserves in the short run.

The study employs an ARDL methodology to account for both the short-run and long-run relationship between foreign reserves and their determinants. The analyses of reserves' adequacy have shown us that Namibia has done well in meeting most of the traditional benchmarks, from being unable to meet the simple three-month import cover benchmark to doubling it in recent years. Therefore, given the substantial stock of international reserves, it is worth investigating the factors that have contributed to this growth in foreign reserves.

The empirical evidence from this study shows that in the long run, broad money, FDI, real GDP and opportunity costs have a significant impact on foreign reserves. The significant finding on opportunity cost is an indication that the accumulation of reserves is motivated by returns to assets in Namibia. While those on capital account vulnerability proxied by broad money postulate that the precautionary motive is clearly at play, in contrast to the theoretical reasons, we found no substantial effect of NEER and current account deficit on Namibian reserves.

Furthermore, we can conclude from the results of the error correction model that reserve management is inactive in Namibia, on average, roughly 16 percent of the deviation from equilibrium was corrected within one quarter. This implies that for the Bank of Namibia to increase the adjustment speed, it needs to actively manage its foreign reserves. Moreover, we failed to validate the existence of the theory of MABoP, as signified by the term monetary disequilibrium. The findings of the study on monetary disequilibrium allude to the fact that the Bank of Namibia does not utilise its foreign reserves to correct any disequilibrium in the domestic money market.

5.2 Policy Recommendations and/or Implications

The study's results have important implications for Namibia's reserve management. To begin, it is true that nations operating on a quasi-currency board, such as Namibia, must retain appropriate reserves to preserve trust in Namibia's monetary, financial stability, and exchange rate policy. But it is also true that maintaining high foreign reserves comes at a considerable cost.

As previously stated, Namibia has amassed sufficient foreign reserves to double several international standards for appropriate reserves. As a result, it seems desirable that there is a need to manage reserve levels more efficiently to leverage the opportunity cost associated with hoarding these reserves. This presents an opportunity for the Bank of Namibia to increase their returns they can get by investing their foreign reserves in low-risk and secure foreign assets instead of accumulating them. Furthermore, following the significance of FDI as a driver of international reserves in Namibia, it is worth noting that Namibia's central bank explores FDI as a channel to continue strengthening their reserve position.

5.3 Suggestions for Further Research

Having explored the drivers of international reserves in Namibia, further research is needed in this area. For instance, Namibia, which finds itself in CMA agreements due to necessity, lacks research on optimal reserve levels. This analysis assumes Namibia has a healthy stock of foreign reserves; however, it is vital to empirically identify the optimal quantity of reserves at the CMA and national levels.

References

Abdourahmane S., Ludvig, S., Domenico, F. and Taline, K. (2004): Assessing Reserves Adequacy in Tunisia, IMF Country Report No. 04/360.

Afrin, S., Sarder, M. W., & Nabi, M. G. (2014). *The demand for international reserves of Bangladesh*. BB working paper series, WP 1402, Bangladesh Bank, Dhaka.

Aizenman, J., & Marion, N. (2003). The High Demand for Foreign exchange reserves in the Far East: What's Going On. *Journal of the Japanese and International Economics*, *17*, 370-400.

ANDRIYANI, K., MARWA, T., ADNAN, N., & MUIZZUDDIN, M. (2020). The Determinants of Foreign Exchange Reserves: Evidence from Indonesia. *The Journal of Asian Finance, Economics and Business*, *7*(11), 629-636.

Badinger, H. (2004). Austria's demand for international reserves and monetary disequilibrium: The case of a small open economy with a fixed exchange rate regime. *Economica*, *71*(281), 39-55.

Bahmani-Oskooee, M., & Pourheydarian, M. (1990). Exchange rate sensitivity of demand for money and effectiveness of fiscal and monetary policies. Applied Economics, 22(7), 917-925.

Bank of Namibia. (2008). *Namibia's Monetary Policy Framework.*

Bank of Namibia. (2021)*. Bank of Namibia Annual Report 2021, Windhoek: Bank of Namibia.*

Baumol, W. J. (1952). The transactions demand for cash: An inventory theoretic approach. The Quarterly journal of economics, 66(4), 545-556.

