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MONETARY APPROACH TO BALANCE OF PAYMENTS – THE CASE OF
BOTSWANA

BY

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DECLARATION

I the undersigned declare that the work presented in this dissertation has not been submitted to any institution for any degree. It is original work except where acknowledged.

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APPROVAL

This dissertation has been examined and approved as meeting the requirements for the partial fulfillment of Masters of Arts Economics Degree.

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DEDICATION

To my loved ones, my late mother and sister who would have been very proud of me.

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LIST OF ACRONYMS

ADF: Augmented Dickey Fuller

BOB: Bank of Botswana

BOBCs: Bank of Botswana Certificates

BOP: Balance of Payments

BPM: Balance of Payments Manual

ECM: Error Correction Model

GDP: Gross Domestic Product

IMF: International Monetary Fund

IRF: Impulse Response Function

MABOP: Monetary Approach to Balance of Payments

NDP: National development Plan

OLS: Ordinary Least Squares

OMO: Open Market Operations

PP: Phillips Perron

REER: Real Effective Exchange Rate

SACU: Southern African Customs Union

VAR: Vector Autoregression

VECM: Vector Error Correction Model

ABSTRACT

This study examines the applicability of monetary approach to balance of payments in Botswana for the period 1995-2013. The study employs Cointegration and Vector Error Correction Model (VECM) to examine whether monetary variables influence balance of payments. Only two relationships were established at the 5 percent level of significance. Net foreign assets and inflation reflected a negative relationship while interest rates were found to have a positive relationship with net foreign assets. Although non-mining GDP was found to be statistically insignificant the results showed that it is negatively related to balance of payments which confirmed the role of mining to the economy of Botswana. The results of VECM confirm that although some monetary variables suggested by monetary approach to balance of payments play a significant role, balance of payment in Botswana is not a purely monetary phenomenon, a finding which is in line with similar studies in other countries. The simultaneous use of both fiscal and monetary policies (policy mix) is therefore recommended to correct BOP disequilibrium in Botswana.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The term balance of payments (BOP) refers to an account that shows a country's economic transactions or interaction with the rest of the world for a given period, normally a year. The BOP represents the intersection of trade and finance and illustrates the relationship of a given economy with the rest of the world. It entails purchases and sales of goods and services, gifts, government transactions and capital movements. The presentation of the account is normally divided into the current account (primarily consists of goods and services), the capital account (foreign-held and domestic-held assets) and the official settlement balance account. The purpose of the latter component is to balance out the disparities between the current and capital account.

Despite the structural adjustment and stabilization programmes offered by the IMF and the World Bank in the 1970s and 1980s most developing countries continued to experience balance of payments deficits. Most of the BOP problems among these countries stemmed from the basic obstacles they faced in trying to become industrialized. Another common cause of BOP disequilibrium faced by these countries was monetary imbalance caused by an excessive rate of credit creation (IMF Working Paper, 1997) Inflationary pressures resulting from excessive credit expansion often give rise to price-cost disparity which tends to impair a country's competitive position. Other causes of balance of payments disequilibrium include structural changes such as the loss of major exports markets and terms of trade deterioration. Balance of payments adjustment mechanisms are needed to restore equilibrium in the BOP. The mechanism can be automatic (economic processes) or discretionary (government policies). An automatic adjustment under a fixed exchange rate system involves the manipulation of prices, interest rates, income and money, IMF Working Paper (1997).

Since the discovery of diamonds shortly after gaining independence in 1966, the country which is dubbed the world's largest producer of diamond by value has consistently

accumulated large amounts of BOP surpluses largely due to trade inflows from diamond sales. Exports of goods and services contributed around 40 percent to GDP over the past decade, while the trade and current account balance surpluses averaged around 12 % and 10 % of GDP, respectively, between 1998 and 2008 (Phetwe, 2014). The large and persistent foreign exchange inflows especially from diamond sales had the potential to induce excess money supply and currency appreciation pressures which could have affected economic growth.

Persistent disequilibrium in the balance of payments (whether deficit or surplus) is not desirable as it can lead to macroeconomic instability. Policy makers and regulators are therefore constantly trying to correct any imbalances in the most efficient manner. Governments will explicitly or implicitly calculate the optimum combination of policies depending on their relative costs (Bird, 2004). Literature has identified three main BOP adjustment mechanisms namely elasticity and absorption approaches (traditional) as well as the monetary approach. The main distinction between the three approaches is that while the absorption and elasticity approaches consider the flow equilibrium only, the monetary approach focuses on the stock-flow equilibrium with more emphasis on the stock equilibrium for money, Ardalan (2003).

The monetary approach asserts that BOP is a monetary phenomenon and therefore it requires analysis with the tools of monetary theory and not "real trade" (Frenkel and Johnson, 1977). According to Johnson, the theory views money as a stock while real trade deals with flows, therefore an adequate theory must integrate both stocks and flows. The approach postulates that money stock is a function of credit creation and international reserve flows. Although the BOP is made up of various accounts, the monetary approach is mainly concerned with the official settlement balance account. When the monetary authorities of a country are purchasing foreign exchange assets in order to prevent the appreciation of the domestic currency it implies that the official settlement balance account is in surplus. Similarly when the account is in deficit, monetary authorities sell the domestic currency in order to prevent depreciation of the domestic currency. This therefore means that the analysis of BOP makes more sense in an explicitly monetary model, Mussa (1974).

The monetary approach to balance of payments is the most appropriate approach for a country as small as Botswana. The price elasticity of demand for goods and services plays an

insignificant role in Botswana's BOP since as a small open economy; the country is a price taker in the international trade market. Botswana's absorptive capacity has also been dubbed low and hence has no effect on the BOP (Harvey, 1985). In view of this, it can be argued that the elasticity and absorptive approaches to BOP adjustment are not applicable in Botswana leaving monetary approach as the only feasible BOP adjustment mechanism. Literature review also suggests that in small and developing countries where there is a problem of data and the economy is not fully monetized, the monetary approach to balance of payments is the best tool to study the balance of payments problem. This research hence attempts to investigate the applicability of the monetary approach to balance of payments adjustment in Botswana.

1.2 Statement of the Problem

Countries that are not self-sufficient require substantial amounts of foreign exchange reserves in order to fulfil the world demand for it. Net importers like Botswana need good management of foreign exchange reserves as they are used to cover import bills. Excessive accumulation of reserves however increases domestic money supply which in turn affects macroeconomic variables such as interest rates, production, employment, imports, exports, price level and exchange rates, ultimately affecting a country's balance of payments. Many developing countries whose economies are mainly mineral-driven face the "Dutch disease" problem. This is a condition where excess money supply due to a booming mineral resource export sector results in balance of payment deficit due to exchange rate appreciation (Lewin, 2011). Income derived from these exports in this case induces consumption and expenditure resulting in excess demand for tradables and hence imports.

