EXAMINING THE EFFECT OF FINANCIAL INNOVATION ON THE STABILITY OF THE DEMAND FOR MONEY FUNCTION IN NAMIBIA

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ABSTRACT

The study examines the effect of financial innovation on the demand for money in Namibia. The sample period of the study covers the first Quarter of 2000 to the fourth Quarter of 2013. The secondary data utilized is sourced from Bank of Namibia, Namibia Statistics Agency as well as the World Bank Financial Statistics. The study employs the following variables; real Gross Domestic Product (GDP) as a proxy for income, inflation, repo rate and credit extended to the private sector as a proxy for financial innovation. The VAR technique, which has been used by various scholars since its inception in 1980 by Christopher Sims is employed to investigate the dynamics of Namibia's macroeconomic data. The Augmented Dickey-Fuller test and the Phillips-Perron tests show that all variables in the model are integrated of order 1, the co-integration results indicate the absence of long-run association among the variables. The result further indicates that private sector credit extension only affects money demand in the short run, albeit, insignificantly. This implies that financial innovation may not be having an impact on demand for money in Namibia. In addition, AR polynomial has modulus that are less than one hence, the VAR stability condition is not violated and this implies that the demand for money function is stable. Inclusion of financial innovation to model the demand for money in Namibia need cautious consideration as financial innovation was insignificant in the model. However Policies to deepen the financial market in Namibia by way of promoting financial intermediation between savers and investors in the economy still need to be pursued like the Namibia Financial sector strategy 2010-2020. Financial sector deepening smoothen credit allocation, encourage savings, and reduce constraints on capital accumulation by economic agents. This can be envisaged to increase demand for money and promote economic growth in the short-run.

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DEDICATIONS

This thesis is dedicated to my beloved parents Mr. Aron Shidhika and Mrs. Johanna Shidhika, my siblings, Fenni, Erastus and Lucky and my name sake Ms. Alisa Kakwambi and her daughter Rosemary for the support and courage they offered during the time period of my study.

DECLARATIONS

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

……. Date……..
Alisa Ndapanda Ndamoniihuna Shidhika

ABBREVIATIONS

ATM	Automated Teller Machine
BoN	Bank of Namibia
CCTV	Electronic Closed Circuit Television
CPI	Consumer Price Index
GDP	Gross Domestic Product
E-banking	Electronic banking
FEVDs	Forecast Error Variance Decompositions
FISIM	Financial Services Indirectly Measured
IMF	International Monetary Fund
IRFs	Impulse Response Functions
NFSC	Namibia Financial Sector Charter
NSA	Namibia Statistics Agency
NAD	Namibia dollar
NSX	Namibian Stock Exchange
M2	Broad money supply
PSC	Credit extended to the Private Sector
VAR	Vector Auto Regression

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CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Background Information

The main purpose of the current study was to investigate the effect of financial innovation and the stability of the money demand function on the Namibian economy. The demand for money is an important matter in macroeconomics. Generally, people demand money to make day-to-day payments for goods and services. Hence, Money is an asset, which is widely used and accepted as a means of payment (Laidler, 1993). The demand for money comes from two important functions of money. The first of these functions is that money act as a medium of exchange and the second is that money acts as a store of value. This therefore implies that money is held by individuals and businesses either in the form of cash or assets.

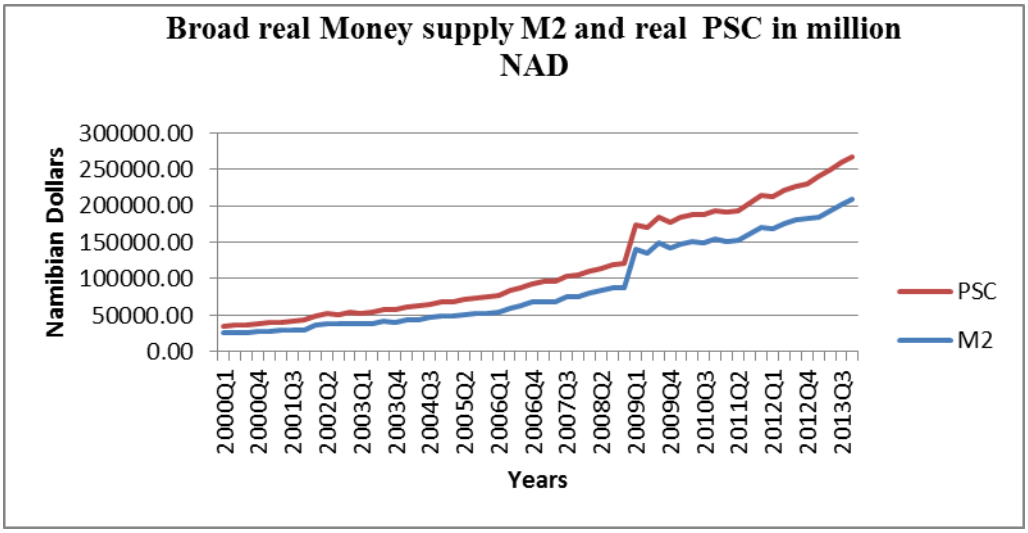
According to Goldfeld (as cited in Safdar & Khan, 2014, p.1) "the relationship between the demand for money and its key determinants is an important building block in macroeconomic theories and it is a crucial component to conduct the monetary policy". In this regard, the demand for money function is of particular interest in understanding the impact of monetary policy on the economy.

Due to a fixed exchange rate with South Africa, Namibia has discretionary powers to maintain its repo rate at a different level from the repo rate of the South African Reserve Bank (Bank of Namibia [BoN], 2008). Therefore, this discretionary power enables the Bank of Namibia to control money demand as well as money supply in the economy.

Financial innovation can be in the form of a new product, a new process for supplying and delivering an existing product, and different market arrangements (Lewis & Mizen 2000). Therefore, introduction of new funding and investment products and the way transactions are processed form part of financial innovation in the banking sector. In addition, financial innovations are vectors of financial liberalization, which provide greater opportunities for investment to take place that in turn positively affects economic growth through the diversification of the possibilities of investments in the global real economy (Barna & Nachescu, 2012, p.1). Financial innovation affects nearly every aspect of the central bank operations, including traditional macroeconomic stabilization policy, prudential regulation, supervision, and payments systems (Bank for International Settlements [BIS], 2009).

The Bank of Namibia issued a number of e-banking licenses, and this trend has encouraged the existing commercial banks to come up with new forms of payments to clients. This means that the financial services sector in Namibia is going through financial innovation. It can be noted that financial innovation is actually an ongoing process and it commenced in the early 1990's when the technology boom commenced. However, in the current study the credit extended to the private sector is used as a proxy for financial innovation. Figure 1 shows the trend of credit extended to the private sector and M2 aggregates in Namibia from 2000: Q1 to 2013:Q4.

Figure 1: Trend of M2 and PSC from 2000:Q1-2013:Q4



Data Source: Bank of Namibia Quarterly reports (2000-2013)

Figure 1 shows that both M2 and the credit extended to the private sector have been trending upwards for the past 13 years. The graph shows a positive relationship between the two variables. However, in 2009 both variables jumped upwards this could be due to the expansionary monetary policy adopted by the Bank of Namibia in 2009 as a way to counteract the negative effects of the global economic crises (Ministry of Finance, 2011). The policy was meant to encourage both domestic consumption and business investments. The purpose of the study is to examine the effect of financial innovation on the demand for money/money demand in Namibia.

1.2 Statement of the Research Problem

The stability of the demand for money function is important for maintaining macroeconomic stability through monetary policy management (Manoj & Prakash, 2010, p. 2). The Bank of Namibia aims to attain macroeconomic stability through monetary policy management that

ensures price stability (BoN, 2008). Given these theoretical arguments, the success of the central bank policies requires the presence of a stable demand for money function. There are several studies that investigated the determinants and the stability of the demand for money function in Namibia. The results show that real money balances, income, and interest rates are the variables explaining money demand in Namibia and they result in a stable money demand function (Ikhide & Katjomuise, 1999; Mabuku, 2009 and Humavindu, 2011). However, these studies did not consider the aspect of financial innovation, financial reforms, and changes in the policy environment that also affects the stability of the demand for money function. Given that little has been done on the effects of financial innovation and the stability of the demand for money function in Namibia, the current study attempts to close this gap.

1.3 Objective of the study

Given the above background, the objectives of the current study are as follows:

- To investigate the effects of financial innovation on the demand for money in Namibia.
- To investigate the stability of the demand for money function in Namibia.
- To suggest relevant policy recommendations to policy makers and other relevant authorities.

1.4 Research questions

- What are the effects of financial innovation on the demand for money in Namibia?
- What policy recommendations emanate from the current study?

1.5 Significance of the Study

The current study is relevant to Namibia in a sense that very little has been done as far as the effect of financial innovation on money demand in Namibia is concerned. Therefore, the current study is going to contribute to the literature on financial innovation and money demand in Namibia. It is a fact that effective policies depend on research that provides answers to relationships between key macroeconomic variables. Information about the relationship between financial innovation and money demand is very relevant to the central bank and the ministry of finance. Thus, the results of the current study will be quite useful to these two institutions in their policy making process.

1.6 Limitations of the study

The study is concentrating on assessing the effect of credit extended to the private sector (financial innovation) on demand for money in Namibia. The scope of the study does not include other elements of financial innovation such as policy changes and market arrangements.

1.7 Outline of the study

The study is organized in six (6) chapters. Chapter one is the introduction of the study, chapter two deliberates on the nature of the monetary policy and financial system in Namibia. Chapter three discusses the theoretical and empirical literature review. Chapter four highlights the methodology utilized to answer the research problem whilst, Chapter five analyses the results of the study. Lastly, Chapter 6 presents the summary of results, conclusion and recommendations of the study.

1.8 Conclusion

The current chapter sets the stage for the research by looking at the following issues, the research background, statement of the research problem, objectives of the study, the significance of the study, limitations of the study and the outline of the study. The next chapter discuses the Namibian financial services sector.

CHAPTER 2: THE NAMIBIAN FINANCIAL SERVICES SECTOR

2.1 Introduction

2.1.1 Namibia Financial System

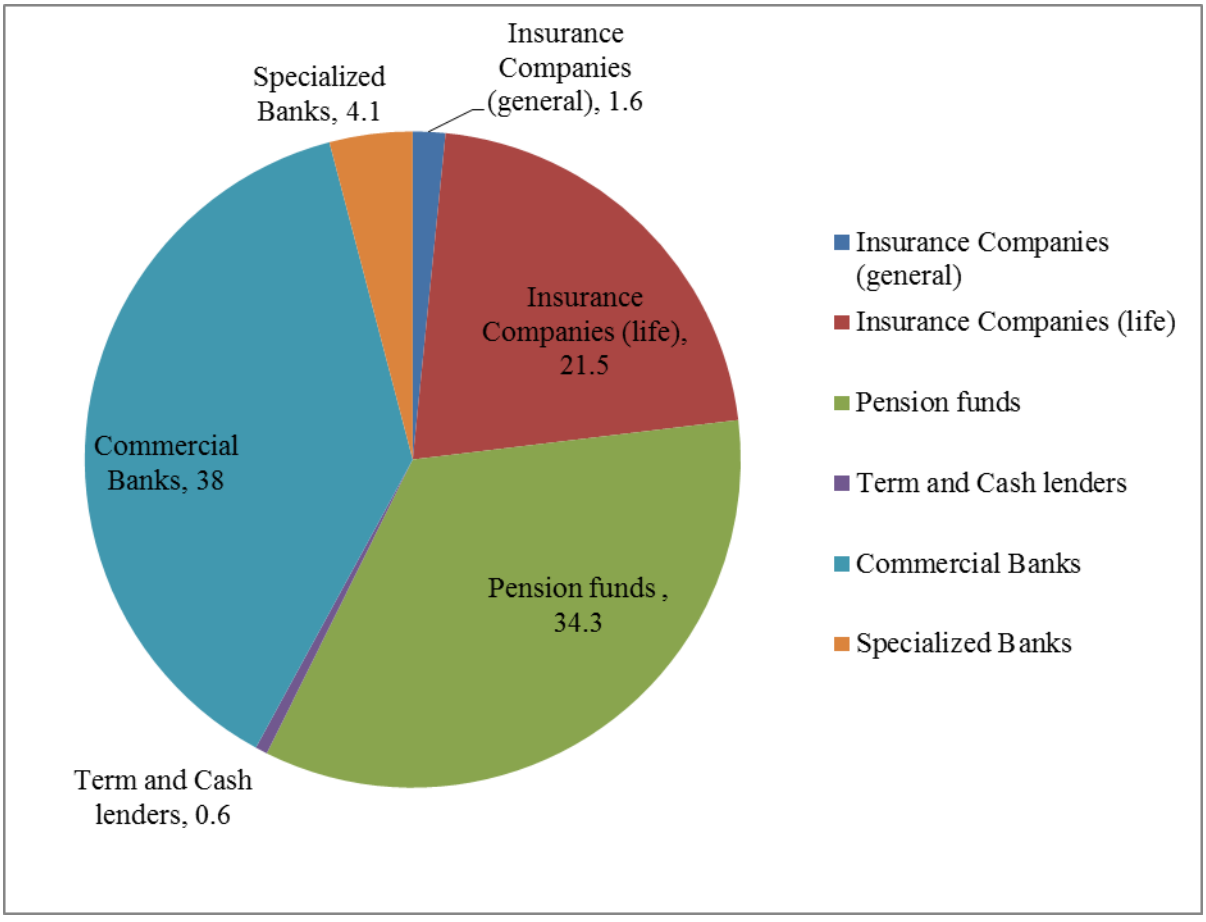
The World Economic Forum (2013) ranked Namibia 55 out of 148 countries as far as the availability of financial services is concerned. Namibia's banking institutions are sound and profitable, due to strong financial foundation, the banking system has remained resilient to financial shocks originating from the global and Eurozone financial crisis.