Ben-Bassat, A., & Gottlieb, D. (1992). On the effect of opportunity cost on international reserve holdings. *The review of economics and statistics*, 329-332.

Cheung, Y. W., & Ito, H. (2009). A cross-country empirical analysis of international reserves. International Economic Journal, 23(4), 447-481.

Cifarelli, G., & Paladino, G. (2009). The buffer stock model redux? An analysis of the dynamics of foreign reserve accumulation. *Open Economies Review*, *20*(4), 525-543.

Clark, P. B. (1970). Optimum international reserves and the speed of adjustment. *Journal of political economy*, *78*(2), 356-376.

Dabla-Norris, M. E., Kim, M. J. I., & Shirono, M. K. (2011). *Optimal precautionary reserves for low-income countries: a cost-benefit analysis*. International Monetary Fund.

Demetriades, P., & Andrianova, S. (2004). Finance and growth: what we know and what we need to know. In *Financial development and economic growth* (pp. 38-65). Palgrave Macmillan, London.

Dlamini, N., & Mabuza, Z. (2020). Financial innovation and money demand in eswatini. *Res. Bull*, *4*, 48.

Edwards, S. (1983). The demand for international reserves and exchange rate adjustments: the case of LDCs, 1964-1972. *Economica*, *50*(199), 269-280.

Edwards, S. (1984). The Demand for International Reserves and Monetary Equilibrium: Some Evidence From Developing Countries. *The Review of Economics and Statistics*, 495-500.

Elhiraika, A., & Ndikumana, L. (2007). *Reserves accumulation in African countries: sources, motivations, and effects* (No. 2007-12). Working Paper.

Eliza, N., Azali, M., Law, S. H., & Lee, C. (2008). *Demand For International Reserves in ASEAN-5 Economies*. University Library of Munich, Germany.

Flood, R. and Marion, N. (2002), ''Holding international reserves in an era of high capital mobility'', International Monetary Fund, IMF Working Paper WP/02/62, Washington, DC.

Ford, J. L., & Huang, G. (1994). The demand for international reserves in china: an ecm model with domestic monetary disequilibrium. *Economica*, 379-397.

Frenkel, J. A. (1974). The demand for international reserves by developed and less-developed countries. *Economica*, *41*(161), 14-24.

Frenkel, J. A. (1983). *International liquidity and monetary control* (No. w1118). National Bureau of Economic Research.

Frenkel, J., & Johnson, H. (Eds.). (1976). The Monetary Approach to the Balance of Payments. London: Allen & Unwin

Gosselin, M. A., & Parent, N. (2005). *An empirical analysis of foreign exchange reserves in emerging Asia* (No. 2005-38). Bank of Canada.

Haider, S., Ganaie, A. A., & Kamaiah, B. (2017). Asymmetric exchange rate effect on money demand under open economy in case of India. *Economics Bulletin*, *37*(1), 168-179.

Harris, R., & Sollis, R. (2003). *Applied time series modelling and forecasting*. Wiley.

Heller, H. R. (1966). Optimal international reserves. *The Economic Journal*, *76*(302), 296-311.

Huang, T. H., & Shen, C. H. (1999). Applying the seasonal error correction model to the demand for international reserves in Taiwan. *Journal of International Money and Finance*, *18*(1), 107-131.

Ikhide, S. I., & Katjomuise, K. (1999). *Estimating the demand for money in Namibia*. Bank of Namibia.

IMF, I. (2009). Balance of Payments and International Investment Position Manual–. *manual, International Monetary Fund*.

Inder, B. (1993). Estimating long-run relationships in economics: A comparison of different approaches. *Journal of econometrics*, *57*(1-3), 53-68.

International Monetary Fund, IMF (2016). Guidance Note on the Assessment of Reserve Adequacy and Related Considerations. Available online at: https://www.imf.org/en/Publications/Policy-Papers/Issues/2016/12/31/Guidance-Note-on-the-Assessment-of-Reserve-Adequacy-and-Related-Considerations-PP5046

Islam, S. (2021). Macroeconomic determinants of the demand for international reserves in Bangladesh. SN Business & Economics, 1(2), 34.