Over the past two decades Botswana consistently maintained a current account surplus except during periods of global recession and hence low mineral exports. The revenues from Southern African Customs union (SACU) which constituted about 30 % of the annual gross domestic product (GDP) in 2012 (Bank of Botswana Annual Report, 2012) contributed to the BOP surplus however diamond sales were the main source of the reserve build-up. During the period 1998-2008 alone, the trade and current account balance surpluses averaged around 12 percent and 10 percent of GDP respectively (Phetwe, 2014). The combination of recurring current account surplus and hence excess liquidity, a fixed exchange rate framework, limited absorptive capacity and partial sterilization resulted in a surge in the liquidity surplus in Botswana's financial system (Phetwe, 2014). This gave rise to concerns that the excess

liquidity could lead to increased domestic credit, negative real interest rate, high inflation, real exchange rate appreciation and deterioration in the non-mineral trade account. A rise in liquidity could result in a reduction in interest rates and banks compete for depositors. This in turn makes borrowing cheaper and hence increases domestic credit. Demand pressures due to increased liquidity result in price level increases which drives inflation up. As prices rise the domestic currency begins to appreciate hence reducing the competitiveness of the domestic commodities with the world. Other problems associated with excess liquidity include an increase in loan advancing to unworthy borrowers, downward pressure on interest rates and banks may turn away interest bearing deposits.

Over the years Botswana has had some success in managing excess liquidity, however for the larger part of the period under study inflation has remained above the medium term range of 4-7%. To mop out excess liquidity some the mechanisms the monetary authorities employed were open market operations (OMO) through the Bank of Botswana Certificates (BoBCs), the bank rate and the reserve requirement. The use of BoBC proved to be even more effective as most financial institutions were keen to participate in OMO, however the primary use of BoBCs was being abused. During the height of the BoBCs era banks preferred to hold BoBCs not because of their primary purpose but because they offered a risk-free investment vehicle that attracted substantial interest rates. Banks were no longer focused on securing deposits and increasing their loan book as a way of making profit as the BoBCs provided a better alternative. In 2006 Bank of Botswana made a decision to reduce the issuance of the market BoBC from P17.5 billion in 2008 to P5.5 billion in December 2013 in the market, BOB annual report (2013). The reduction led to a rise in the price of BoBCs and hence a decline in interest rates earned from them. This therefore meant that banks had to seek alternative source of income and hence the banks lent out more.

The combined effect of reduction in BoBCs interest rates and the bank rate meant investing in Botswana became less attractive as institutional fund investors now seek better returns in other countries. As deposits declined the loan to deposit ratio fell from 47% in 2007 to 82% in 2013. A need to attract more deposits has thus resulted in heightened competition among banks and should this trend continue it is feared that interest rates may be pushed up independent of the monetary policy. Limited deposits imply limited credit and this has the potential to reduce production and hence exports eventually affecting the balance of payments. In view of the foregoing developments in the management of excess liquidity, it is

important to re-establish the effectiveness of monetary variables/tools in curbing the problem of excess money supply in Botswana.

According to BOB annual report (2008), diamonds constituted about 80 percent of exports with mineral revenue accounting for about 50 percent of government revenues in 2008. The diamond industry is projected to start declining in 2016 and by 2029 the diamonds are expected to be depleted, Lewin (2011). If the predictions are to be accurate it is important for policy makers in Botswana to identify the appropriate measures that will be taken in case of BOP deficits. This study therefore further investigates the impact of non-mining GDP on balance of payments. The outcome is expected to show the contribution of non-mineral sector to balance of payments. This study also aims to re-affirm empirical studies covering the years 1976 to 1994 which indicated that monetary approach was an appropriate tool for analysing BOP and economic growth.

1.3 Objectives of the study

1.3.1 General Objective
The primary objective of the study is to investigate the applicability of monetary approach to balance of payments in Botswana.

1.3.2 Specific Objectives

i. To determine whether there is a long-run relationship between net foreign assets and domestic credit, interest rate, inflation, real GDP and real exchange rate
ii. To determine whether there is causality among variables, net foreign assets, GDP, domestic credit, inflation rate, interest rates and exchange rates
iii. To determine the effects of changes in domestic credit, interest rate, inflation, real GDP and real exchange rate on net foreign assets
iv. To make policy recommendations

1.4 Significance of the Study

The empirical studies analysing monetary approach to balance of payments in Botswana by Fidzani (1982) and Ngwenya (1997) were for the period between 1976 and 1994. More investigations are therefore required to establish whether the same conclusions that were

reached during that period could be reached during the period under study. Diamond mining has been the main catalyst of the trade balance and current account surpluses over the years. This therefore implies that studies undertaken have mainly based their investigations on BOP surpluses. The contribution of this study to previously done studies will therefore be the analysis of the monetary approach on BOP excluding the contribution of the diamond inflows. The investigations will help to inform authorities on appropriate measures to undertake when faced with both BOP surplus and deficit.

1.5 Organization of the Study

The study is organized into six chapters. Chapter one presents the background of the study, statement of the problem, the objectives of the study as well as the significance of the study. Chapter two gives a brief review of the economic developments with the main focus being balance of payments and the monetary policy. Chapter three presents theoretical literature on the three theories of balance of payments while empirical literature review focuses on empirical evidence on monetary approach to balance of payments. Chapter four discusses the methodology adapted in the study as well as data analysis or estimation methods while chapter five presents the results and their interpretation. Finally chapter six offers the summary and conclusion of the study, limitations and areas of further research.

CHAPTER TWO

REVIEW OF THE ECONOMY

2.1 Introduction

At independence, beef was the main export and largest sector in the economy contributing about 40% of the GDP. At the time the government budget was dominated by international aid, which was the country's main source of foreign exchange. The mineral wealth from the diamond mining sector (contributing about 35% of GDP) soon attracted a lot of foreign capital which contributed vastly to Botswana's extraordinary growth. This led to consistent balance of payments surpluses and accumulation of substantial foreign exchange reserves, which currently (2014) represents around 18 months of imports. The country's good governance and economic management prevented the economy from falling prey to the resource curse as was experienced by other developing countries.