The financial system in Namibia consists of financial markets, financial instruments, and financial institutions. According to BoN (2014) the central bank has an objective to promote and maintain a sound monetary, credit and financial system in Namibia and sustain the liquidity, solvency and functioning of the system. Irrespective of the objective of the Bank of Namibia to promote and maintain a sound financial system, the financial institutions are regulated and supervised by the Namibia Financial Institutions Supervisory Authority (NAMFISA). The mandate of NAMFISA, with regards to financial stability, includes supervision of the business of financial institutions and financial services and providing advice to the Minister of Finance on matters related to financial institutions and services. The stability of the financial system is critical as the system provides important services to households, corporates, and the real economy.

The Namibian financial institutions are dominated by commercial banks, which accept deposits and make loans directly to borrowers and non-bank financial intermediaries who lend via the

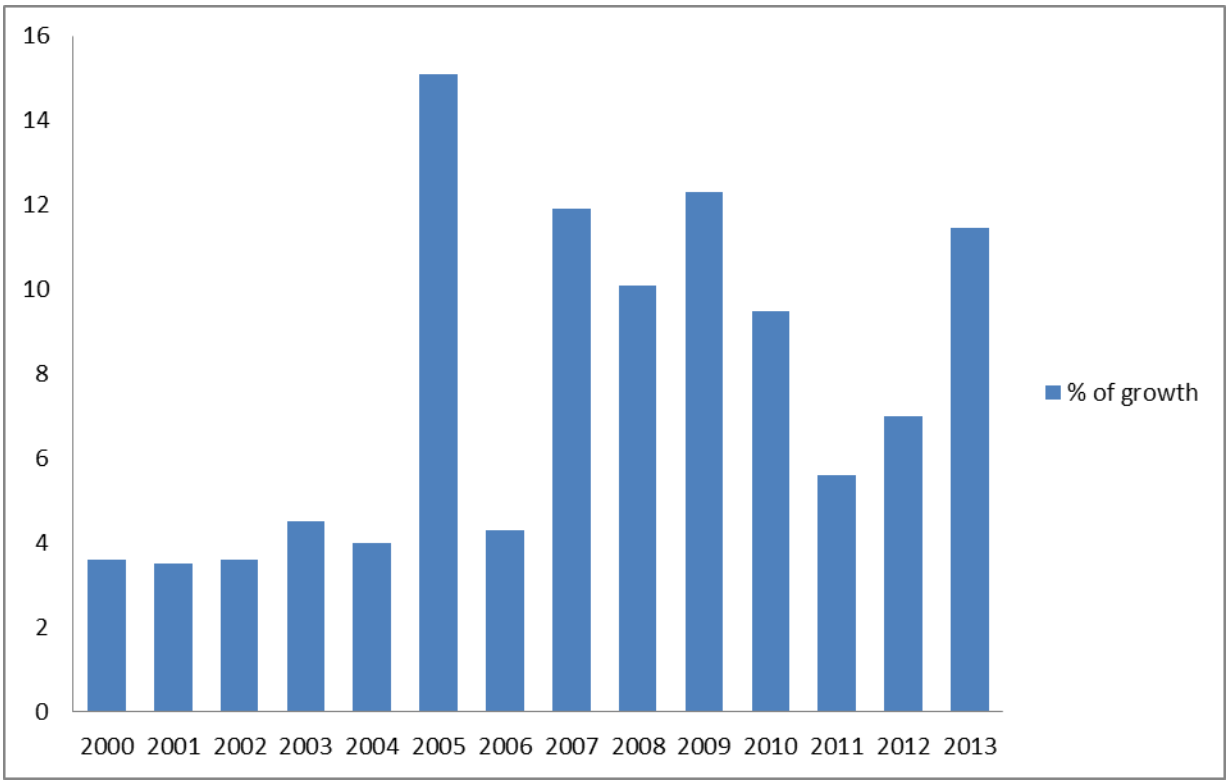
purchase of securities. Commercial bank assets account for 38 percent of the market (IMF, 2007). The latter category includes insurance companies, pension funds, and investment trusts, which purchase securities, thus providing capital indirectly rather than making loans. Financial institutions hold the potential to contribute extensively to development and economic stability in Namibia, both through providing an enabling environment for business and contributing directly to the development of the real sector through project financing, which in turn affects the overall economy. Figure 2 below shows percentage share of total assets within the financial system while figure 3 depicts annual growth for the financial intermediation sector in Namibia.

Figure 2: Total Assets of the Namibia Financial System



Data Source: IMF country report (2007)

Figure 3: Annual aggregate growth in the Financial Intermediation sector in Namibia from 2000-2013



Data Source: National Accounts (2000-2013)

The bar graph above depicts the growth in the financial intermediation sector that forms part of the financial sector in Namibia. The financial intermediation sector comprises of commercial banks, insurance companies, pension funds and non-financial institutions. The graph shows a sector boom in 2005, attributed to low interest rate (repo rate), which dropped from 7.75 percent in 2004 to 7 percent (BoN, 2005). Commercial banks contributed to the escalation in the financial intermediation sector due to low interest rate that made borrowing cheaper for both individuals and firms in the economy. However as from 2006, the financial intermediation sector keeps on fluctuating till 2013.

The financial market comprises the money market and the capital market. The short run instruments under the money market include, among others, demand deposits, traveler's checks, transferable deposit unit trust, and 32-day accounts. According to the World Bank (2008) the percentage of bank capital to asset ratio was 8.3 percent in 2006, while in the same year the domestic credit provided by the banking sector was 63.9 percent. It demonstrates that the banking sector has been sound and stable over the years, which justifies Namibia ranking of 55 out of 148 countries by the World Economic forum.

On the other hand, the capital market issue and trade long run securities. The Namibia Stock Exchange aims to enable, develop, and deepen the capital markets in Namibia by working in partnership with stakeholders in government and the financial sector (Namibia Stock Exchange [NSX], 2012). The economic contribution of the stock market has remained small. It has 9 listed domestic companies with a market capitalization of barely 8.3 percent of GDP and a market turnover ratio (value of shares traded as percentage of market capitalization) of 3.5 percent in 2007 (World Bank, 2008).

2.1.2 Monetary Policy

The fixed currency peg to the South African Rand (ZAR) supports the Namibian Monetary policy. The fixed peg ensures that the goal of price stability is achieved by importing stable inflation from the anchor country (South Africa). Due to this fixed peg between the two countries, Namibia through a discretionary approach towards monetary policy deviates from the policies of the anchor country to affect domestically induced inflation. The discretionary approach gives room to handle unexpected structural breaks in the economy. By and large, this

justifies why Namibia's monetary policy ultimate goal is to ensure price stability in the interest of sustainable growth and development, rather than targeting the exchange rate regime. Since the introduction of the Namibia dollar in 1992 and the signing of the bilateral Monetary Agreement with South Africa, Namibia has maintained a cautious approach to monetary policy (Sherbourne, 2009).

2.2 Banking sector and financial innovation initiatives

2.2.1 Banking Sector

The Banking sector of Namibia is guided by the code of banking practice, which is a voluntary code that sets standards of good banking practice for financial institutions to follow when dealing with customers (Bankers Association of Namibia & BoN, 2013). There are six commercial banks operating in Namibia, namely, Bank Windhoek, First National Bank (FNB), Ned Bank, Standard Bank, SME Bank Limited and Fides Bank Namibia. In addition, to commercial banks, there are other banks like the Development Bank of Namibia, which provides finance to viable enterprises that contribute immensely to the economic development of the country and AGRIBANK lending to farmers to promote agricultural activities. The Bank of Namibia was established in accordance with a provision in the Constitution of the Republic of Namibia, Chapter 17, Article 128, and it has the mandatory power to regulate commercial Banks operating in Namibia with openness and prudential measures. Sherbourne (2014) accentuated that Namibia's banking sector remains exceptionally profitable, while access appears to be stagnating at around 50 percent of the population.

Ikhide (2000) indicated that commercial banks account for close to 65 percent of total financial assets as well as close to 90 percent of total credit to the private sector. The total assets of the

banking sector rose by an annual growth of 14.7 percent at the end of December 2013, as compared to 12.7 percent at the end of June of the same year. Net loans and advances, which constitute over 75 percent of total assets, continue to be the main driver of asset growth in the banking sector, rising by 7.6 percent between the first half and the second half of 2013. Within this lending category, residential mortgages and instalment debt represents 41 percent and 16.2 percent share of net loans and advances at the end of December 2013, respectively (BoN, 2014).

According to the Namibia Statistic Agency [NSA], (2013) the overall Financial Intermediation sector showed robust growth of 14.1 percent in 2013 as compared to 9.8 percent in 2012. Nonetheless, the banking Subsector specifically registered a strong growth rate of 15.0 percent in real value added in the year 2013. The growth of the banking Subsector is attributed to an increase in FISIM activities, which registered a growth of 12.1 percent. The banking sector contributes immensely to the Namibian GDP for the past years from a meagre 5.5 percent in 2010 to 15.0 percent in 2013. The banking sector is crucial in the Namibian economy as it provides financial support to increase investment in the business industry, such as real estate, construction, manufacturing and agricultural production.

2.2.2 Financial innovation initiatives

Development in financial instruments or products, process and the means of payments form part of financial innovation. The banking sector in Namibia has demonstrated development in this area. To start off, the introduction of online banking or e-banking in Namibia has increased efficiency in the four commercial banks (FNB, Bank Windhoek, Standard Bank and Ned Bank). The services offered permits customers *among others, to* make payments, transfer funds between

their accounts, access bank accounts 24 hours a day, and they also have the flexibility to print own statements from any of the customer's account. Online banking is very convenient and cuts down the cost and inconveniences of standing in bank queues.

The online service operates in such a way that there are user rights restrictions in terms of dual authorization for businesses in order to mitigate fraud, hence all transactions are recorded, ensuring that users/ customers keep track of all payments made. In order to ensure a high standard of e-banking risk management in Namibia, banking institutions are required to implement the *Risk Management Principles for Electronic Banking.* The Bank of Namibia verifies the implementation of the principles during bank examinations and by means of regular surveys regarding electronic banking in Namibia (BoN, 2003). The principles have been developed to assist banking institutions expand their existing risk oversight policies and processes to cover their e-banking activities. The second instrument is the use of ATMs. ATMs countrywide are operated by designated commercial banks and provide accessibility to withdraw cash any time the customer wishes as well as transferring of funds. The CCTV cameras to eliminate possible fraud protect ATMs premises.

The third instrument is the use of debit and credit cards. All commercial banks in Namibia issue visa electronic cards, which allow customers to withdraw cash and to pay for purchases of goods and services. This creates a convenient environment for individuals not to travel with cash as most of the shops, hotels, medical centres in Namibia have debit cards pay points. In addition, the card can be used to withdraw cash from any ATM displaying a Visa sign internationally.

The credit card on the other hand can be applied for at any commercial bank in Namibia. There are different types of credit cards, which vary, from one commercial bank to another.