Jeanne, O. (2007). International reserves in emerging market countries: too much of a good thing?. *Brookings papers on Economic activity*, *2007*(1), 1-79.

Jeanne, O. (2016). The macroprudential role of international reserves. *American Economic Review*, *106*(5), 570-73.

Karfakis, C. (1997). The demand for international liquidity: a cointegration approach. *Applied Financial Economics*, *7*(6), 673-678.

Khan, K., Ahmed, E., & Kazmi, A. A. (2005). The Demand for International Reserves: A Case Study of Pakistan [with Comments]. *The Pakistan Development Review*, 939-957.

Khoirunnisa, A., & Oktavilia, S. (2022) Determinant of Foreign Exchange Reserve in 6 Asian Developing Country Before and During Crisis Pandemic COVID-19.

Khomo, M., Mamba, N., & Matsebula, L. (2018). Determinants of foreign exchange reserves in Eswatini: An ARDL approach. *African Review of Economics and Finance*, *10*(2), 134-150.

Manja, L. P. (2020). An Empirical Investigation of Factors that Determine Demand for International Reserves in the SADC Region (Doctoral dissertation, UNIVERSITY OF MALAWI).

Manja, L., Silumbu, E., & Chaweza, R. (2022). Determinants of demand for international reserves in the SADC region. *African Review of Economics and Finance*, 2042-1478.

Manuel, V., Eita, J. H., Mbazima_Lando, D. & Naimwhaka, E., 2020. Asymmetric Determinants of Money Demand in Namibia: The NARDL Approach, Windhoek: Bank of Namibia.

Manuel, V., Mbazima-Lando, D., & Naimhwaka, E. (2021). *Effects of government expenditure on foreign reserves: evidence for Namibia* (BON Working Paper: WP2- 2021). Bank of Namibia.

Mbazima-Lando, D. & Manuel, V., 2020. The Impact of FInancial Innovation on the Demand for Money and its Implication for Monetary Policy in Namibia.

Mishra, R. K., & Sharma, C. (2011). India's demand for international reserve and monetary disequilibrium: Reserve adequacy under floating regime. *Journal of Policy Modeling*, *33*(6), 901-919.

Molapoa, S. S., & Thamaeb, R. I (2015). The Demand for International Reserves in Lesotho. *EUROPEAN JOURNAL OF ECONOMICS AND MANAGEMENT*, 57.

Nayak, S., & Baig, M. A. (2019). International reserves and domestic money market disequilibrium: empirics for India and China. *International Journal of Emerging Markets*.

Osigwe, A. C., Okechukwu, A. I., & Onoja, T. C. (2015). Modeling the determinants of foreign reserves in Nigeria. *Developing Country Studies*, *5*(19), 72-77.

Pesaran, M. H., & Shin, Y (1999). An autoregressive distributed lag modelling approach to cointegration analysis (Vol. 9514). Cambridge, UK: Department of Applied Economics, University of Cambridge.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Popovska-Kamnar, N., Nikolov, M., & Sulejmani, A. (2016). Determinants of the international reserves in the Republic of Macedonia. *CEA Journal of Economics*, *11*(2).

Prabheesh, K. P., Malathy, D., & Madhumathi, R. (2007). Demand for Foreign Exchange Reserves in India: A Co-integration Approach. *South Asian Journal of Management*, *14*(2), 36-46.

Ramachandran, M. (2004). The optimal level of international reserves: evidence for India. *Economics Letters*, *83*(3), 365-370.

Ramachandran, M. (2006). On the upsurge of foreign exchange reserves in India. *Journal of Policy Modeling*, *28*(7), 797-809.

Rodrik, Dani & Velasco, Andres (2000) Short-term capital flows, *Annual World Bank Conference on Development Economics 1999, April.*

Romero, A. M. (2005). Comparative Study: Factors that Affect Foreign Cllrrency Reserves in China and India. *Honors Projects Paper*, *33*.