2.2 Balance of Payments

Botswana remains the world's largest diamond producer by value at the present moment. Revenues from diamond exports have contributed to the relatively high GDP growth and positive current account balance over the years. While the country has progressed in reducing its reliance on diamonds over the past 20 years (BOB Annual Report, 2012), diamond exports still remain the largest contributor to the current account and GDP. The level of economic diversification needed to diminish dependence on diamonds remains substantially low. Table 2.1 presents a summary of balance of payments from 1995 to 2013. The table shows that Botswana has maintained a positive current account balance from 1995 to 2008. However the trade balance and services account displayed negative balances which contributed to the current account deficit from 2009 to 2012. The negative balances have been attributed to the global financial crisis which occurred within the same period. Diamond exports make about 70-80% of exports earnings and about a third of government earnings; hence a fall in demand for diamonds was a critical factor in the sharp economic contraction of 2009-2012.

The services account which covers payments related to transportation, travel and other was in deficit for most of the period except the period between 2003 and 2008. The deficit has been mainly attributed to heavy dependence on imports which is highly associated with transportation costs. In 2005 the services account was highest at P1, 255 million, this was a result of growing surpluses in the travel account in the prior years. The travel account surpluses reflected an increase in travel related spending by non-residents which offset transportation costs (BOB Annual Report, 2007). The capital account showed a positive trend from 1995 after which it registered negative balances from 2003 to 2007. The negative figures were a result of reclassification of grants received by government from capital account to current transfers (BOB Annual Report, 2012). The capital account now records transfer by migrants which were significant in most years. The net current transfers account registered a deficit in 1995 following which it recorded surpluses. The account surpluses were attributed to SACU receipts.

Table 2.1 Summary of Balance of Payments (BWP millions)

Year	Trade Balance	Balance on services	Net Current Transfers	Balance on current a/c	Balance on capital a/c	Net Errors and Omission	Overall Balance
1995	1,538	(510)	(108)	831	40	(186)	591
1996	2,493	(602)	595	1,643	21	(83)	1,722
1997	3,269	(841)	735	2,634	62	(398)	2,318
1998	328	(988)	1,015	860	134	117	256
1999	3,629	(721)	1,164	2,859	95	2	1,829
2000	4,603	(1,136)	1,108	2,782	194	(6)	1,941
2001	4,149	(1,010)	1,153	3,491	34	474	1,023
2002	4,280	(127)	1,344	1,078	99	533	336
2003	3,449	174	1,535	3,703	(42)	457	797
2004	3,036	871	2,229	1,659	(39)	4	518
2005	8,123	1,255	3,227	8,334	(44)	624	7,036
2006	10,159	1,151	4,615	11,414	(48)	284	10,256
2007	7,094	747	6,837	10,147	(51)	2,072	10,694
2008	(2,304)	(1,414)	8,302	269	-	2,563	7,452
2009	(9,480)	(3,070)	6,101	(8,152)	-	2,181	(4,563)
2010	(6,825)	(2,985)	7,942	(5,602)	23	954	(6,511)
2011	(4,982)	(2,317)	7,463	(605)	3	(2,251)	3,430
2012	(14,772)	(3,129)	13,395	(4,331)	-	4,136	(862)
2013	2,027	(2,098)	13,853	12,890	-	(3,835)	1,340
Source: BOB Annual Reports 1998-2013							

2.3 Foreign Exchange Reserves

The consistent current account surplus (except during the global crisis) resulted in the accumulation of a significant stock of reserves amounting to about 80 % and 54 % of GDP in 2006 and 2014 respectively. Between 2001 and 2002 the foreign exchange reserves fell by 27% from P41 billion to P30 billion. This was mainly due to payments to the funding of public officers pension fund and a fall in equity values of major international markets. In 2005 the foreign exchange reserves which make up a substantially large percentage of net foreign assets grew by a massive 42% from P24 billion in 2004 to P34 billion. The growth was a result of favourable diamond prices and growth in domestic currency value. The reserves continued to grow until they reached their highest at P68 billion in 2008. The following year the reserves fell by 15.6% as a result of net outflows arising from the overall BOP deficit particularly the contraction of exports. Depreciation of the Pula against the SDR and US dollar led to an 18.7% increase of foreign exchange reserves from P50 billion in 2010 to P59 billion in 2011. The foreign exchange reserves increased by 14% from P58 billion in 2012 to P66 billion in 2013. The increase is attributed to net inflows mainly due to SACU receipts. The Pula depreciation against currencies in which reserves are held also contributed to the increase.

**Figure 2.1: Foreign Exchange Reserves in P (billions)**
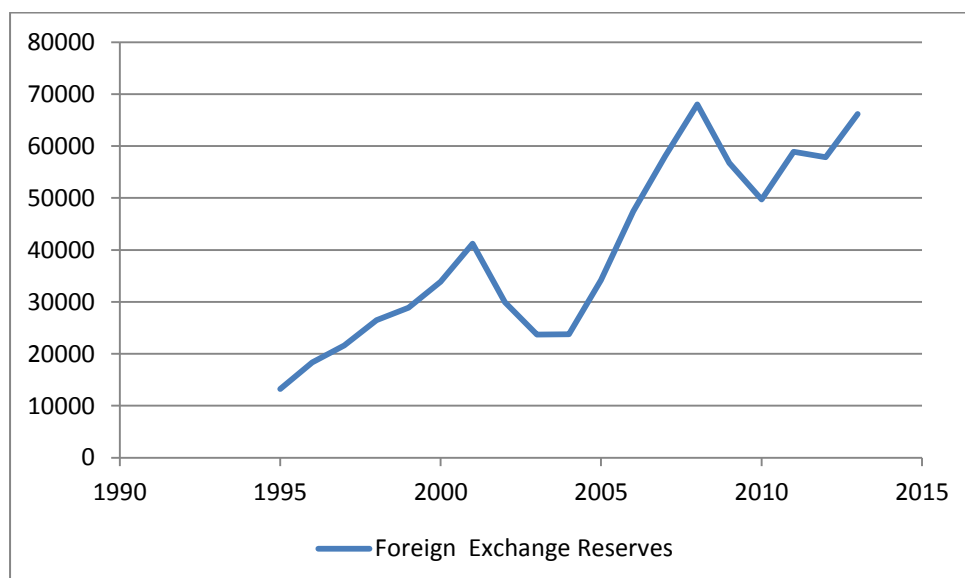
2.4 Exchange rates

On its introduction in 1976, the exchange rate of the Pula was fixed to the US dollar and from June 1980 to a trade-weighted basket of currencies, including the Special Drawing Right (SDR) of the IMF and the South African rand. Following the discovery of diamonds and the large, persistent surpluses that followed the real exchange rate of the Pula gradually appreciated subsequently eroding Botswana's competitive position. This went against the objective of the exchange rate policy which is to maintain the country's competitiveness as measured by the real effective exchange rate (REER). In order to correct for the misalignment of the currency in 2004 the Pula was devalued by 7.5% and later by 12%. In 2005 a new exchange rate system, the crawling peg was introduced. This involved a continuous adjustment of trade weighted nominal exchange rate of Pula at a rate equal to the difference between the forecast inflation for trading partners and the Bank's inflation objective. This consequently improved the country's balance of trade significantly, recording P6.4 billion in 2005 from P1.3 billion recorded in 2004. The success of the new policy was confirmed through an empirical investigation which established the stability of the currency due to the crawling peg system (Motlaleng, 2009)