Finally, an increase in credit to the private sector demonstrates easing of customer requirements by the banks to access credit. The easing in credit establishes a liberalized financial sector view on access to credit, enhanced competition and efficiency in the financial system, advocated by McKinnon and Shaw (1973). Financial depth in Namibia justifies the private sector (individuals and firms) restoring their financial position with banks willingness to avail credit to them. Financial depth is measured as deposit resources mobilized and credit extended by the financial system (banking) relative to GDP (Ministry of Finance, 2012).

2.3 Conclusion

The chapter summarises the financial services sector of Namibia. The chapter explains the role of the financial services sector in Namibia. In line with this, assets traded in the Namibian financial system are discussed, including the short-term money market instruments and the long-term capital market instruments. In addition, the chapter also briefly discusses the Namibian Banking sector and its role in financial innovation. The next chapter discusses literature review, which is divided into theoretical and empirical literature review.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

Financial innovations can be in the form of new products, new processes, new markets and new market arrangements or as a source of policy changes (Lewis & Mizen, 2000). In Ghana the impact of financial innovation, resulting from the Financial Sector Adjustment Program (FINSAP) reached a conclusion that financial innovation has a significant impact on the demand for money (Mannah-Blankson & Belnye, 2004). The demand for money function on the other hand is described by different traditional theories in economics. These theories explain different motives of money holding in an economy. In this chapter, we review the traditional theories of demand for money as well as the empirical studies that closely relate to the current study.

3.2 Theoretical Literature Review

3.2.1 Traditional Theories of Demand for Money

The classical theory started way back as from 1776. Fisher (as cited in Laidler, 1993) develops the transactions motive based theory of the demand for money in which the demand for real balances is proportional to real income and is insensitive to interest rate movements. Fisher's theory suggests that interest rates have no effect on the demand for money and further argues that velocity of money is constant in the short-run and movements in the quantity of money solely determine nominal income. The Cambridge School on the other hand agrees with Fisher in that nominal income is determined by the quantity of money and that the velocity of money is constant. The two schools of thoughts differ in the sense that the Cambridge school argues that interest rates have an effect on the demand for money in a short- run, while Fisher ignores the effect of interest rate (Laidler, 1993).

According to Keynes (as cited in Laidler, 1993) there are three motives of holding money which are; transactions, precautionary and speculative motives of which the latter motive depends on the level of interest rates and the former two motives depends on income level. The three motives of holding money extended the Cambridge approach on money holding. Keynes emphasized that the speculative motive of money demand is sensitive to interest rate as well as to expectations about the future movements of interest rates. Nevertheless, he disagrees with the classical thought that velocity is constant and implies that velocity is not constant but positively related to interest rates (Laidler, 1993).

Friedman (as cited in Laidler, 1993) used a similar approach to that of Keynes and the Cambridge school on money demand theory. Friedman treated money like any other asset; he used the theory of asset demand to derive a demand for money that is a function of the expected return on money and permanent income. In contrast to Keynes, Friedman viewed money and goods as substitutes. He argued that economic agents choose between the two when deciding how much money to hold.

The theory by Tobin and Baumol (as cited in Laidler, 1993) build on the Keynesian views of the demand for money. It seeks to draw the implications of the variables that determine the segment of the demand for money than Keynes' analysis. It explains that individuals hold money or bonds one at a time due to the uncertainty of the interest rate fluctuations.

McKinnon and Shaw (1973) theory of the demand for money also acknowledges the importance of income as a determinant of the demand for money. It emphasizes the theory of financial liberalization and stipulates that real deposit rates of interest form part of the money demand function and individuals first accumulate savings for investment.

Given the importance of the traditional theories of the demand for money, from which the conventional demand for money function is constructed, the traditional theories are explained in detail in the sections that follow:

3.2.2 Classical Theory of Demand for Money

According to Laidler (1993), classical economists limited their view of money to its function as a medium of exchange, and proposed that the most obvious reasons that households and businesses demand money are to facilitate transactions. Therefore, money is neutral in the sense that changes in the money supply affect only the price level and not real output. This view was clearly expressed by the quantity theory of money. The first theory under the classical school is the Irving Fisher specified in an equation as:

$$MV = PT \quad \ldots\ldots (3.1)$$

Where M is money supply in circulation, V is velocity of Money (i.e. the number of times money changing hands), P is the price level and T is the volume of transactions. However, Fisher's quantity theory was further modified to equation 3.2 as:

$MV = PQ$ ..... (3.2)

Where V , P are already defined above, and Q is the output level. It is assumed that V is constant and Q is constant in the long run, therefore, a change in the nominal money supply (M) must lead to a proportionate change in the absolute price level (P).

The Cambridge Cash Balance Approach on the other hand concentrated on what influences the sum of money of money an individual agent would wish to admit given the desire to carry on proceedings. The Cambridge economists thought that two properties of money make people want to hold it and these are: money used as a medium of exchange and money as a store of wealth. They, however, agreed with Fisher that demand for money would be related to the level of transactions and there would be a transaction component of money demand proportional to nominal income.

Thus, Cambridge economists chose to simplify the theory of demand for money by assuming that for an individual, the level of wealth and the level of income over a short period, at least move in a stable proportion to one another. He further argued that, other things being equal, the demand for money in nominal terms are proportional to the nominal level of income for each individual as well as for the aggregate economy. Thus, they specified a demand for money equation as:

$M^d = kPy$ ..... (3.3)

Where M^d is demand for money, k is is the proportion of money balances people hold, P is the absolute price level and y is the output level/income.

3.2.3 Keynesian Theory of Demand for Money

According to Laidler (1993) Keynes criticized the Cambridge equation because it neglects the role of interest rates in determining the demand for money. He proposed an alternative expression of the demand for money, which he names the ‘liquidity preference’. Keynes identified three motives why people demand money, which are transaction motive, precautionary motive and speculative motive. According to the Keynesians, the transaction motive describes the necessity of holding cash to bridge the gap between receipts and planned regular payments. The Keynesians suggested that people also hold some cash for unplanned activities, such as paying unexpected bills, and this is known as the precautionary motive of holding money. The Keynesians suggested that both transaction and precautionary motives depend on the level of income. The last motive of holding money identified by Keynes is the speculative motive, of which individuals demand money if they expect the market value of alternative assets to fall. Hence, the speculative motive for holding money arises from the desire to maximize wealth and it depends on the rate of interest (Laidler, 1993).

The Keynesian specify the demand for money as follows:

$$M^d = kY + L(r) \quad \text{.......} \quad (3.4)$$

Where M^d, is demand for money, kY is the transaction and the precautionary motive which depends on the level of income (Y), $L(r)$ is the speculative motive which depends on interest rate (r). Keynesians stress that the demand for real money balances is negatively related to interest rates, which implies that the demand for real money balances increases with a decrease in interest rate. However, the demand for real money balances is positively related to real income, therefore the demand for real money balance increases with an increase in real income.[1]

3.2.4 Milton Friedman Theory of Demand for Money

According to Laidler (1993) Friedman's view on demand for money draws attention away on why people hold money. His view considers factors that determine how much money people would want to hold under various circumstances. These factors are expected percentage rate of change of price levels, and the interest rate earned for holding other assets rather than money. Friedman view money just like any other asset and the money yield a flow of services just like any other assets. However, his view does not show any analysis on how this flow of services is satisfied. Friedman's analysis of the demand for money emphasizes that the more money is held, the lesser the valuable services are held (and vice-versa). He also talked about the diminishing marginal rate of substitution between goods and consumption. Friedman accentuated the inclusion of wealth in the demand for money function and by wealth; he means human capital and non-human capital. He recognized the problem of lack of market in human wealth, therefore according to him, the ratio of human to non-human wealth should be considered as a subsidiary variable in the demand for money. He further emphasized that the opportunity cost of holding

[1] The Keynesian theory/model is the first to introduce the price of money (interest rate) in the demand for money function.

money is the income earned from holding bonds, equity, and human wealth and the market forces determined the amount of holding bonds, and equity via interest rate.

Therefore, the interest rate is one of the variables in Friedman's demand for money function. Another variable Friedman also introduced is the expected percentage rate of change in prices and further realized that the expected rate of inflation is also an important variable in his demand for money function.

$$M^d = f(W, r - \frac{1}{r}\frac{dr}{dt}, \frac{1}{p}\frac{dp}{dt}, h)P \quad \ldots\ldots (3.5)$$

Where; M^d is demand for money, W is wealth, r is the rate of interest, h is the ratio of human to non-human wealth, P is the price level, and all the time derivatives denote expected rates of change $\left(\frac{dr}{dt}, \frac{dp}{dt}\right)$. Other things being equal, the higher the expected rate of return to holding money, the more it will be held and vice versa (Laidler 1993).

3.2.5 The Baumol-Tobin Theory of Transaction Demand for Money

The theoretical work on the transaction demand for money by both Baumol and Tobin (as cited in Laidler, 1993) seeks to draw more precise implications about the variables that determine the segment of the demand for money than Keynes' analysis did. They explained that individuals hold money or bonds at a time due to uncertainty of interest rate fluctuations. They highlight that an increase in income will lead to larger investments in bonds and the investor will enjoy the benefits of economies of scale. They assumed that the individual agent receives an income

payment once per period (say, one month) and that the entire receipts of the agent are expended at a constant rate over the period. Then, the agent will hold some assets at every time period, except the final time period when last expenditure is made. The agent incur a brokerage fee every time wealth is switched between assets (money and bond only) and that the aim of the individual is to determine that level of bond holdings, which will jointly maximize the returns from interest income and minimize brokerage cost (Laidler, 1993).

3.2.6 McKinnon and Shaw theory of demand for money

According to McKinnon and Shaw (1973) challenged the dominant theoretical positions of Keynes, and the structuralist economists on the ground that the crucial assumptions in these models are erroneous in the context of developing countries. They, therefore, advocate financial liberalization and development as growth-enhancing economic policies. They argued that policies such as interest rate ceiling, higher reserve requirement, directed credit policies, and discriminatory taxation of financial intermediaries has harmful effects on economic growth. McKinnon and Shaw theory stated that, a low or negative real rate of interest discourages savings and hence reduces the availability of loanable funds, constrains investment, which in turn lowers the rate of economic growth. On the contrary, an increase in the real interest rate may induce the savers to save more, which enables more investment to take place and positively affects economic growth (Fry, 1995).

McKinnon and Shaw (1973) advocate the theory of financial liberalization as an alternative to the harmful restrictive policies. The financial liberalization policies are aimed at liberalizing interest rates by switching from an administered interest rate setting to a market based interest

rate determination; reducing controls on credit by gradually eliminating directed and subsidized credit schemes; developing primary and secondary securities markets; enhancing competition and efficiency in the financial system by privatizing nationalized commercial banks. It suggests a basic complementarity between the accumulation of money balances and physical capital accumulation.

According to the McKinnon-Shaw model, the success of the financial liberalization process depends to the following hypothesis: (i) the effective deepening of the financial sector, (ii) a positive correlation between savings and the real interest rate, and (iii) a perfect complementarity between the money demand and investment (McKinnon & Shaw 1973).

McKinnon (1973) argued that potential investors must accumulate money balances prior to their investment. The lower the opportunity cost of accumulating real money balances or the higher the real deposit rate of interest, the greater is the incentive to save. The McKinnon's complementarity hypothesis is reflected in the demand for money function below:

$$\frac{M}{P} = f(Y, \frac{I}{Y}, d - \pi^{e}) \quad \text{.....(3.6)}$$

Where M is the money stock, P is the price level, Y is real Gross National Product (GNP), $(\frac{I}{Y})$ is the ratio of gross investment to GNP, and $(d - \pi^{e})$ is the real deposit rate of interest.

The ratio of gross investment to GNP can also be expressed as:

$$\frac{I}{Y} = f(\bar{r}, d - \pi^{e}) \quad \text{.....(3.7)}$$

Where; $\bar{r}$ is the average return on physical capital, thus, the complementarity is expressed as;

$$\frac{\partial(M/P)}{\partial(I/Y)} > 0 \quad \ldots\ldots \quad (3.8a)$$

$$\frac{\partial(I/Y)}{\partial(d - \pi^e)} > 0 \quad \ldots\ldots \quad (3.8b)$$

Equations (3.8a) and (3.8b) suggest that it is not the cost of capital, but the availability of finance that constrains investment in financially repressed economies. By and large, the partial derivative of equation (3.8a) represents the money demand for investment, an increase in investment rate lead to an increase in money demand, while the partial derivative of equation (3.8b) demonstrates that an increase in real deposit rate lead to an increase in investment, because financial constraints are relaxed (Fry, 1995).