Sanusi, K. A., Meyer, D. F., & Hassan, A. S. (2019). An investigation of the determinants of foreign exchange reserves in Southern African countries. *Journal of International Studies*, *12*(2).

Sehgal, S., & Sharma, C. (2008). A study of adequacy, cost and determinants of international reserves in India. *International Research Journal of Finance and Economics*, *20*(2), 75-90.

Shidhika, A. N., 2015. Examining the Effect of Financial Innovation on the Stability for Money Demand Function in Namibia , Windhoek: University of Namibia.

Streeter, L. E. (1970). *Optimal international reserve holdings: an inventory model and empirical tests*. University of Illinois at Urbana-Champaign.

Suman, B., & Aman, V. (2021). Determinants of Foreign Exchange Reserves in India.

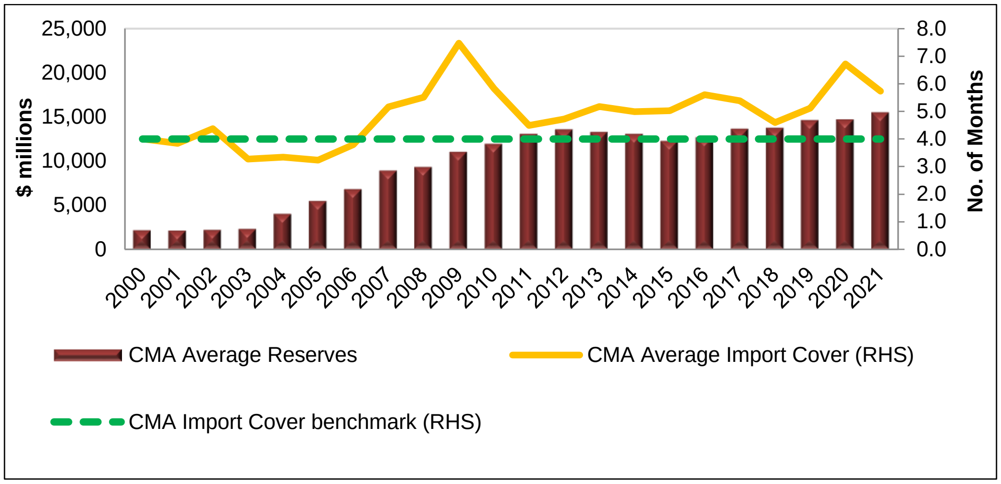
Suvojit, L., Ram, L., & Benito, R. (2008). The Optimal Level of International Reserves–The case of India. http://www.igidr.ac.in/conf/money/mfc-11/Chakravarty_Suvojit.pdf 29 April 2017.

Tsheole, T. (2006). *The demand for broad money (m2) in Botswana* (Doctoral dissertation, Rhodes University).

Yesigat, A., Rao, T. K. & Nagaraja, G., 2018. Determinants of Demand for Money and its Stability in Ethiopia. *International Journal of Research and Analytical Reviews*, 5(4), pp. 349-360