2.4 Monetary Policy and Inflation

The main objective of Botswana's monetary policy is to achieve and maintain a low and sustainable inflation that will enable the country to maintain the competitiveness of domestic goods and services internationally. It aims at keeping inflation at levels that promotes macroeconomic balance and stable growth. The inflation rate fluctuated throughout the period 1995 to 2013 registering an average of 8.3% during the period and recording an all-time high at 13.7% in 2008 (Figure 2.2). Demand pressures as highlighted by high growth of domestic credit to the private sector resulted in a sharp increase of inflation from 5.8% to 11.2% in 2002. Inflation thereafter eased to 6.4% in 2003 before it peaked to 11.4% in 2005. The 7% devaluation of the Pula in 2004 substantially contributed to the hike in inflation. The positive inflation outlook indicated by restrained demand pressures and the impact of 2004 devaluation led to the lowering of the Bank's objective range from 4-7 in 2004 to 3-6 in 2005. The objective range was revised back to 4-7% in 2005 following the anticipated positive outlook arising from demand pressures of the 12% devaluation. In 2013 inflation fell within the target range of 4-7% registering a low 4.1%.

Figure 2.2 Inflation Rate (%)
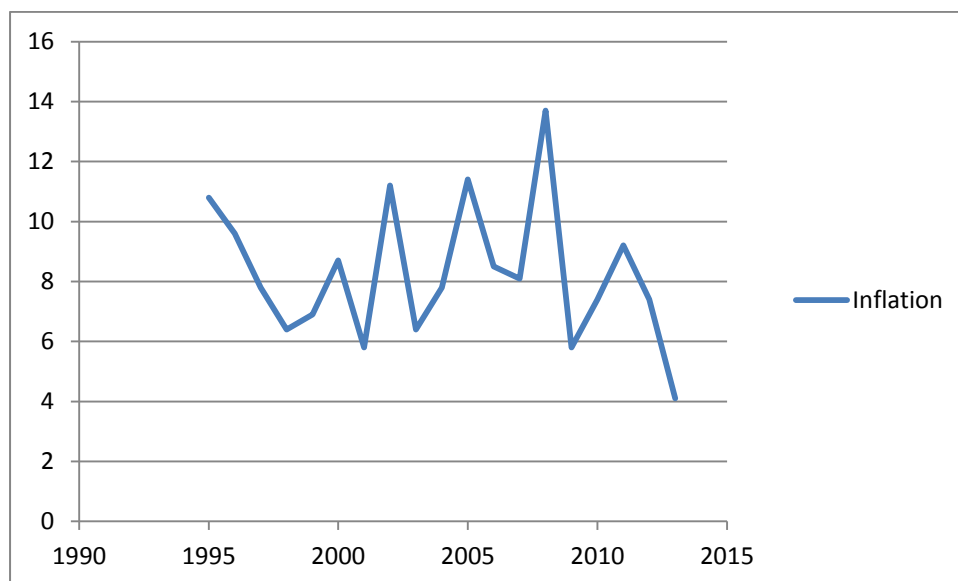
2.5 Interest Rates

Figure 2.3 depicts an increasing interest rate trend for the most part of the period 1999 to 2008. Following the increase in the Bank rate in 2002 commercial banks increased the prime lending rate from 15.75% to 16.75%. The rate of credit expansion which stood above the target range had prompted the monetary authority to increase the bank rate. The increase was expected to reduce the rate of credit growth and hence reduce pressure on inflation. The bank rate was revised three times in 2008. It was increased in the first quarter and later subsequently reduced twice. Following the global financial crisis annual growth in commercial bank credit fell sharply from 27.7% to 15.2%. The fall was a response by commercial banks to a reduction of the bank rate that was accompanied by open market operations. The year 2013 was characterised by falling inflation and signs of slow growth in non-mining output. This led to a reduction of the bank rate by 2% from 9.5% to 7.5%. In response to this, commercial banks reduced the prime lending rates from 11% to 9%.

Figure 2.3: Prime Interest Rate (%)
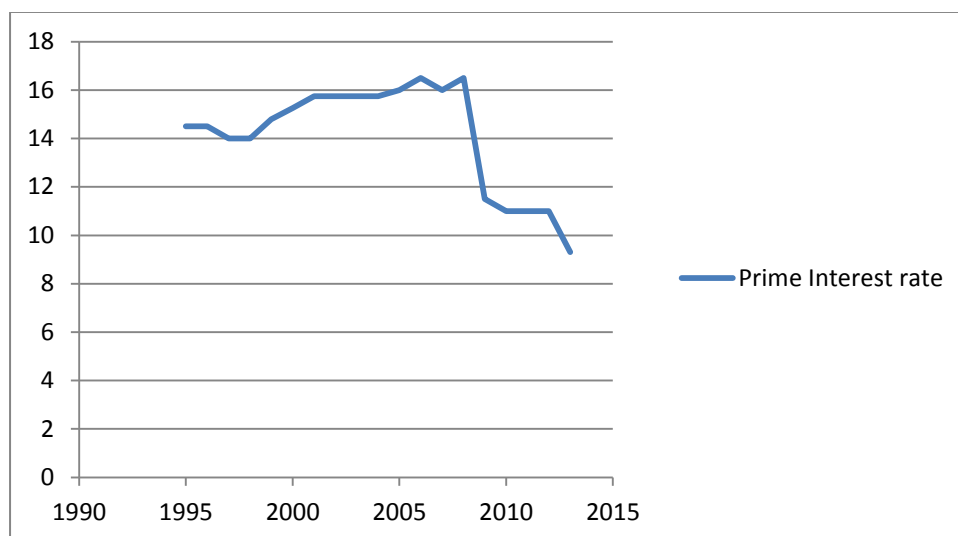
2.6 Excess Liquidity

The mineral boom (particularly diamonds) in the late 1990's towards the late 2000s induced current account surplus. With a fixed exchange rate system, there was considerable accumulation of foreign exchange reserves, averaging around 80% of GDP between 2001 and 2010. The large and accumulating current account surpluses combined with a fixed exchange rate regime, low domestic absorption capacity and partial sterilization resulted in excess liquidity in the financial system (Phetwe, 2014). The large portion of liquidity flowing into the economy following the increase in diamond exports benefited the commercial banks. However the few viable lending opportunities in the economy resulted in excess liquidity in the financial system. This raised concerns that the excess liquidity could lead to high inflation, negative real interest rates and real exchange rates appreciation and in the process weaken the non-mineral trade account balance. To avoid the possible effects of excess liquidity the government and parastatals increased their deposits with Bank of Botswana and the Bank started accepting deposits from large depositors such as Debswana mining company. The Bank also used open market operations (OMO) in the form of BoBCs to sterilize excess liquidity from the system.