Shaw (1973) on the other hand discards Keynes' finance motive and the neoclassical monetary growth model in favour of the debt-intermediation view. It stems from the fact that there are significant differences in the financial systems in developed and developing countries. For instance, developed countries possess sophisticated financial institutions, which facilitate intermediation between savers and investors, contrary to developing countries. Therefore, Shaw (1973) constructed a monetary model, in which money is backed by productive investment loans to the private sector and that the amount of money stock, in relation to the level of economic activity, is positively related to the extent of financial intermediation between savers and investors through the banking system. He concludes that improved financial intermediation

through financial liberalization and financial development, increases the incentive to save and invest, thereby raising the average efficiency of investment (Fry, 1995).

3.2.7 Similarities and differences among the traditional theories on the demand for money:

- The classical theory of the demand for money function accentuated that money is demanded as a means of exchange and a store of wealth; however, in their specification for the demand for money function, interest rate is not part of the function. On the contrary, Keynes agreed with the Classical Cambridge economist that money could be used as a store of value, hence; he emphasized the significance of interest rate as an influencing variable of how much wealth should be held.

- Tobin and Baumol (as cited in Laidler, 1993) build on Keynes theories of the demand for money. They argued that individuals and business persons hold either money or bonds at a time, due to uncertainty, unlike Keynes who emphasized that they can hold money and bonds at the same time. Baumol and Tobin (as cited in Laidler, 1993) concluded that people switch between money and returns from interest income earned from holding bonds. In addition Friedman (as cited in Laidler, 1993) explains that the demand for money is not merely a function of income and the interest rate, as stipulated by Keynes, but also of total wealth.

- According to Friedman, Keynes and Tobin and Baumol (as cited in Laidler, 1993) considered income as a key determinant for the demand for money function. McKinnon

and Shaw (1973) also share the same view. However, McKinnon and Shaw (1973) further substantiate on the level of investment on capital returns, by which an individual first accumulate savings in order to invest. Thus, real deposit rate of interest is one of the variables in their specification for the demand for money function.

- All theories on the demand for money specification by the Cambridge School, Keynes, Friedman, Tobin and Baumol, McKinnon and Shaw emphasize income as a key variable in the demand for money specification.

3.2.8 Financial innovation and demand for money

The theoretical literature on financial innovation of demand for money emerged from empirical work of financial innovation by Goldfeld (as cited in Ireland, 1992, p.1). The years in which standard money equations broke down witness the creation of a number of assets that appear to be very close substitutes of demand deposit, including accounts and security repurchase agreements, as well as the development of a variety of new cash management techniques used by firms to economize on their real balances. As a result, Goldfeld findings launched an extensive program directed at repairing the conventional specification by taking the effects of financial innovations on the demand for money into account (Ireland, 1992).

There are major financial innovations and theories that emphasize specific sources of financial innovation. Lewis and Mizen (2000) explained that the effect of financial innovation on the demand for money depends on the sort of innovation taking place. Table 1 presents some examples under the three forms of financial innovation (product, process, and market arrangement). While Table 2 presents some sources of financial innovations.

Table 1: Major Financial Innovations

Major financial innovations		
A. Products	**B. Processes**	**C. Market arrangement**
Retail ✓ Money Market Mutual Funds ✓ Money Market accounts ✓ Cash management accounts ✓ Sweep accounts ✓ Index-linked securities ✓ Personal equity plans ✓ Housing Equity Loans	**Retail** ✓ Automated teller machines ✓ Point of sale terminal ✓ Electronic funds transfer ✓ Electronic trading ✓ Automated Clearing system	**Retail** ✓ Secondary mortgage markets ✓ Joint ventures ✓ Financial service centres ✓ Financial conglomerates ✓ Banc assurance
Wholesale ✓ Rollover credits ✓ Medium term notes ✓ Leveraged buyouts ✓ Interest rate and currency swaps ✓ Options, swap options ✓ Caps, floor and collars ✓ Hedge funds	**Wholesale** ✓ Automated Clearing Houses ✓ CHIPS, CHAPS ✓ Automated securities trading ✓ Euro clear ✓ Electronic delivery of securities	**Wholesale** ✓ Eurocurrency markets ✓ International Banking Facilities ✓ Financial futures markets ✓ Repurchase markets ✓ Over-the-counter markets

Data Source: Lewis and Mizen (2000)

Table 2: Sources of Financial Innovations

Sources of Financial Innovations	
1. Changing requirements of customers ✓ Risk/yield combination ✓ Agency cost ✓ Tax asymmetries ✓ Scale of financing ✓ Accounting benefits	**4. Policy changes** ✓ Regulatory/legislative/supervisory changes **5. Technology** ✓ Technological factors ✓ Academic research
2. Changed conditions of suppliers ✓ Transaction costs ✓ Capital pressures ✓ Competition	**6. Market completeness** ✓ Risk-hedging ✓ Cross-border arbitrage
3. Environmental changes ✓ Interest rates ✓ Prices, exchange rates	

Data Source: Lewis and Mizen (2000)

Lewis and Mizen (2000) provides three reasons, which explain how financial innovation impacts the demand for money. Firstly, they indicate that some innovations change the absolute and the relative costs of holding various financial assets, as well as reducing the transaction costs associated with exchanging of a financial asset for another. Secondly, financial innovation has eroded the distinction between banks and other financial intermediaries and between intermediated transactions and market ones. Thirdly, some new financial assets created by innovation are close substitutes for the traditional 'medium of exchange' assets, which is included in the definition of money. As a result, the elasticity of substitution for money rises, thereby increasing the interest elasticity of demand.

3.3 Empirical Literature Review

Empirical evidence on the effect of financial innovation received worldwide attention in the last few years. There is, however, little being done in Namibia, on this topic. Arrau, Gregorio, Reinhard and Wickham (1991) assessed the role of financial innovation on the demand for money for 10 developing countries using quarterly data. The study considered first, the possibility of modelling financial innovation as a deterministic drift process. In other words, incorporating a time trend into regressions and a ratio of M1 to M2 (M2/M1) as a proxy for financial innovation. In the sample of developing countries chosen, the role of financial innovation was quantitatively important in determining money demand.

Mannah-Blankson and Belnye (2004) examines the impact of financial innovation, resulting from the Financial Sector Adjustment Program (FINSAP) in Ghana on money demand using cointegration and error correction modelling. The findings from the study show a long run demand for real money balances in Ghana, driven by income, inflation, exchange rate and

financial innovation, with financial innovation exerting a positive influence on the money demand in the long-run.

Bilyk (2006) investigated and estimated the relationship between financial innovations and the demand for money in Ukraine, using monthly data from 1997-2005, using the Vector error correction model (VECM). The results reveal the significance of financial innovations on both narrow and broad money (M1 and M2) respectively. The impulse-response analysis indicates that the impact of financial innovations is stronger in the narrow demand for money specifications. In addition, the study finds a positive impact of financial innovations on money demand in Ukraine in the long run and a negative impact in the short-run.

Maniragaba (2011) examined the effects of financial liberalization on the money demand and economic growth using yearly data from 1978-2008 in Uganda. The study, essentially investigates financial sector reforms in Uganda following financial liberalization measures, like interest rate deregulation, reduction in direct credit, implementation of prudential rules, privatization of state owned banks, reduction in entry requirements, liberalization of securities markets and international financial liberalization. Employing the error correction method, the study found a positive long-run effect of financial liberalization on the demand for money in Uganda.

Odularu and Okunrinboye (2009) assessed the impact of financial innovation on the demand for money in Nigeria using the Engle and Granger Two-Step Cointegration technique. The results show that financial innovations have not significantly affected the demand for money in **N**igeria**.**

Godslove (2011) investigated interest rates and the demand for credit in Ghana between 1970 and 2007 using a vector autoregressive model. The study suggests that repressive high interest rates in the 1980s in Ghana disrupted effective financial intermediation. Even though the interest rates were still high since the year 2000, it was lower than that of previous decades. The results indicate that interest rates have a positive impact on domestic credit in the short-run and a negative impact in the long- run. He concludes that while increases in real lending rate may not immediately hamper the demand for credit, they might eventually lead to a fall in the demand for credit in the long run.

In Namibia, Ikhide and Katjomuise (1999) estimated the demand for money function using co-integration and error correction modelling from 1990-1998. The results indicate that real money balances, income, and interest rates have a stable relationship in the economy and among others; income and interest rates are important determinants of money holding in Namibia. Mabuku (2009) investigates the stability of money demand in Namibia for the period 1993-2006 using the Engle Granger and co-integration technique. Key determinant variables, such as real output, which is a proxy for income (scale variable), inflation, exchange rates, and interest rates as opportunity cost variables were utilized. Mabuku (2009) concludes that interest rates and inflation rates have negative significant impacts on money demand, while income and exchange rates have significant positive effects on money demand. The analysis was more on co-integration between two or more time series and missed the estimation of endogeniety among the variables of interest.

3.4 Conclusion

The traditional theoretical literature on the demand for money, particularly the McKinnon and Shaw 1973 on financial liberalization reveal the importance to investigate financial innovation on demand for money function in Namibia. Financial innovation is a broad concept, which is measured by different proxies such as M2/M1, credit extended to the private sector as a ratio of GDP and compilation of indexes. The current Chapter has discussed both the theoretical and empirical literature review. Relevant variables from the previous studies were identified, some of which are adopted for the purposes of this study. The next chapter discusses the research methodology used in the study.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

The specification of the conventional demand for money function employed in the literature depends positively on a scale variable, most frequently used is GDP as a proxy for income/wealth, and negatively related to one or more opportunity cost variables such as inflation, interest rate and exchange rate (Laidler, 1993).

This chapter describes the methodology employed in the study to examine the effect of financial innovations, proxied by private sector credit extension, on the demand for money using the VAR econometric technique. Reside (2001) defined VAR as a vector of endogenous variables regressed against their lags and the lags of the other variables included in the model. VAR models are considered when modelling simultaneous equations rather than focusing on single equations.

In a VAR model there is *n*-equation and n-variables in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining *n*-1 variables. The technique provides a systematic way to capture the dynamics in multiple time series (Stock & Watson, 2001). Quarterly data provide a larger sample size, unlike annual data, thus, the study employs quarterly data covering the period from 2000:Q1- 2013:Q4. The descriptions of various variables used in the model are presented in this chapter as well as their data sources.

4.2 Data Analysis and Estimation Package

The study utilises secondary data sourced from the Bank of Namibia, Namibia Statistics Agency and the World Bank Financial Statistics. The estimation package used for the purposes of this study is Eviews (Eviews 7). It is one of the packages that are best suited for estimating systems of equations like the vector autoregression models.

4.3 Model Specification

The theoretical model is informed by the Keynesian demand for money specification equation discussed in Chapter three given as: $M^{d} = kY + L(r)$ ..... .(4.3.0)

Where M^{d}, is demand for money, kY is the transaction and precautionary motive, which depend on the level of income (Y), $L(r)$ is the speculative motive which depends on interest rate (r).