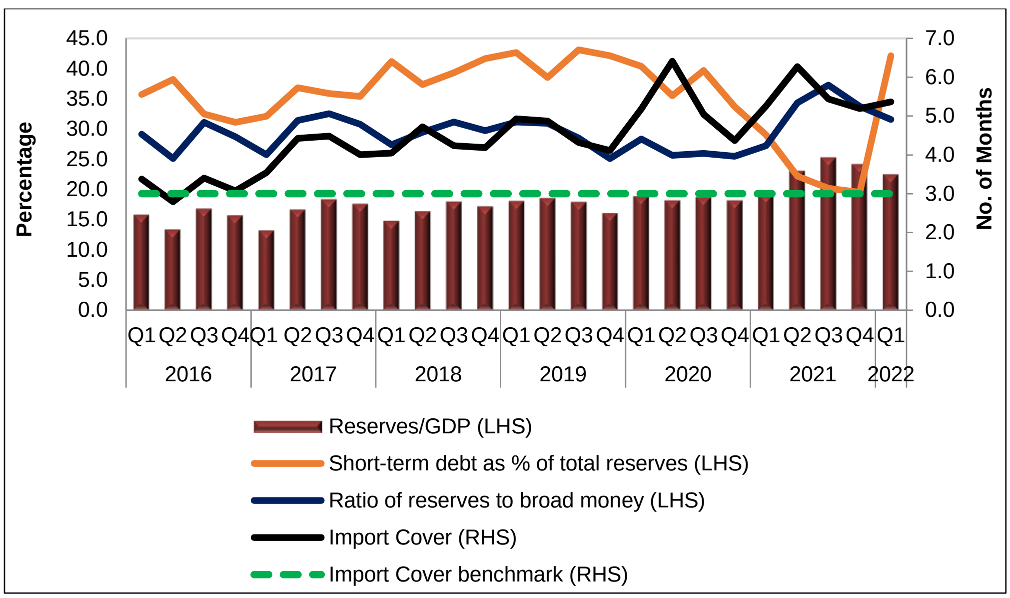
Appendix

Figure 1: Trends in CMA countries reserves and import cover (2000–2021)



Source: International Monetary Fund, International Financial Statistics.

Figure 2: Assessing Namibia's International Reserves Adequacy.



Source: NSA and the Bank of Namibia (2022).

Table 1: Macroeconomic drivers of international reserves

Categories	Rationale
Economic size	Population and per capita GDP.
Current account vulnerability	Imports to GDP ratio, trade to GDP ratio and the current account deficit to GDP ratio.
Capital account vulnerability	Capital account deficit to GDP ratio, short-term external debt to GDP ratio and the broad money to GDP ratio.
Exchange rate flexibility	Standard deviation of exchange rate
Opportunity cost of holding reserve	Interest rate differential

Source: Manuel et al, (2021).

Table 7: Money demand function bounds test results

```
Testing for existence of a level relationship among the variables in
the ARDL model
**********************************************************************
*********
 F-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90%
Upper Bound
    6.2217          3.6805          4.8444          3.1404
4.2082

 W-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90%
Upper Bound
   31.1085         18.4026         24.2220         15.7018
21.0408
**********************************************************************
*********
 If the statistic lies between the bounds, the test is inconclusive.
If it is
 above the upper bound, the null hypothesis of no level effect is
rejected. If
 it is below the lower bound, the null hypothesis of no level effect
can't be
 rejected. The critical value bounds are computed by stochastic
simulations
 using 20000 replications.
```