CHAPTER THREE

LITERATURE REVIEW

3.1 Theoretical Literature Review

Disequilibrium in the external balance of a country is caused by disparities in export revenues and import expenditures or inequality in capital inflows and outflows. Policy makers and regulators of an economy have the task of correcting these imbalances in the most economically efficient manner. Three main theories of balance of payment adjustment have so far been identified in literature. These are elasticity approach, absorption approach and the monetary approach. Both elasticity and absorption (associated with Keynesian theory) are referred to as the traditional approaches, while the monetary approach is the improved or modernised approach.

3.1.1 The Elasticity Approach to Balance of Payments

This approach was founded by Alfred Marshall and Abba Learner in the 1920s and 1940s respectively. John Robinson and Fritz Machlup later on made substantial contributions to the approach in the late 1940s and 1950s. The main focus of the elasticity approach is the trade balance or the current account and how it is determined. It emphasises the effects of exchange rate changes on exports and imports but ignores other variables such as investment income. The approach adopts the Marshall Lerner condition which states that, for a devaluation to improve the balance of payments the sum of price elasticities of demand for imports and exports must be greater than unity (Arize, Bonitsis & Malindretos, 2000). This however is not always the case empirically. It is of the view that a flexible exchange rate regime will restore a country to external equilibrium provided the condition is satisfied.

Taking into consideration the law of one price, the effect of exchange rate on the balance of payment equation is reduced to the following when applying the elasticity approach;

$$\delta B/\delta r = M\,(Ex\, +\, Em\, -\, 1)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.(3.1)$$

where B=trade balance (current account)

    r= exchange rate

    M=imports

Ex=elasticity of exports

Em=elasticity of imports

Equation 3.1 represents the marshal learner condition. It implies that starting from a position of equilibrium in the current account, a devaluation will improve the current account only if (Ex + Em) >1but worsen it if (Ex + Em) < 1.

Devaluation improves the balance of payments by making exports cheaper and hence increasing their sales and making imports expensive thereby decreasing them when there is deficit in balance of payments. A revaluation on the other hand will correct the balance of payment surplus by reducing exports and increasing imports.

Empirical evidence has shown that the Marshall Learner condition is only applicable in developed countries where elasticities of exports and imports can be greater than one. According to Dhliwayo (1996), the elasticities of exports and imports in developing countries are generally low and this makes devaluation of currency ineffective in improving the balance of payments. The approach assumes high substitutability between domestically produced goods and foreign produced goods as well as the high elasticities of demand and supply of goods and service. These requirements are however less likely to exist in reality. According to Arize, Bonitsis and Malindretos (2000) the approach is also not appropriate for analysing effects of changes in exchange rate on real output and monetary variables in an economy hence it is not applicable in countries such as Botswana.

3.1.2 The Absorption Approach to Balance of Payments

Purported by Alexander (1952) the absorption approach looks at the balance of payment from the national income accounting perspective. The approach intends to show how devaluation changes the relationship between expenditures and income in both nominal and real terms (Adamu and Itsede, 2010). The approach which is limited to the balance of trade (current account) emphasizes how domestic spending changes relative to domestic production. According to the approach, if a country is in deficit it implies that domestic expenditure on consumption and investment (absorption) exceeds national income (output).The approach is of the view that BOP disequilibrium is a result of domestic consumption and therefore the

current account improvement or deterioration depends on the relative changes on the domestic income and domestic expenditure.

- The basis of the absorption approach is the Keynesian national income identity

$$Y = C + I + G + X - M \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.2)$$

Where Y = national income; C = private consumption of goods and services purchased at home and from abroad; I = total investment, by firms as well as by government; G = government expenditure on goods and services; X = exports of goods and services; and M = imports of goods and services.

- C + I + G represent domestic absorption and hence can be grouped into a single term, A, therefore;

$$Y = A + X - M \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.3)$$

Equation 3 states that national income is equal to absorption plus trade balance. Alternatively equation 3 can be written as

$$X - M = Y - A \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (3.4)$$

Since the absorption approach regards trade balance as the current account (CA) equation 3.4 can be expressed as

$$CA = Y - A \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..... (3.5)$$

Equation 3.5 is the fundamental absorption approach equation. It implies that, if total income (production) exceeds total absorption (expenditure) the current account will be in surplus. On the other hand if absorption exceeds total income then the balance of payments will be in deficit. The effects of devaluation on the current account depend on how the national income is affected relative to domestic absorption. If devaluation increases domestic income relative

to absorption the current account improves but if domestic absorption rises more relative to income the current account will deteriorate.

Although the absorption approach builds on the elasticity approach, both approaches have similarities in that they do not take into account the capital account of the BOP but focus solely on the current account, an observation many scholars have criticized as not representative of the real BOP. Both approaches do not subscribe to the existence of general equilibrium, which in Walras interpretation is an economic world characterised by simultaneous clearing of all markets (Johnson; Kasibhatla and Malindretos, 2000). In both approaches currency devaluation is central to the analysis of the approach to BOP adjustment analysis, the monetary approach is however not confined to the examination of currency devaluation.

3.1.3 The Monetary Approach to Balance of Payments

The monetary approach to balance of payments (MABOP) is a long-run theory that originated much earlier than the elasticity and absorption theories. The approach can be thought of as the modernised version of the specie flow theory propounded by David Hume in the mid-1700s. According to the approach the BOP consists of the current account, capital account and the official reserves account. The main proponents of the monetary approach to BOP surfaced in the late 1960s and throughout the 1970s and these were Robert A. Mundel, Harry G. Johnson, Jacob A. Frenkel, David I. Meiselman, Marc A. Miles and Arthur B. Laffer. It was later advanced by the International Monetary Fund (IMF) economists with the view of restoring the role that money and money balances play in the adjustment process (Arize; Kasibhatla and Malindretos, 2000).