4.3.1 The specified VAR Model

The general VAR model utilized in this study is specified as follows in a system of 5 equations:

$$m_d = f(m_d, rgdp, \inf l, rr, psc) \quad \text{.....(4.3.1)}$$

$$rgdp = f(m_d, rgdp, \inf l, rr, psc) \quad \text{.....(4.3.2)}$$

$$\inf l = f(m_d, rgdp, \inf l, rr, psc) \quad \text{.....(4.3.3)}$$

$$rr = f(m_d, rgdp, \inf l, rr, psc) \quad \text{..... (4.3.4)}$$

$$psc = f(m_d, rgdp, \inf l, rr, psc) \quad \text{.....(4.3.5)}$$

Where Md = Money demand

$rgdp$ = real gross domestic product

$infl$ = inflation rate

rr = repo rate, and,

psc = credit extended to the private sector

The VAR model in a specific form is presented as shown below and the variables are converted into natural logarithms. Logarithms have some benefits in estimation as they smooth out data in comparison to unlogged data and the parameter estimates resulting from an estimated equation are elasticities (Lewis & Mizen, 2000).

$$\ln md_t = \alpha_1 + \sum_{i=1}^{p} \beta_{11}^{i} \ln mdi_{t-i} + \sum_{i=1}^{p} \beta_{12}^{i} \ln rgdp_{t-i} + \sum_{i=1}^{p} \beta_{13}^{i} \ln \inf l_{t-i} + \sum_{i=1}^{p} \beta_{14}^{i} \ln rr_{t-i} + \sum_{i=1}^{p} \beta_{15}^{i} \ln psc_{t-i} + \varepsilon_t^{md} \quad (4.3.6)$$

$$\ln rgdp_t = \alpha_2 + \sum_{i=1}^{p} \beta_{21}^{i} \ln md_{t-i} + \sum_{i=1}^{p} \beta_{22}^{i} \ln rgdp_{t-i} + \sum_{i=1}^{p} \beta_{13}^{i} \ln \inf l_{t-i} + \sum_{i=1}^{p} \beta_{14}^{i} \ln rr_{t-i} + \sum_{i=1}^{p} \beta_{15}^{i} \ln psc_{t-i} + \varepsilon_t^{rgdp} \quad (4.3.7)$$

$$\ln \inf l_t = \alpha_3 + \sum_{i=1}^{p} \beta_{31}^{i} \ln md_{t-i} + \sum_{i=1}^{p} \beta_{32}^{i} \ln lrgdp_{t-i} + \sum_{i=1}^{p} \beta_{33}^{i} \ln l \inf l_{t-i} + \sum_{i=1}^{p} \beta_{34}^{i} \ln rr_{t-1} + \sum_{i=1}^{p} \beta_{35}^{i} \ln psc_{t-i} + \varepsilon_t^{\inf l} \quad (4.3.8)$$

$$\ln rr_t = \alpha_4 + \sum_{i=1}^{p} \beta_{41}^{i} \ln md_{t-i} + \sum_{i=1}^{p} \beta_{42}^{i} \ln rgdp_{t-i} + \sum_{i=1}^{p} \beta_{43}^{i} \ln \inf l_{t-i} + \sum_{i=1}^{p} \beta_{44}^{i} \ln rr_{t-i} + \sum_{i=1}^{p} \beta_{55}^{i} \ln psc_{t-i} + \varepsilon_t^{rr} \quad (4.3.9)$$

$$\ln psc_t = \alpha_5 + \sum_{i=1}^{p} \beta_{51}^{i} \ln md_{t-i} + \sum_{i=1}^{p} \beta_{52}^{i} \ln rgdp_{t-i} + \sum_{i=1}^{p} \beta_{53}^{i} \ln \inf l_{t-i} + \sum_{i=1}^{p} \beta_{54}^{i} \ln rr_{t-i} + \sum_{i=1}^{p} \beta_{55}^{i} \ln psc_{t-i} + \varepsilon_t^{psc} \quad (4.3.10)$$

The system of equations form equations (4.3.6) to (4.3.10) presents the unrestricted VAR model, in which each variable is explained by itself and other variables of concern in the model. Where $\ln md$ is log of real money demand; $\ln rgdp$ is log of real Gross Domestic Product; $\ln \inf l$ is log of inflation; $\ln rr$ is log of repo rate and $\ln psc$ is log of private sector credit and ε_t are the error terms.

4.4 Description of variables

The variables used in the study are; real broad money supply M2, as a proxy for money demand, which is a depended variable and its lags as an explanatory variable; real GDP, consumer price index (CPI), repo rate and credit extended to the private sector (PSC) are additional explanatory variables.

4.4.1 Money Demand (MD)

The study uses M2 as a proxy for Money demand and is assumed exogenous. M2 comprises M1, which includes overall cash balances M0 (notes and coins) in the hands of the public. M2 contains M1 plus demand deposits, traveler's checks and transferable deposits. The willingness of people to hold money in terms of cash or as checks is treated as a depended variable in the current study.

4.4.2 Real Gross Domestic Product

Gross Domestic Product measures the final value of goods and services produced in a country within a year. The study uses real GDP as a proxy for income, income is considered as a scale variable in the specification of the money demand equation. Empirical evidence by Bilyk (2006), Abaliwano (2009), and Mabuku (2009) indicates a positive effect of income on the demand for money function in Ukraine, Uganda, and Namibia, respectively.

4.4.3 Inflation

Inflation is reflected as an opportunity cost variable in the demand for money function. Inflation may have a negative or positive relationship with demand for money, when inflation is expected

to rise; economic agents could increase their money holding, anticipating that their planned nominal expenditure will move up. The Namibia Statistics Agency compiles the index. Humavindu (2007) recognizes a negative effect of inflation on the demand for money in Namibia.

4.4.4 Repo rate

The repo rate indicates the rate at which commercial banks borrow money from the central bank. The repo rate is used as a proxy for interest rate presented as an opportunity cost variable. Theoretically, there is an inverse relationship between interest rate and the demand for money function, at low interest rates money demand will be high, at high interest rates the amount of portfolios that people wish to hold as money will be low, hence the overall demand for money in an economy falls. Monthly data from the Bank of Namibia quarterly bulletins is employed to compute quarterly repo rate in the study, hence, the average repo rate for three months was utilized. Mabuku (2009) establishes a negative effect of the repo rate on the demand for money function in Namibia.

4.4.5 Credit extended to the private sector

Financial depth is used a as a proxy for financial innovation and measured as a ratio of credit extended to the private sector to nominal GDP. The Irving Fisher Committee on Central Bank Statistics informs this measure. The Irving Fisher Committee on Central Bank Statistics (IFC) is a forum of central bank economists and statisticians, which is established and governed by the international central banking community and operates under the umbrella of the Bank for International Settlements (BIS) Private sector credit extension data sourced from the Bank of

Namibia was utilized in the study as a proxy for financial innovation. Financial innovation can have a negative or positive impact on the demand for money. Mannah-Blankson and Belnye (2004) established a positive and negative influence of financial innovation measured as M2/M1 on the demand for M1 and M2, respectively, in the short-run.

4.5 Data Analysis

The time series data were analysed using Eviews statistical package. The time series data have been tested for stationarity before any further procedures. A stationary time series is one whose statistical properties such as mean and variance are all constant over time (Gujarati & Porter, 2009). Estimation of a stationary series removes the stochastic trend, which is responsible for spurious results. The study uses the unit root test to test for non-stationarity of the time series. The Augmented Dicky Fuller (ADF) and the Phillips-Perron tests are applied in this matter.

A five-variable VAR model is analysed, which comprises money demand, real GDP, inflation, repo rate, and credit extended to the private sector. The technique investigates the dynamics of macroeconomic data and various scholars have used it before to model the monetary transmission mechanism in the US economy. The technique allows estimating a system of equations once. For instance, the system of equations previously stipulated from equation (4.3.1) - (4.3.5) will be estimated once.

4.5.1 VAR diagnostics test

The following tests were conducted on the VAR model.

- **VAR stability condition checks**

  The VAR stability condition was justified using the AR Root table and AR Roots graph.

- **Lag order selection**, the optimal lag length is selected based on the Information criteria such as the AIC (Akaike's Information Criterion), FPE (Final Prediction Error), SC (Schwarz Criterion), and the HQ (Hannan-Quinn Criterion). To select the lag order, we choose the lags established by the majority of the tests mentioned above.

4.5.2 Co-integration test

Co-integration portrays long run association among variables. The nature of the equation plays a role in testing for co-integration in a single equation. The Engle Granger method is employed while in a case of a multivariate equation the Johansen approach is utilized as it shows the number of co-integrating equation in a system.

The starting point of the Johansen's method in a VAR model of order *p* is given by;

$$y_t = \mu + A_1 y_{t-1} + ... + A_p y_{t-p} + \varepsilon_t \quad \text{.....4.5.2 (a)}$$

Where y_t is an $nx1$ vector of variables that are integrated of order one I (1) and ε_t is an $nx1$ vector of innovations.

The Trace and the Maximum Eigen values tests under the Johansen method are shown in equation 4.5.2 (b) and 4.5.2 (c) respectively.

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad \text{.....4.5.2 (b)}$$

$$J_{\max} = -T \ln(1 - \lambda_{r+1}) \quad \text{.....4.5.2 (c)}$$

Where T is the sample size and λ_i is the i^{th} largest canonical correlation. The trace test tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of *n* co-integrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of *r* co-integrating vectors against the alternative hypothesis of $r + 1$ co-integrating vectors.

4.5.3 Impulse response function and variance decomposition

The positive or negative effect of credit extended to the private sector, real GDP, inflation, and lending rate on the demand for money is investigated with impulse-response function. The study employed the Cholesky decomposition to test the impulse response functions. The innovation about how much a given variable changes under the impact of its own shock and the shocks of other variables are also investigated through the variance decomposition.

4.5.4 Model Stability

A further test on the stability of the system was performed using the roots of the characteristic polynomial test. The estimated VAR is stable if all the roots have modulus less than one and lie inside the unit circle. It implies that we can use the model for dynamic analysis purposes using the IRFs and FEVDs.

4.6 Conclusion

The chapter discussed the methodology that is applied in the study. The chapter discusses data specification and the estimating package that was used in the study. It also discusses the specification of the VAR model and its stability used in the current study and it also explains the relationships of the variables employed in the study.

CHAPTER 5: PRESENTATION AND INTERPRETATION OF RESULTS

5.1 Introduction

The chapter presents the results obtained using the methodology explained in the previous chapter (chapter 4). The chapter discusses the results of various tests that were conducted, namely, unit root tests, lag length tests, cointegration tests and model stability tests. In addition, the chapter also presents the VAR results. The last part of the chapter presents the impulse response functions and the variance decomposition functions.

5.2 Unit root test (stationarity)

Stationarity in this study was tested using the Augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979) and the Phillips-Perron (PP) test. The two hypotheses used in conjunction with these tests are reflected as H_0 and H_1 representing the null and alternative hypotheses, respectively.

H_0: Unit Root (non-stationary)

H_1: No unit root (stationary)

The decision rule when using these tests is that if the computed t-statistics of a time series is greater than the critical values in absolute terms then one can reject the null hypothesis that there is no unit root and the series is stationary. The decision also relies on the p-values at 5 percent whereby if the computed p-value is less than 5 percent, then one rejects the null hypothesis. Otherwise, if the p-values (probabilities) are greater than 5 percent, then one does not reject the null hypothesis and concludes that there is a unit root and the series are non-stationary.

The Augmented Dickey Fuller stationarity tests were conducted using the equation with a constant and the model with a constant and a trend.

Table 3: Augmented Dickey-Fuller test results in levels

Variables	Critical Values	Critical Values	T-Statistics	Probabilities
LNMD	-3.493692	-3.175693	-2.456707	0.3477
LNPSC	-3.493692	-3.175693	-2.226423	0.4658
LNRGDP	-3.493692	-3.175693	-1.713028	0.7321
LNRR	-3.495295	-3.176618	-2.909414	0.1678
LNINFL	-3.495295	-3.176618	-2.737953	0.2262

Note: (***) (**) and (*) represent 1 percent, 5 percent and 10 percent level of significance respectively.
Data Source: E-views results (2014)

Table 3 depicts that all the variables are non-stationary in levels using the Augmented Dickey Fuller results, which implies that the variables need to be differenced for them to become stationary. In other words, if the trend diagrams of the variables are drawn they should have some trends, which may be either positive or negative. This is true for the 1 percent, 5 percent, and 10 percent levels of significance.

Table 4: Augmented Dickey-Fuller test results in first difference

Variables	Critical Values	Critical Values	T-Statistics	Probabilities	Order of integration
D(LNMD)	-3.495295	-3.176618	-8.708157	0.0000***	1
D(LNPSC)	-3.495295	-3.176618	-9.573239	0.0000***	1
D(LNRGDP)	-3.495295	-3.176618	-8.978320	0.0000***	1
D(LNRR)	-3.495295	-3.176618	-4.188571	0.0087***	1
D(LNINFL)	-3.495295	-3.176618	-5.393493	0.0002***	1

Note: (***) (**) and (*) represent 1 percent, 5 percent and 10 percent level of significance respectively
Data Source: E-views results (2014)

The augmented Dickey Fuller test was repeated for the variables in first differences and it was established that all the variables are stationary at the 1 percent level of significance (Table 4). In

all the cases, the estimated t-statistics are greater than the critical values, which mean that the variables are now stationary and integrated of order one. In other words, all the variables needed to be differenced once for them to become stationary.