Table 8: Money demand function short-run results

```
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16:50:31

         Error Correction Representation for the Selected ARDL Model
        ARDL(5,1,0,1,1) selected based on Akaike Information
Criterion
**********************************************************************
**********
 Dependent variable is dLRM2
 84 observations used for estimation from 2001Q2 to 2022Q1
**********************************************************************
**********
 Regressor              Coefficient       Standard Error         T-
Ratio[Prob]
 dLRM21                    -.43027              .11760            -
3.6587[.000]
 dLRM22                    -.19626              .11577            -
1.6952[.094]
 dLRM23                    -.26655              .11385            -
2.3412[.022]
 dLRM24                    -.15910              .10664            -
1.4919[.140]
 dLRGDP                    .077563             .069429
1.1172[.268]
 dLCPI                     -.56592              .18203            -
3.1090[.003]
 dLEXTR                    .061586             .056503
1.0900[.279]
 dRTB3                   -.0016859           .0039523             -
.42658[.671]
 dT                       .0079037           .0024070
3.2837[.002]
 ecm(-1)                   -.15894             .072945            -
2.1789[.033]
**********************************************************************
**********
 List of additional temporary variables created:
 dLRM2 = LRM2-LRM2(-1)
 dLRM21 = LRM2(-1)-LRM2(-2)
 dLRM22 = LRM2(-2)-LRM2(-3)
 dLRM23 = LRM2(-3)-LRM2(-4)
 dLRM24 = LRM2(-4)-LRM2(-5)
 dLRGDP = LRGDP-LRGDP(-1)
 dLCPI = LCPI-LCPI(-1)
 dLEXTR = LEXTR-LEXTR(-1)
 dRTB3 = RTB3-RTB3(-1)
 dT = T-T(-1)
```
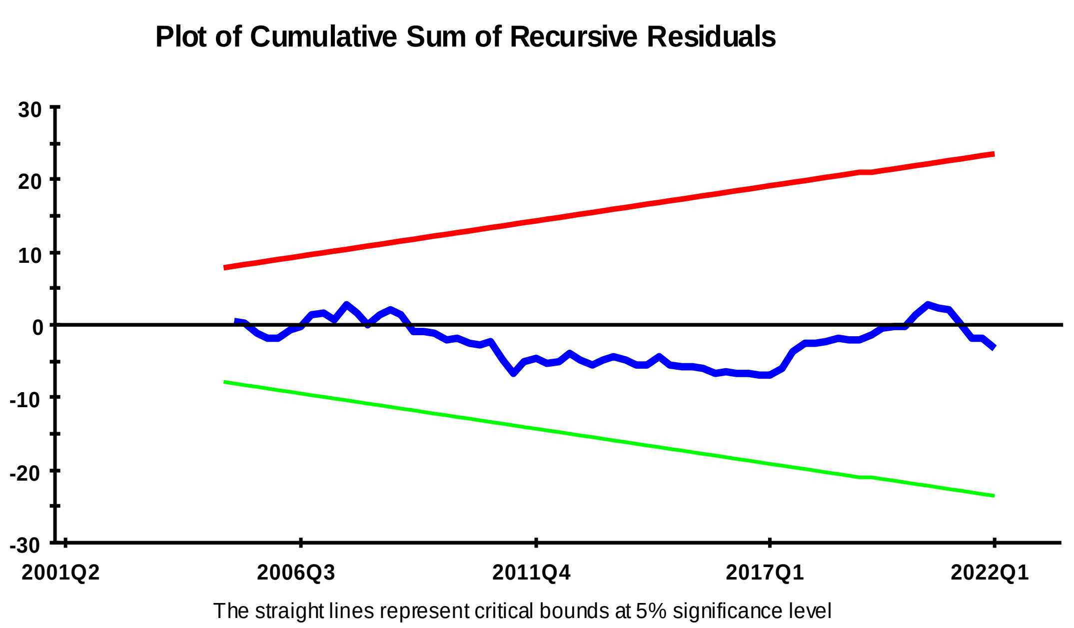

```
 ecm = LRM2   -1.4446*LRGDP +   3.5606*LCPI +   .32799*LEXTR  -
.027164*RTB3   -
 6.0522*C  -.049727*T
*********************************************************************
**********
 R-Squared                    .43062   R-Bar-Squared
.32488
 S.E. of Regression          .031647   F-Stat.    F(10,73)
5.2941[.000]
 Mean of Dependent Variable  .010104   S.D. of Dependent Variable
.038515
 Residual Sum of Squares     .070105   Equation Log-likelihood
178.5293
 Akaike Info. Criterion     164.5293   Schwarz Bayesian Criterion
147.5136
 DW-statistic                 1.9415
*********************************************************************
**********
 R-Squared and R-Bar-Squared measures refer to the dependent variable
 dLRM2 and in cases where the error correction model is highly
 restricted, these measures could become negative.
```