The approach which is based on the general equilibrium framework views the overall balance of payments as essentially a monetary phenomenon. According to Adamu and Itsede (2010) the approach shows that imbalances in the money market have an influence on overall BOP. Under a fixed exchange rate system, excess money supply results in increased domestic spending and this increases domestic demand for foreign goods. Foreign exchange reserves are eventually used to finance the high demand and this worsens the BOP. The outflow of the foreign exchange will reduce money supply until equilibrium is restored. Excess demand for money will require the opposite adjustment. Defining the balance of payments mechanism as essentially a monetary phenomenon does not imply that only money plays a key role, the

approach takes into consideration the influence of real variables such as interest rates and the level of income on the BOP behaviour, Mussa (1974).

The monetary approach is mainly based on the assumptions that relate to the market clearing process (Bilquees, 1989). The approach assumes that trade and payments are completely liberalised. Only two components make up the money supply, i.e. international reserves and domestic credit. Demand for money is stable and it is a function of prices, real income and real interest rate. Income is determined by real forces which are independent of the monetary factors or balance of payments while the price level is determined according to the law of one price in the international market. The yield on assets denominated in different currencies must be equalised therefore interest rate is exogenously determined in the international capital market. It assumes a small, open economy with no influence in world prices and interest rates. General equilibrium is assumed to exist in all markets.

Based on the reserve flow equation the formal monetary approach to balance of payments model consists of the following set of equations:

- The money supply equation

$$M_s = R + D \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; (3.6)$$

Where R = net foreign reserves/assets (NFA) and D = net domestic credit (NDA)

- The money demand equation

$$M_d = f(Y, P, I) \quad m_y > 0, m_p > 0, m_i < 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; (3.7)$$

Where Y = real domestic income; P = price level and I = interest rate
m_y , m_p , m_i are partial derivatives

- Money market equilibrium

$$M_s = M = M_d \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; (3.7)$$

The monetary theory posits that there is a positive relationship between money demand and income ($m_y > 0$), a positive relationship between money demand and the price level ($m_p > 0$) and a negative relationship between money held and the interest rate ($m_i < 0$). Combining the equations, expressing variables in percentage changes and reserves as the dependent variable the reserve flow equation can be written as follows:

$$\Delta R = \Delta [f (Y, P, I)] - \Delta D \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots .. (3.8)$$

Equation 3.8 shows that changes in foreign reserves (BOP) are influenced by the difference between changes in demand for money and changes in domestic credit. The equation represents the ultimate monetary approach to balance of payments equation. The foreign reserves equalize the changes in domestic credit and the coefficient of change in domestic credit is recognized as an offset coefficient (Dhliwayo, 1996).The coefficient shows the extent to which changes in domestic credit are counterbalanced by changes in money supply as a result of a decline in foreign reserves. The coefficient assumes a negative sign for MABOP in the reserve flow equation.

3.1.4 Criticism of the Monetary Approach to Balance of Payments

Although MABOP has been viewed as an improvement from the more traditional approaches, elasticity and absorption, the approach has been subjected to a number of criticisms. One major criticism is that the approach is more focused on monetary factors while neglecting the real and structural factors that are believed to have a role in BOP disequilibrium (Howard and Mamingi, 2002). The fact that the approach is said to be a monetary phenomenon however does not mean monetary factors are the only cause of BOP disequilibrium as pointed out by Johnson and Frenkel (1977). The approach explains rather that since the disequilibria in the BOP are caused by monetary imbalances it makes more sense to use solutions that are based on monetary policy.

The MABOP has been criticised for the assumption of a stable demand for money. This does not hold for most countries particularly small open economies which are subjected to external shocks. Holding foreign currency instead of domestic currency has been found to have an impact on the trade balance which then affects demand for money. In his study which

assessed the shortcomings of MABOP, Alowade (1997) argued that "the greater the degree of substitution between domestic and foreign currencies, the less stable are both, the exchange rate and the money demand function.

The MABOP has been further criticised for emphasising change in international reserves in bringing BOP to equilibrium while neglecting other economic policy measures. The approach disregards other factors such as current account balance, trade deficit/surplus, and the extent of a country's international borrowing which play a significant role in BOP determination (Danjuma, 2013). It has however been argued that devaluation and other imports restrictions can only affect the BOP by influencing money stock. The government budget constraint was also expected to be included in the MABOP, however according to Howard and Mamingi (2002), the budget constraint is not totally excluded as an interaction between government's fiscal policy and credit creation exists.

The MABOP which is based on a self-correcting long-run equilibrium has also been criticised for failing to address the short-run through which the economy passes. According to Alowade (1997), policies need to be short-term based and therefore a model that works on the long-run basis such as MABOP might cause economies tremendous adjustment costs.

3.2 Empirical Literature Review

The validity of the monetary approach to balance of payments is the most empirically tested of all the approaches. A lot of empirical evidence exists on the approach with most studies finding identical results. Empirical evidence has also shown that the approach is more applicable in small open economies with fixed interest rates. Most studies employed the cointegration and error correction mechanism based on the reserve-flow equation. Net foreign assets were commonly used as the dependent variable while a combination of exogenous variables varied from study to study. Independent variables included domestic income (GDP), domestic credit, price level or inflation, interest rates, exchange rates, money multiplier and money stock.

Fidzani (1982) used the Polak model to investigate how BOP disturbances and money supply due to international fluctuations could be addressed in Botswana. To determine the appropriate policy strategy quarterly data for the period 1976 to 1982 was used. The period was in two parts, a period where BOP was in deficit and a peak period where BOP was in

surplus. Domestic credit was found to be the only viable variable in the study while capital movements and exports were found to be insignificant. A decrease in domestic credit was found to improve BOP deficit while a surplus was corrected by an increase in credit. The author's rationale as supported by empirical evidence was that an increase in money supply due to excessive credit led to an increase in imports which then reduced the net foreign assets and inevitably leading to BOP deficit.

Dhiliwayo (1996) used cointegration test and error correction modeling to estimate the reserve flow equation for Zimbabwe. The study used quarterly data for the period 1980 to 1991. The results indicated that money is significant in determining the BOP in Zimbabwe. The study also established a strongly negative relationship between domestic credit and international reserves flows. The study concluded that, given a stable demand for money function, disequilibrium in the balance of payments can be corrected through appropriate financial programming and monetary targeting.

On their empirical analysis of the monetary approach to the balance of payments in Barbados, a small open economy with a fixed exchange rate system, Howard and Mamingi (2002) confirmed that the monetary approach to BOP applies in Barbados. The study also employed the cointegration and error correction mechanism (ECM) to estimate the reserve flow equations using annual data for the period 1973-1998. The analysis confirmed that excessive credit expansion led to balance of payments deficits in fixed exchange rate systems.