Table 5: Phillips-Perron test results in levels

Variables	Critical Values	Critical Values	T-Statistics	Probabilities
LNMD	-3.493692	-3.175693	-2.456707	0.3477
LNPSC	-3.493692	-3.175693	-2.060090	0.5559
LNRGDP	-3.493692	-3.175693	-1.552533	0.7987
LNRR	-3.493692	-3.175693	-2.180908	0.4903
LNINFL	-3.493692	-3.175693	-2.313420	0.4198

Note: (***) (**) and (*) represent 1 percent, 5 percent and 10 percent level of significance respectively

Data Source: E-views results (2014)

To prove that what is found using the Augmented Dickey Fuller test was correct, the Phillips Peron test is used to test for the stationarity of the variables. The results in Table 5 indicate that all the variables are non-stationary in levels, implying that they need to be differenced to become stationary. This is what was obtained when the Augmented Dickey Fuller test was applied in levels.

Table 6: Phillips-Perron results in first difference

Variables	Critical Values	Critical Values	T-Statistics	Probabilities	Order of integration
D(LNMD)	-3.495295	-3.176618	-8.701237	0.0000***	1
D(LNPSC)	-2.916566	-2.596116	-9.662558	0.0000***	1
D(LNRGDP)	-3.495295	-3.176618	-9.124494	0.0000***	1
D(LNRR)	-3.495295	-3.176618	-4.163707	0.0093***	1
D(LNINFL)	-3.495295	-3.176618	-5.290405	0.0003***	1

Note: (***) (**) and (*) represent 1 percent, 5 percent and 10 percent level of significance respectively

Data Source: E-views results (2014)

Table 6 shows the application of the Phillips Peron test on the first differences of the variables. It also shows that all the variables become stationary after differencing once. These results are the

same as the ones obtained earlier using the ADF test. The implication once again is that the variables need to be differenced once in order to become stationary.

In conclusion the unit root test results indicates that all the variables are integrated of order one (I) using both the Augmented Dickey-Fuller test and the Phillips-Perron test.

5.3 VAR stability condition results

The VAR model with five endogenous variables LNMD, LNRGDP, LNINFL, LNRR, and LNPSC is stable because all roots lie inside the circle and modulus are less than one

Table 7: Characteristics of Polynomial Stability condition of the general model

Roots	Modulus
0.981010	0.981010
0.938277	0.938277
0.830560	0.830560
0.704025 - 0.201471i	0.732285
0.704025 + 0.201471i	0.732285
0.431703 - 0.332629i	0.544985
0.431703 + 0.332629i	0.544985
-0.461952	0.461952
-0.275005	0.275005
-0.185909	0.185909

Data Source: VAR results from E-views (2014)

The results in table 7 indicate that all ten roots of characteristics AR polynomial have modulus that are less than one, hence, the VAR stability condition is not violated. We therefore can proceed with other VAR components such as impulse response and forecast error variance decomposition. It also implies that there is convergence and the demand for money in Namibia is stable. Mabuku (2009) also establishes that the demand for money was stable for the period 1993-2006. Appendix 1 indicates that all roots lies within the circle, implying model stability. The unrestricted VAR with lag order of two is presented in appendix 2.

5.4 Lag order selection

The result from the test for lag length criteria based on the five-variable VAR system with the maximum lag number 4 is reported in table 8 below. The Lag length is set at two, which is the optimal value according to the sequential modified LR test statistic, Final prediction error (FPE), Akaike information criterion (AIC), and Hainan-Quinn (HQ). The lag length of two is applied to all the estimations that are carried out in this chapter.

Table 8: Test for lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	52.42135	NA	1.11e-07	-1.823898	-1.636278	-1.751969
1	344.8725	517.4135	3.81e-12	-12.11048	-10.98476*	-11.67891
2	380.7072	56.50857*	2.58e-12*	-12.52720*	-10.46338	-11.73598*
3	393.2360	17.34764	4.47e-12	-12.04754	-9.045626	-10.89668
4	417.6836	29.14907	5.26e-12	-12.02629	-8.086282	-10.51579

Note:

***** indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final Prediction Error
AIC: Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

5.5 Johansen Co-integration test results

Table 9 and 10 reports the findings of both cointegration tests under the assumption that the underlying trends are of a deterministic nature. In order to assess the sensitivity of cointegration analysis to the alternative specification of the trend parameter, especially, given that unit root tests provide supporting evidence of plausible stochastic trends, the sample series cointegration tests are also performed under the assumption that the underlying trends in the variables are of stochastic nature. The qualitative outcome of the cointegration analysis remained the same, and did not hinge on the choice of the trend parameter. The results presented in table 9 and 10 show no cointegrating relationship among the variables. The result is supported both by the Trace test and by the Maximum Eigen Value.

Table 9: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No.of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.
None	0.455244	67.69076	69.81889	0.0730
At most 1	0.309475	35.49767	47.85613	0.4220
At most 2	0.152881	15.87160	29.79707	0.7213
At most 3	0.108291	7.078181	15.49471	0.5686
At most 4	0.018757	1.003538	3.841466	0.3165

Note: Trace test indicates no co-integration at the 0.05 level

Table 10: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No.of CE(s)	Eigen Value	Max-Eigen Statistic	0.05 Critical Value	Prob.
None	0.455244	32.19309	33.87687	0.0783
At most 1	0.309475	19.62607	27.58434	0.3676
At most 2	0.152881	8.793417	21.13162	0.8487
At most 3	0.108291	6.074643	14.26460	0.6037
At most 4	0.018757	1.003538	3.841466	0.3165

Note: Max-eigenvalue test indicates no co-integration at the 0.05 level

The results of co-integration suggest that the null hypothesis could not be rejected. The probability values for both tests (Trace and maximum Eigenvalue) are greater than 5 percent. In addition, the Trace test in Table 9 indicates that the null hypothesis cannot be rejected because the computed t-statistic of 67.69076 is less than the critical value of 69.81889. The trace statistics therefore present no co-integrating equation.

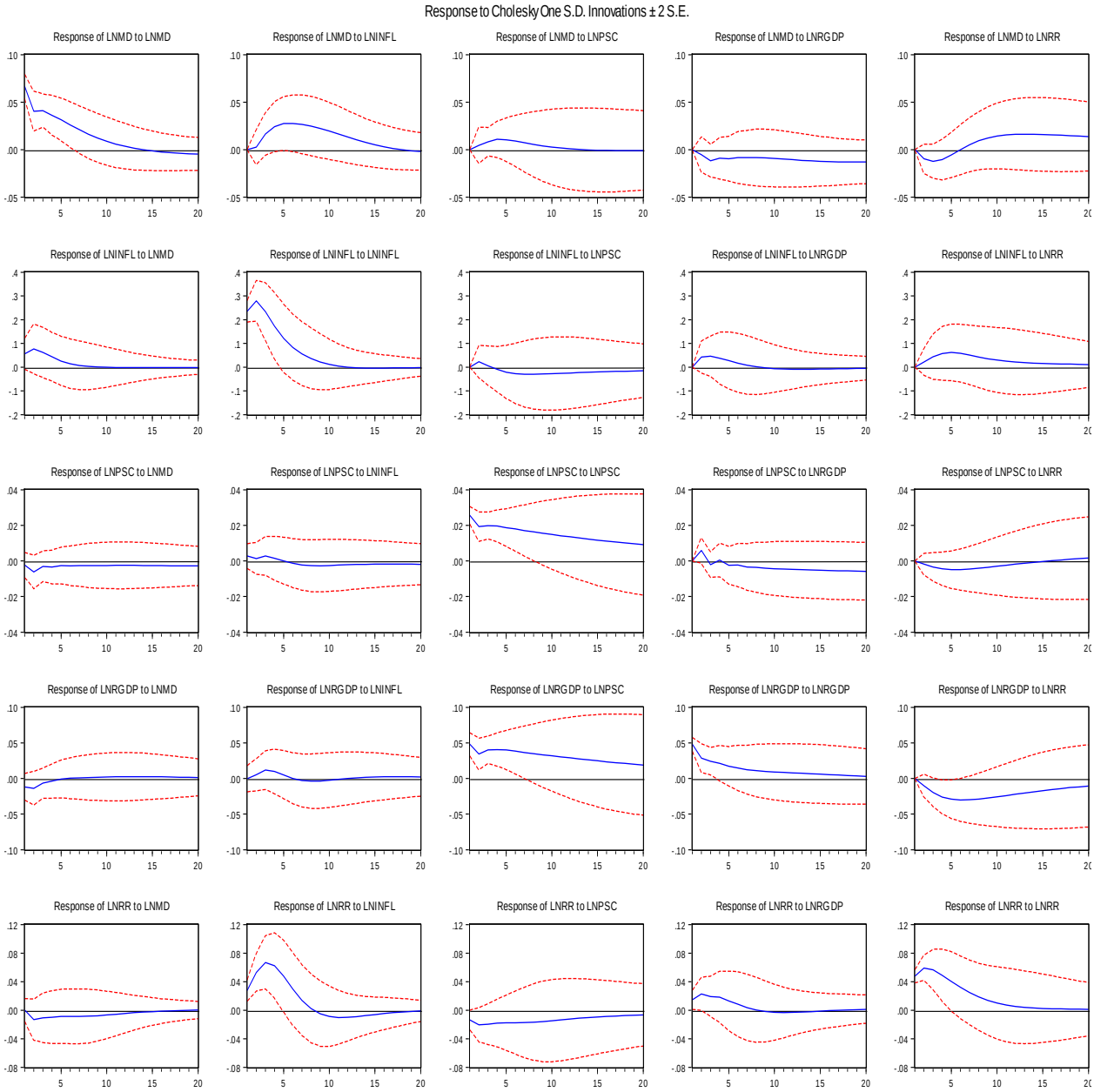
Table 10 shows that the null hypothesis cannot be rejected, the computed- Max-Eigen statistic value of 32.19309 is less than the critical values of 33.87687. To conclude, both tests present no co-integrating equations. This means that money demand (MD), real GDP (RGDP), inflation (INFL), repo rate (RR) and private sector credit extension (PSC) are not cointegrated. Since there is no co-integration among the variables, there is no need to proceed with the error correction model, which reconciles the long-run relationship with a short-run association. The results are the same as those obtained by Sheefeni (2013) using the Autoregressive Distributed Lag (ARDL)

to examine the demand for money in Namibia. He found that there was no co-integrating relationship among real money aggregates (M1 and M2), real income, inflation, and interest rates.

5.6 Impulse response function

The impulse response analysis is a device used to display the dynamics of the variables by tracing out the reaction of each variable to a particular shock at time *t*. In other words, impulse response functions (IRFs) allow the researcher, over time, to trace out the response of endogenous variables to the effects of their own shocks, as well as other related shocks in an underlying system of equations. The direction of the impact/effect and the relative importance between financial innovation and demand for money and other variables in the VAR system is established via a shock on each of the endogenous variables. Figure 3 exhibits the Cholesky asymptotic impulse response functions. The figure includes 25 small figures and each figure indicates the dynamic response of each target variable (LNMD, LNINFL, LNPSC, LNRGDP, and LNRR) to a one-standard-deviation shock on itself and other variables. The horizontal axis in each figure presents 20 quarters following a shock while the vertical axis measures the quarterly impact of a shock on each endogenous variable.

Figure 4: The impulse response functions



The numbering used below is horizontally where the first impulse response in the first row is numbered 3.1 and the second impulse response in the first row is numbered 3.2 and so on and so forth. Figure 3.1 presents the impulse response of demand for money from its own shock. A shock to money demand affects money demand negatively in the short run/run and in the long run, it has no effect on money demand. From a theoretical point of view, a negative shock to

money demand is likely to lead to a decrease in money demand and it seems as if this is what this figure is depicting. However, a positive shock to money demand is supposed to depict a positive response to money demand.

Figure 3.2 presents the impulse response of demand for money from a shock to inflation. The response is insignificant, it picks up from quarter one up to the fifth quarter and starts dropping slightly from the seventh quarter to the fifteenth quarter and thereafter the response becomes constant. From a theoretical point of view, a positive shock to inflation is supposed to lead to an increase in money demand in the short run and this is what the diagram depicts. In the long run a shock to inflation does not have an effect on money demand. This makes theoretical sense in a sense that in the long run after full adjustment by economic agents the central bank takes corrective measures to counteract the effects of inflation through tightening the monetary policy.

Figure 3.3 show that the private sector credit extension/financial innovation has a short-run positive effect on demand for money, which is insignificant. The response increases at a decreasing rate until the ninth quarter, and thereafter around the tenth quarter the response become constant. This figure depicts that financial innovation appears not to be significant in influencing money demand in the Namibian economy. The insignificance of financial innovation may be attributed to the proxy utilized. Instruments that form part of financial innovation such as automated teller machines, debit card and electronic banking .etc. are not incorporated and also domestic credit to the private sector as a percentage of GDP in Namibia is quite trivial, it was recorded at 46 percent only in 2010 (Ministry of Finance, 2012).