Figure 3:CUCUM and CUSUMSQ plots of the Money demand function



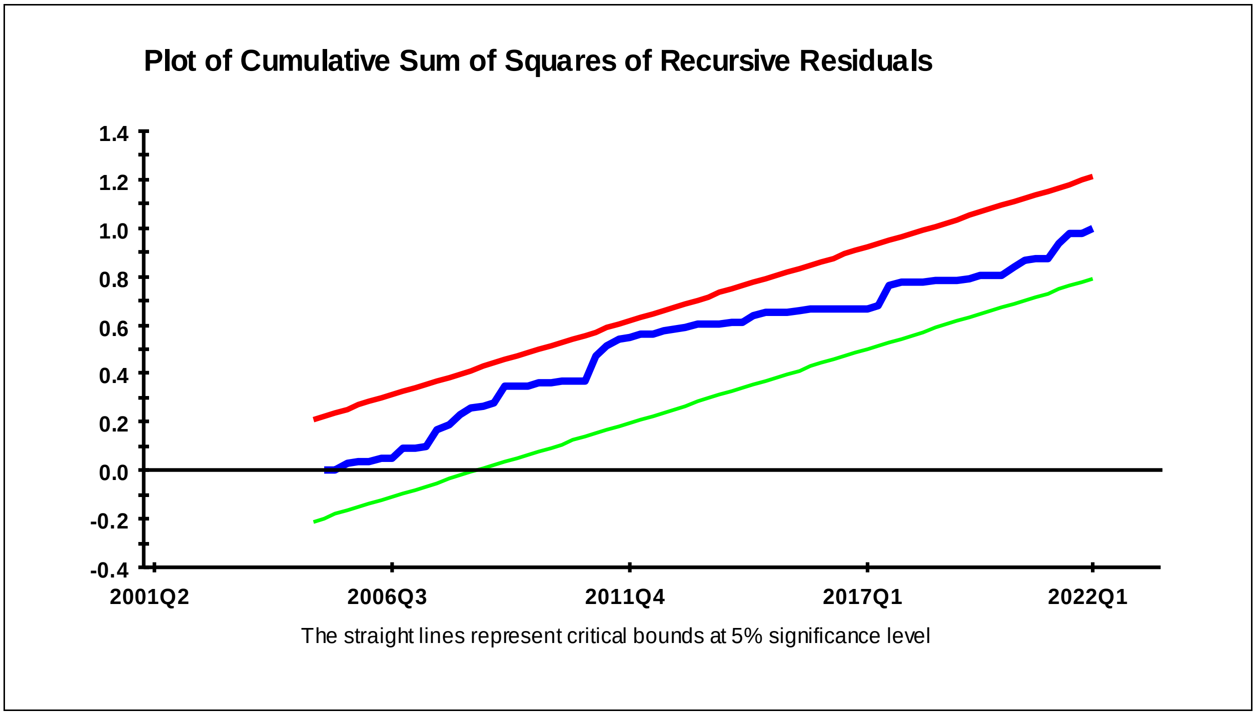
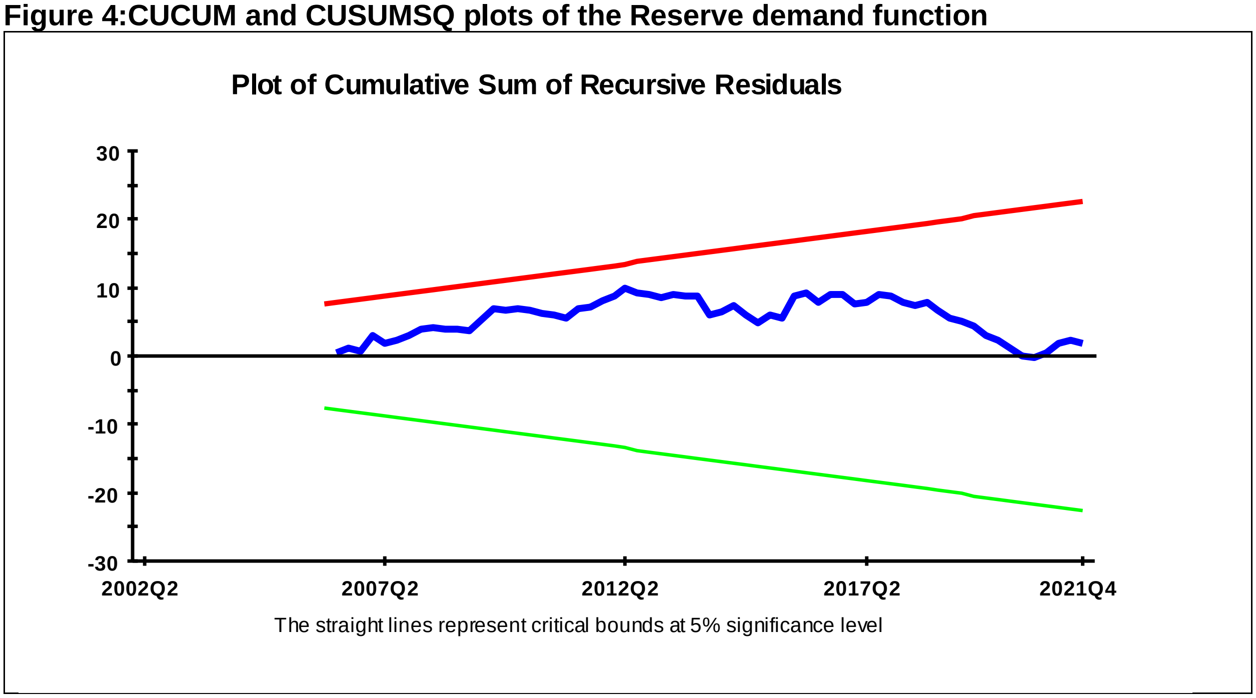
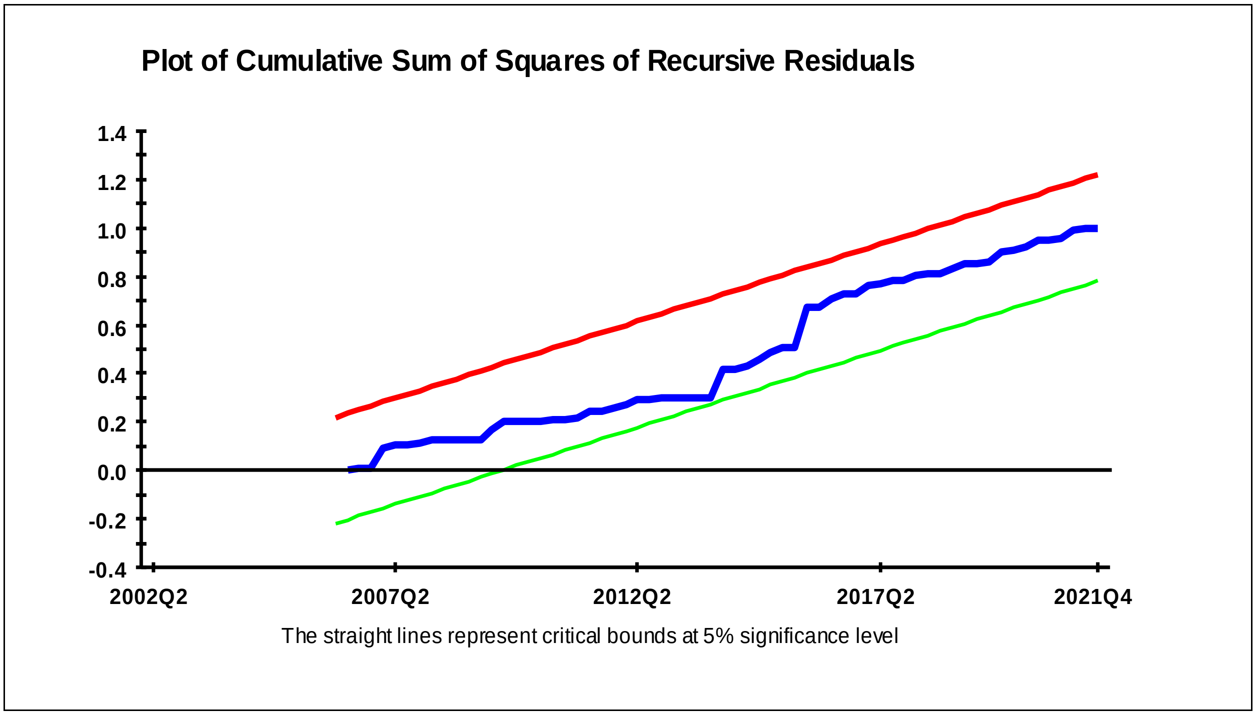


Figure 4:CUCUM and CUSUMSQ plots of the Reserve demand function




Plot of Cumulative Sum of Squares of Recursive Residuals
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
2002Q2
2007Q2
2012Q2
2017Q2
2021Q4
The straight lines represent critical bounds at 5% significance level