Fleermuys (2005) examined the monetary approach to balance of payments using quarterly data for the period 1993-2003 for Namibian. The study used the reserve flow equation, cointegration test and error correction modelling to assess the significance of excess money in correcting balance of payments disequilibrium. The variables used were net foreign assets, gross domestic product, inflation, interest rate and domestic credit. Inflation and domestic credit were the only variables found to be significant. Inflation was found to have a strong positive relationship with net foreign assets while domestic credit was negative. The study concluded that monetary actions, when used on their own, cannot correct balance of payments disequilibrium.

Adamu and Itsede (2010)'s study examined the monetary approach to balance of payments adjustment for West African Monetary Zone (WAMZ) countries for the period 1975-2008.

The study employed the generalised method of moments on the standard model of the MABOP on panel data. The variables used in the study were net foreign assets, domestic credit, interest rate, inflation and GDP growth. Within-country effects established that interest rates and domestic credit had significantly negative relationships with net foreign asset while log of GDP and net foreign assets were positively related. The study reached the conclusion that money played a significant role in determining BOP in WAMZ and there was need for financial programming, monetary targeting and prudent fiscal policy.

Umer et al. (2010) examined the monetary approach theory and its implications on Pakistan's BOP using the reserve flow equation, cointegration test and error correction model. Only three variables were found significant; as was expected GDP growth rate and net foreign assets had a positive relationship while both domestic credit and interest rates were negatively related to the net foreign assets. The study was in agreement with many similar studies in other countries which concluded that balance of payments is not a purely monetary phenomenon.

Boateng and Ayentimi (2013) used annual data for the period 1980-2010 to analyse the applicability of the monetary approach to BOP in Ghana. Ordinary least square estimate of linear regression was used to provide value for the coefficient of models. To test the variability of the parameter estimate in the model, the coefficient of determination was employed to justify the explanatory power of the exogenous variables. While economic theory was used to test the plausibility of the model, statistical criteria (t-test and f-test) were employed to evaluate the significance of the parameter estimates. Domestic credit, gross domestic product and interest were significant in explaining changes in foreign assets. Domestic credit and interest rate were found to be negatively related to net foreign assets while GDP growth was positively related.The study concluded that the balance of payments disequilibrium in Ghana was not solely influenced by monetary variables.

Tijani (2014) analysed the balance of payments adjustment mechanism using monetary channel for Nigeria. The study was conducted through ordinary linear regression analysis using annual data from 1970 to 2010. The results showed a positive relationship between balance of payments and domestic credit, exchange rate as well as balance of trade. Inflation rate and gross domestic product were on the other hand found to be negatively related to balance of payments. The study was in agreement with the Ghana study concluding that

although not solely, monetary measures contribute tremendously to the position of BOP and could be used as an adjustment mechanism depending on its application and policy mix by the monetary authority. Tijani's results were in line with Danjuma's (2013) findings who also concluded that Nigerian balance of payments is not purely influenced by monetary variables. Danjuma had employed the VECM and impulse response model to determine whether excess money supply played a significant role in Nigeria's BOP disequilibrium.

3.3 Summary of Empirical Literature Review

Dhiliwayo (1996) estimated a reserve flow equation through multivariate cointegration and error correction modeling for Zimbabwe. The variables used were reserves, real income, the price level, interest rates and domestic credit. Howard and Mamingi (2013) also used the same model and variables as Dhiliwayo to test for MABOP applicability in Barbados. Both studies concluded that monetary variables play a significant role on BOP for their respective countries. For the Nigerian BOP adjustment mechanism Tijani (2014) used a simple open economy LM model employed to derive long run BOP equation. His exogenous variables were domestic credit, balance of trade, inflation, GDP and real exchange rates. Boateng and Ayetimi (2013) followed the same model as Tijani both studies concluded that there was a need for policy mix as monetary variables on their own do not determine BOP.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter discusses the methodology used in the study. It presents the overview of the model adopted, describes the variables used in the study and discusses the data analysis techniques employed as well as the source of data.

4.2 Theoretical Framework

Past studies have focused on distributed lag models to analyse the monetary approach to balance of payments. In this thesis, we consider a Vector Autoregression (VAR) model for our analysis. This model is adopted from the model used in a study by Kouassi et al (1999). The VAR models are normally used for forecasting systems of interrelated time series and for the analysis of the dynamic impact of random disturbances on the system variance. The models are therefore commonly used for policy analysis. The VAR model treats every endogenous variable in the system as a function of the lagged values of all endogenous variables in the system. The model also follows a model adopted by Bobai (2013) whose paper analysed the applicability of monetary approach to BOP in Nigeria.

4.3 Model Specification

Let X_t= (log of net foreign assets (LNFA), log of GDP or non-mining GDP (LGDPXM), log of domestic credit (LDCP), inflation rate (INFLA), interest rate (PRINT) and exchange rate (EXCR) be the vector of variables to be analysed.

Then the pth order vector autoregressive model or VAR (p) can be written as:

$$X_t = c + b_1 X_{t-1} + b_2 X_{t-1} + \cdots + b_P X_{t-p} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4.1)$$

Where:

X_t is a 6×1 vector of variables defined as above at time t

$c = 6 \times 1$ vector of constant coefficients

$b_i = 6 \times 6$ matrices of time invariant coefficient

$i = 1, \ldots \ldots, p \ and \ \varepsilon = 6 \ x \ 1$ vector of i.i.d errors with a positive covariance matrix.

The VAR (p) defined in equation (4.1) is covariance stationary iff all values of Z satisfying

$$\left| In - b_1 Z - b_2 Z^2 - \cdots - b_p Z^p \right| = 0 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4.2)$$

lie outside the unit circle.

To make a distinction between stationarity by linear combinations and by differencing a reparamisation of equation (4.1) is needed. Therefore the system in equation (4.1) can be written in Vector Error Correction (VECM) form

$$\Delta X_t = c + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{i-p} + \pi X_{t-p} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4.3)$$

where,

$$\pi = -\left(I - \sum_{i=1}^{p} b_i \right) \quad and$$

$$\Gamma_i = (b_{i+1} + \cdots \ldots \ldots + b_i), \quad i = 1, \ldots \ldots \ldots, p - 1$$

The only difference between equation (4.3) and a standard VAR in differences is the error correction term, πX_{t-p}. The system represented in equation (4.3) also contains information on both the short and long run adjustment to changes in X_t, via estimates of $\Gamma_i \ and \ \pi_i$ respectively.