Figure 3.4 presents the impulse response of demand for money to real Gross Domestic Product. The response is insignificant and negative from the first quarter until the twentieth quarter. This result does not make sense in that we would expect real GDP to have a positive effect on money demand in the economy, but this is not the case. This could be because increase in income that is supposed to increase the demand for money negatively affects speculative demand for money as individuals do not take up opportunities of holding bonds as such the demand for speculative demand for money goes down as individuals rather demand money for transaction purposes.

Figure 3.5 indicates that repo rate has a negative insignificant short-run impact on demand for money only up to the sixth quarter. The response peaks up after the seventh quarter at an increasing rate and continues to increase at a steady rate until the twentieth quarter. What this means is that the repo rate only insignificantly affects money demand in the short run and in the long run the repo rate has no effect on the money demand. From a theoretical viewpoint, one would expect the interest rates to only affect money demand in the short run and in the long run, some corrective measures are adopted to correct the shock.

Figure 3.6 show that a shock to demand for money has a short-run positive effect on inflation. However, the effect starts declining from the second quarter up to the fifth quarter. Theoretically, a positive shock to money demand has the effect of increasing money demand in the short run and this is what this diagram depicts. Additionally, in the long run a shock to money demand has no effect on the inflation rate.

The impulse response of inflation to a shock of its own in figure 3.7 shows a positive effect in the short run. The effect declines sharply from the third quarter to the tenth quarter and then

levels off. Thus, a positive shock to inflation affects inflation in the short run and in the long run; the shock to inflation has no effect on inflation.

Figure 3.8 presents the impulse response of inflation to a shock in private sector credit extension. The response is positive in the first and second quarter and zero in the fourth quarter, after the fifth quarter the response will be negative. The figure shows that a shock to private sector credit extension does not have an effect on inflation.

Figure 3.9 presents the impulse response of inflation from a shock to real Gross Domestic Product. The response is insignificant, it picks up from quarter one and start slowing down to zero. This result is not surprising, since inflation for a long time was very low in Namibia. In fact, from 1980 to date inflation in Namibia averaged below the 10 percent mark, which implies that shocks to GDP may not have any big impact on the inflation rate in Namibia. The other reason could be the fact that the Namibian dollar is pegged to the South African rand, which gives stability to the price fluctuations in Namibia.

The response of inflation from a shock in repo rate in figure 3.10 indicates a positive short-run effect. The effect slightly increases from quarter one up to the fifth quarter. From the sixth quarter, the response of inflation moderately falls continuously until it becomes almost zero. The results are informing that a shock to the repo rate has a short run insignificant effect on inflation. Theoretically, this is true, because the repo rate adjustments normally have short run effects on inflation. The insignificance of the effects could be attributed to the reason explained previously that the Namibian dollar is pegged to the South African Rand.

Figure 3.11 presents a negative response of the private sector credit extension, both in the short-run and in the long run, from a shock to demand for money. A shock to money demand does not have any effect on private sector credit extension. This could be because of the size of the loans extended to the private sector annually. A big chunk of the market does not have access to the loans in Namibia mainly due to lack of collateral security.

Figure 3.12 presents a marginally short-run positive effect of private sector credit extension from a shock to inflation. The shock to inflation does not significantly affect private credit extension in Namibia for the reasons already explained above. The response of private sector credit extension to a shock of its own in figure 5.13 indicates a significant response in the short run, but in the long run, the response is insignificant.

Figure 3.14 and 3.15 present the response of private sector credit extension to a shock in real Gross Domestic Product and the repo rate respectively. Private sector credit extension is supposed to respond positively to a shock in GDP and negatively to a positive shock in the repo rate. The diagrams show that private sector credit extension responds positively to GDP in the first three quarters, after which it falls continuously. In addition, private sector credit extension falls in the short run, albeit insignificantly, after which it rises also within the insignificant range.

The response of real Gross Domestic Product from a shock to demand for money is shown in figure 3.16. The response is negative in the first five quarters and constant at zero. The size of private sector credit may be to blame for the insignificance in this case.

Figure 3.17 presents the response of real Gross Domestic Product to a shock to inflation. The impulse response of GDP to a positive shock is positive in the short run, after which it becomes zero.

The impulse response of real Gross Domestic Product to a shock to a private sector credit extension is shown in Figure 3.18. The effect is positive in both the short-run and long-run. In the first quarter, the response to real Gross Domestic Product drops slightly and then increases slightly up to the fourth quarter. As from the fifth quarter, the response starts to drop at a steady decreasing rate. Theoretically, a positive shock to private sector credit should lead to GDP responding positively and vice versa. Thus, the results portrayed in this figure are consistent with the theory.

Figure 3.19 presents the impulse response of real Gross Domestic Product from a shock of its own. The positive response will drop slightly from the second quarter and continue to drop at a steady rate. We can safely say that, a shock to GDP affects GDP in the short run, but in the long run, it has no effect. This is also theoretically sound. Figure 3.20 presents the impulse response of real Gross Domestic Product from a shock to a positive shock in the repo rate. The response is negative in the short-run, but has not significant effect in the long-run. This makes sense, because a general increase in the interest rates increases the cost of borrowing in the economy, which negatively affects GDP in the short run.

The impulse response of the repo rate to a shock in the demand for money is shown in figure 3.21. The impulse response of the repo rate is negative in the short run and insignificant and zero

in the long-run. This could be explained by the fact that the repo rate is very low in Namibia, due to the fact that the inflation rate is also very low and stable for the reasons explained earlier on.

The response of repo rate to a shock in inflation rate is shown in figure 3.22. The response of the repo rate is positive in the short run and negative in the long-run. These results clearly indicate that a positive shock to inflation affects the repo rate only in the short run and in the long run, the effect is insignificant. This is true because an increase in inflation normally leads to an increase in the interest rates as the monetary authority attempts to reign in inflation.

Figure 3.23 presents a negative impact on repo rate from a shock to private sector credit extension in both the short and long-run. In fact, the shock to private sector credit does not significantly affect the repo rate. This could be due to the insignificance of the private sector credit in Namibia, given the fact that the majority of the population does not have access to credit in Namibia due to collateral requirements..

Figure 3.24 presents a positive short-run effect of repo rate from a shock to real Gross Domestic Product. The response remains positive up to the eighth quarter and it becomes zero afterwards. In the long run, a shock to the repo rate does not affect real Gross Domestic Product. Theoretically a positive shock to the repo rate is supposed to lead to an increase or decrease in the inflation rate, which in turn leads to an increase or decrease in the repo rate. Therefore, the fact that repo rate initially rises and then falls in response to a shock in real GDP is theoretically sound.

The response of the repo rate on its own shock in figure 3.25 indicates a positive short-run effect. Initially, in the first three quarters, the repo rate responds by increasing up to the third quarter, and then falls until the fifteenth quarter. As from the fifteenth quarter, the impact of a shock of the repo rate to itself is zero. In other words; a shock to the repo rate affects the repo rate in the short run only.

The information summarized above indicates that private sector credit only affects money demand in the short run, albeit, insignificantly. This implies that financial innovation may not be having an impact on money demand in Namibia. In addition, a shock to money demand does not seem to affect private sector credit in Namibia. This means that money demand in the case of Namibia is not affected by financial innovation. As explained earlier on private sector credit (the proxy for financial innovation) is small in Namibia and this could be the reason why a shock to money demand is not affecting financial innovation and a shock to financial innovation is not affecting money demand in Namibia.

5.7 Forecast error Variance decomposition results

According to Reside (2001), analysis of forecast error variance decomposition examines various forecast horizons, to determine the variables that are important in explaining movements in other variables and themselves in a VAR model. The result of the forecast error variance decomposition is shown in the following table below.

Table 11: Variance decomposition results

Variance Decomposition of LNMD)					
Variance period (Quarters)	**LNMD**	**LNINFL**	**LNPSC**	**LNRGDP**	**LNRR**
2	97.61675	0.108000	0.316431	0.445055	1.513764
5	79.15052	12.64005	2.433176	2.706227	3.070032
8	68.75572	22.05623	2.819460	3.359048	3.009547
11	61.81034	25.46361	2.604243	4.360662	5.761146
14	57.28391	25.22313	2.414181	5.923375	9.155401
17	54.04745	23.91675	2.283810	7.811688	11.94030
20	51.49901	22.70930	2.179818	9.651542	13.96033
Variance Decomposition of LNINFL					
Variance period (Quarters)	**LNMD**	**LNINFL**	**LNPSC**	**LNRGDP**	**LNRR**
2	6.180160	91.92425	0.344466	1.234997	0.316132
5	5.779381	87.94860	0.402604	2.287802	3.581611
8	5.420467	85.07400	1.244362	2.234846	6.026320
11	5.314792	83.61106	1.994930	2.230775	6.848447
14	5.265008	82.76320	2.528017	2.294309	7.149467
17	5.234013	82.21779	2.896829	2.341270	7.310095
20	5.213634	81.85108	3.156409	2.363216	7.415664
Variance Decomposition of LNPSC					
Variance period (Quarters)	**LNMD**	**LNINFL**	**LNPSC**	**LNRGDP**	**LNRR**
2	3.990115	0.824769	91.87845	3.022113	0.284552
5	3.113202	0.808018	91.64353	1.913432	2.521817
8	2.805600	0.986430	90.36208	2.249271	3.596615
11	2.741121	1.274641	89.20356	3.193046	3.587631
14	2.797751	1.370298	88.28081	4.302069	3.249072
17	2.941001	1.427500	87.13942	5.538373	2.953704
20	3.143017	1.504638	85.65383	6.873753	2.824760
Variance Decomposition of LNRGDP					
Variance period (Quarters)	**LNMD**	**LNINFL**	**LNPSC**	**LNRGDP**	**LNRR**
2	4.714061	0.378978	49.15593	44.28703	1.463998
5	2.534003	1.836417	53.77683	28.84240	13.01035
8	1.743738	1.356470	54.48886	21.90744	20.50349
11	1.460508	1.169752	55.00809	18.65254	23.70911
14	1.351659	1.044450	55.75635	16.96997	24.87757
17	1.296567	1.014509	56.51929	15.98315	25.18649
20	1.257469	1.011235	57.21603	15.34405	25.17122
Variance Decomposition of LNRR					
Variance period (Quarters)	**LNMD**	**LNINFL**	**LNPSC**	**LNRGDP**	**LNRR**
2	1.630735	32.98605	5.705032	6.583496	53.09469
5	1.515989	46.01174	5.377309	5.112896	41.98207
8	1.978644	43.48274	7.285620	4.719283	42.53372
11	2.292371	42.42071	8.813177	4.610841	41.86290
14	2.361525	42.22872	9.672611	4.579913	41.15723
17	2.359695	42.05839	10.20974	4.546370	40.82580
20	2.349724	41.89504	10.57397	4.530910	40.65036

Note: The variance decomposition of each variable is presented from two-quarter horizon to 20 quarters

Table 11 shows the variance decomposition of money demand. The results indicate that in the second quarter money demand variations are to a large extent explained by money demand (97.6%) and all the other variables including the proxy for financial innovation are not significant. However, after 20 quarters 51.5 percent of the variation in money demand is explained by money demand. In addition, the other variables such as inflation, repo rate, and real GDP become increasingly important in explaining money demand and they explain 22.7 percent, 13.9 percent, and 9.6 percent in the 20th quarter, respectively. Just as the impulse response functions indicated, private sector credit is insignificant in explaining variations in money demand. This means that financial innovation is also impotent in explaining money demand in the long run.

The variance decomposition for inflation shows that inflation is explained by itself in both the short run and long run. In addition, all the other variables explain less than ten percent of the variance decomposition of inflation. Furthermore, the financial inovation variable is also not important in explaining the variations in inflation.

The variance decomposition for private sector credit (proxy for financial innovation) is mainly accounted for by itself in both the short run and long run. In the second quarter 91.9 percent of the variation in financial innovation is explained by itself and each of the other variables explain less than four percent of the variation. In addition, in the 20th quarter, about 86 percent of the variation in financial innovation is explained by financial innovation itself and all the other variables each explain less than 7 percent of the variation. Just like the results obtained under the impulse response analysis, variations in financial innovation appear not to be influenced by the

other variables included in the VAR model. As explained earlier, this could be due to the size of the private sector credit in Namibia.

Variance decomposition of real GDP in the short run, that is, in the second quarter is mainly explained by financial innovation (about 49 percent) and real GDP (44 percent). However, after 20 quarters the influence of financial innovation on variations in GDP increases to 57.2 percent. Moreover, the influence of GDP on itself decreases to 15.3 percent and the influence of the repo rate on real GDP increases from 1.46 percent to 25.17 percent. The impact of the repo rate appears to have a lag of at least one year. Inflation and money demand do not influence the variation in real GDP in both the short run and long run.

The variance decomposition of the repo rate shows that in the short run it is mainly affected by itself (53 percent) and by inflation (about 33 percent). The other three variables, namely money demand, financial innovation and real GDP each explain less than 7 percent of the variation in the repo rate. After 20 quarters, the variation in the repo rate is explained by inflation (42 percent), the repo rate (41 percent), and financial innovation (10.6 percent). Money demand and real GDP still does not have any effect in the variations of the repo rate in the long run.

5.8 Conclusion

The current chapter discusses various issues that relate to the empirical analysis of the VAR model. The first tests done were meant to test for unit roots. The Augmented Dickey Fuller tests and the Phillips-Perron tests were applied to the same variables and both tests concur that all the variables used in the current study are integrated of order 1 meaning that they need to be differenced once for them to become stationary. The chapter also tested for the VAR stability

condition using the inverse roots table and circle. The study found that all the roots lie within the circle, which implies that the model specified and estimated, is stable and, therefore, can be used for further analysis. The model was tested for cointegration and it was established that the variables are not cointegrated. The last parts of the chapter comprehensively dealt with impulse response analysis and variance decomposition analysis.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of results

The impulse response shows that private sector credit extension (financial innovation) has a short-run positive effect on demand for money, which is insignificant. Financial innovation does not significantly influence money demand in the Namibian economy.

The study found out that a shock to GDP does not have any significant effect on money demand. This result does not make sense in that we would expect real GDP to have a positive effect on money demand in the economy. The results show that a positive shock to money demand has the effect of increasing inflation in the short run. Additionally, the results also show that in the long run a shock to money demand has no effect on the inflation rate. A positive shock to inflation affects inflation in the short run and in the long run the shock to inflation has no effect on inflation, while a shock to private sector credit extension does not have an effect on inflation. The results show that a shock to the repo rate has a short run insignificant effect on inflation. This is true theoretically, since repo rate adjustments normally have short run effects on inflation.

The shock to inflation does not significantly affect private sector credit extension. The response of private sector credit extension to a shock of its own indicates a significant response in the short run and in the long run, the response is insignificant. Private sector credit extension responds positively to shocks to GDP in the first three quarters, after which it falls continuously. The response of real Gross Domestic Product from a shock to demand for money is negative in the first five quarters and it is insignificant in the long run. The impulse response of GDP to a positive shock in inflation is positive in the short run, after which it becomes zero while the

impulse response of real Gross Domestic Product to a shock to private sector credit extension is positive in both the short-run and long-run.

The variance decomposition results, on the other hand, indicate that in the second quarter money demand variations are to a large extent explained by money demand (97.6 percent) and all the other variables including the proxy for financial innovation are not significant, asonly about 31 percent of variations is attributed by financial innovation. However, after 20 quarters 51.5 percent of the variation in money demand is explained by money demand and 2.7 percent is explained by financial innovation. The variance decomposition for inflation shows that inflation is explained by itself in both the short run and long run. In addition, all the other variables explain less than ten percent of the variance decomposition of inflation. Furthermore, the financial innovation variable is also not important in explaining the variations in inflation.

The variance decomposition for private sector credit extension (proxy for financial innovation) is mainly accounted for by itself in both the short run and long run. In the second quarter 91.9 percent of the variation in financial innovation is explained by itself and each of the other variables explain less than four percent of the variation. In addition, in the 20^{th} quarter, about 86 percent of the variation in financial innovation is explained by financial innovation itself and all the other variables each explain less than 7 percent of the variation. Variance decomposition of real GDP in the short run, that is, in the second quarter is mainly explained by financial innovation (about 49 percent) and real GDP (44 percent). However, after 20 quarters the influence of financial innovation on variations in GDP increases to 57.2 percent. Moreover, the influence of GDP on itself decreases to 15.3 percent and the influence of the repo rate on real GDP increases from 1.46 percent to 25.17 percent. The variance decomposition of the repo rate

shows that in the short run it is mainly affected by itself (53 percent) and by inflation (about 33 percent). The other three variables, namely money demand, financial innovation and real GDP each explain less than 7 percent of the variation in the repo rate. After 20 quarters, the variation in the repo rate is explained by inflation (42 percent), the repo rate (41 percent), and financial innovation (10.6 percent).

6.2 Conclusion

The main purpose of the study was to study the effects of financial innovation on demand for money in Namibia. The information summarized above indicates that private sector credit extension only affects money demand in the short run, albeit, insignificantly. This implies that financial innovation may not be having an impact on demand for money in Namibia, the study also indicates that there is convergence in the variables that explains demand for money, which implies stability of demand for money in Namibia. In addition, we also see that a shock to money demand does not seem to affect financial innovation in Namibia. This means that demand for money in the case of Namibia seems not to be affected by financial innovation. As explained earlier on private sector credit extension (the proxy for financial innovation) a big chunk of the market does not have access to the loans in Namibia mainly due to lack of collateral security in addition, private sector credit extension may not be comprehensive enough to capture all the elements of financial innovation in Namibia This could be the reason why financial innovation is insignificant on demand for money in Namibia.

6.3 Policy Recommendations

Based on the results obtained from the impulse response, inclusion of financial innovation to model the demand for money in Namibia need cautious consideration as financial innovation

was insignificant in the model. This is to say that, financial innovation does not have a significant impact on the demand for money function in Namibia hence; there is a need for further inquiry, to establish why the financial innovation has no significant impact on money demand in Namibia empirically. However Policies to deepen the financial market in Namibia by way of promoting financial intermediation between savers and investors in the economy need to be pursued like the Namibia Financial Sector Strategy 2010-2020 which aims to develop capital and financial markets, enhance ownership of financial institutions, ensure access to finance by consumer, protection of consumers and enhancing financial literacy. Financial sector deepening smoothen credit allocation, encourage savings, and reduce constraints on capital accumulation by economic agents. This can be envisaged to increase demand for money and promote economic growth in the short-run.

6.4 Areas for further research

This study looked at the effects of financial innovation on the demand for money function in Namibia as well as other determinants of demand for money, such as real GDP, inflation, and the repo rate. Further research can be carried out to improve the results obtained. A different proxy for financial innovation, such as compilation of a financial innovation index, M2/M1 may be utilized on the same model employing a different econometric technique like the Autoregressive Distributed Lag (ARDL). In addition, examination of the impact of financial innovation on economic growth may be considered also as a further area to be researched on.

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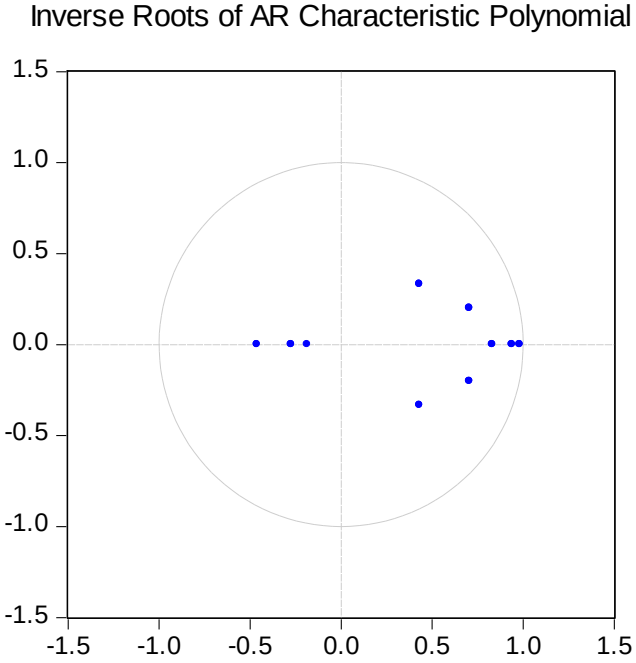
APPENDIX 1: INVERSE ROOTS OF AR CHARACTERISTIC POLYNOMIAL



APPENDIX 2: VAR MODEL RESULTS

Vector Autoregression Estimates
Date: 10/12/14 Time: 15:47
Sample (adjusted): 2000Q3 2013Q4
Included observations: 54 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNMD	LNINFL	LNPSC	LNRGDP	LNRR
LNMD(-1)	0.575383	0.301230	-0.057961	-0.134323	-0.269557
	(0.14690)	(0.53191)	(0.05699)	(0.15217)	(0.12816)
	[3.91683]	[0.56631]	[-1.01704]	[-0.88271]	[-2.10323]
LNMD(-2)	0.127911	-0.044622	0.035192	0.028504	0.169202
	(0.13662)	(0.49467)	(0.05300)	(0.14152)	(0.11919)
	[0.93628]	[-0.09021]	[0.66399]	[0.20142]	[1.41960]
LNINFL(-1)	0.033171	1.137626	0.004917	0.048302	0.083361
	(0.04451)	(0.16118)	(0.01727)	(0.04611)	(0.03884)
	[0.74518]	[7.05797]	[0.28472]	[1.04750]	[2.14644]
LNINFL(-2)	0.056475	-0.484520	0.002038	0.032877	-0.045806
	(0.05056)	(0.18308)	(0.01962)	(0.05238)	(0.04411)
	[1.11694]	[-2.64645]	[0.10389]	[0.62770]	[-1.03836]
LNPSC(-1)	0.153365	-0.277222	0.482667	-0.005313	-0.313240
	(0.45859)	(1.66050)	(0.17791)	(0.47504)	(0.40010)
	[0.33443]	[-0.16695]	[2.71298]	[-0.01118]	[-0.78291]
LNPSC(-2)	0.276869	0.028139	0.541762	0.150604	0.397062
	(0.45245)	(1.63828)	(0.17553)	(0.46868)	(0.39474)
	[0.61193]	[0.01718]	[3.08645]	[0.32133]	[1.00588]
LNRGDP(-1)	-0.048242	0.741591	0.131620	0.654128	0.095516
	(0.19098)	(0.69152)	(0.07409)	(0.19783)	(0.16662)
	[-0.25261]	[1.07241]	[1.77646]	[3.30650]	[0.57325]
LNRGDP(-2)	-0.133440	-0.653969	-0.175385	0.173569	-0.173288
	(0.19870)	(0.71949)	(0.07709)	(0.20583)	(0.17336)
	[-0.67156]	[-0.90894]	[-2.27515]	[0.84326]	[-0.99959]
LNRR(-1)	-0.205225	0.451686	-0.037680	-0.215257	1.248632
	(0.16283)	(0.58961)	(0.06317)	(0.16868)	(0.14206)
	[-1.26033]	[0.76608]	[-0.59646]	[-1.27616]	[8.78916]
LNRR(-2)	0.093768	0.052302	0.007072	-0.053742	-0.448007
	(0.16143)	(0.58453)	(0.06263)	(0.16722)	(0.14084)

	[0.58085]	[0.08948]	[0.11292]	[-0.32138]	[-3.18094]
C	0.793978	-1.627483	0.519548	1.778991	1.365708
	(0.95762)	(3.46744)	(0.37151)	(0.99197)	(0.83547)
	[0.82912]	[-0.46936]	[1.39848]	[1.79339]	[1.63465]

APPENDIX 3: CO-INTEGRATION RESULTS

Date: 10/12/14 Time: 15:56
Sample (adjusted): 2000Q4 2013Q4
Included observations: 53 after adjustments
Trend assumption: Linear deterministic trend
Series: LNMD LNINFL LNPSC LNRGDP LNRR
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.455244	67.69076	69.81889	0.0730
At most 1	0.309475	35.49767	47.85613	0.4220
At most 2	0.152881	15.87160	29.79707	0.7213
At most 3	0.108291	7.078181	15.49471	0.5686
At most 4	0.018757	1.003538	3.841466	0.3165

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.455244	32.19309	33.87687	0.0783
At most 1	0.309475	19.62607	27.58434	0.3676
At most 2	0.152881	8.793417	21.13162	0.8487
At most 3	0.108291	6.074643	14.26460	0.6037
At most 4	0.018757	1.003538	3.841466	0.3165

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values