The non-stationary component π can be factored to test the null hypothesis r of reduced or equivalently , the number of cointegrating relationships, that is

Ho: $\pi = \alpha\beta'$, rank $(\pi) = r < n$…………………………………………………..(4.4)

Where β is a matrix of cointegrating vectors and α the adjustment coefficients. Since X_t is a vector of non-stationary I(1) variables, all the terms in equation (4.3) which involves ΔX_{t-i} are stationary or I(0), and πX_{t-p} must also be stationary for $\varepsilon_t \sim I(0)$ to be stationary. Usually π has reduced rank, i.e, there are $r \leq$ (n-1) cointegration vectors present.

Let us assume that long-run relationships exist in our system. Several implications including 'spurious' regression and granger non-causality can therefore be established.

Table 4.1: Definition of variables and expectations

Variables	Measure/Definition	Expected sign
Balance of Payments	Net foreign Assets	
Inflation	consumer price index	*Negative;* An increase in the general price level depresses demand for real balances resulting in excess money supply and hence reserve outflows
Interest Rate	Prime Rate	*Negative*; An rise in real interest rates reduces demand for liquidity hence creating excess money supply and reserve outflows
Domestic Credit	Net claims on the private sector by financial sector	*Negative* An increase in domestic credit increases money supply and hence reserve outflows
Real GDP growth **Non-mining GDP**	Level of domestic income/real GDP	*Positive;* Increase in domestic income is expected to increase foreign reserves *Negative;* Increase in non-mining GDP is expected to reduce foreign reserves
Real Exchange Rate	Defined as domestic currency units required to purchase a unit of foreign currency (BWP/SDR)	*Positive;* An increase in exchange rate (depreciation) makes exports relatively cheaper compared to imports hence increasing foreign reserves

4.4 Data Estimation Techniques

The test for stationarity is carried out to determine the order of integration and this is followed by the cointegration test which is done in order to examine the long-term behaviour of the variables and finally the error correction mechanism is employed to estimate the model. To test the explanatory power of the independent variables, the coefficient of determination (R^2) was used. Statistical criteria (t-test and F-test) were also employed to evaluate the significance of the variables.

4.4.1 Unit Root Test

Empirical studies based on time series data often assume the underlying time series is stationary. However many studies that employ econometric models involving time series data encounter problems of the presence of unit roots (Gujarati & Porter, 2009). Regression of time series variables that are non-stationary yield spurious results resulting in unreliable estimates. This therefore compels researchers to use data that is differenced, a process which can result in the negligence of long-term relationships between variables. To test for stationarity the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests are used.

4.4.2 Cointegration Test

Cointegration exists when two variables have a long-run or equilibrium relationship between them (Gujarati and Porter, 2009). In the case where variables in this study are not stationary at levels, a cointegration test is employed. The study uses the Engel-Granger two-step procedure to long-run estimation and the Johansen Cointegration to test for cointegration. The long-run relationships is specified and if the variables are found to be cointegrated the unit root test is applied to the residual and if it is stationary the Error Correction Mechanism (ECM) is used to correct for disequilibrium (Gujarati and Porter, 2009).

4.4.3 Granger Causality Test

The Granger causality test shows how much of the current dependent variable can be explained by its past values and whether lagged values can explain the explanation of such a variable (Granger, 1969). The test does not show causality as commonly expressed but measures preference and information content. The equations below explain Granger causality where variables are not cointegrated and when there is cointegration among variables.

Without Cointegration

$$y_{1t} = a_{11} y_{1t-1} + a_{12} y_{2t-1} + \varepsilon_{1t}$$

$$y_{2t} = a_{21} y_{1t-1} + a_{22} y_{2t-1} + \varepsilon_{2t}$$

$$y_2 \not\Rightarrow y_1 \ \ iff, a_{12} = 0$$

$$y_1 \not\Rightarrow y_2 \ \ iff, a_{21} = 0$$

With Cointegration

$$y_{1t} \ = \ a_{11}\,y_{1t-1} + \ a_{12}\,y_{2t-1} \ - \ Y_1\,ECM(-1) + \ \ \tau_{1t}$$

$$y_{2t} \ = \ a_{21}\,y_{1t-1} + \ a_{22}\,y_{2t-1} \ - \ Y_2\,ECM(-1) + \ \ \tau_{2t}$$

Long Run Causality

Long run causality is related to the fact that Y_1 or Y_2 are significant

Long run from y_2 to y_1 iff Y_1 is significant

Long run from y_1 to y_2 iff Y_2 is significant

Short Run Causality

$$y_2 \not\Rightarrow y_1 \ \ iff, a_{12} = 0$$

$$y_1 \not\Rightarrow y_2 \ \ iff, a_{21} \ = 0$$

Causality

$$y_2 \not\Rightarrow y_1 \ \ iff, a_{12} \ = 0 \text{ and } Y_1 = 0$$

$$y_1 \not\Rightarrow y_2 \ \ iff, a_{21} \ = 0 \text{ and } Y_2 \ = 0$$

4.4.4 Impulse Response Function

Impulse response function (IRF) shows the effects of shocks on the adjustment path of the variables in a system. It describes the response of each variable in the VAR overtime to a one-time shock in any given variable while keeping others constant. IRF is useful in empirical analysis of causal relationships and policy effectiveness. It traces the effects of a one standard deviation shock to one of the innovations on current or future values of the endogenous variables. If all stability conditions are satisfied, any shock should decline to zero otherwise the system produces a volatile path.

4.4.5 Variance Decomposition

The variance decomposition is closely associated with the impulse response function. Variance decomposition (VDC) is used in the interpretation a VAR model. It shows the proportion that each variable contributes to the other variables in the autoregression. The VDC explains how much of the forecast error variance of each variable can be explained by exogenous shocks over a period of time. Usually own series shocks explain most of the error variance.

4.6 Data Sources

The study uses quarterly data covering the period 1995-2013 to analyse the monetary approach to Botswana's balance of payments. GDP, domestic credit and net foreign assets were transformed to natural logs before estimation. The data sources are various publications of Bank of Botswana (BOB) annual reports.

CHAPTER FIVE

EMPIRICAL RESULTS

5.1 Introduction

The aim of this chapter is to test the applicability of the monetary approach to balance of payments in Botswana. The chapter presents the empirical results and it is organized into four sections. Section 5.2 presents the results of unit root tests and the order of integration of the variables. The determination of the existence of long-run relationship between the variables is carried out through cointegration test in section 5.3. The error correction model (ECM) is presented in section 5.4 and finally the Granger causality test is presented in section 5.5

5.2 Unit Root Test

In order for data to be used for analysis or economic forecasting it needs to be refined into stationary data. Non-stationary data may otherwise produce spurious results. The unit root test is used to determine the stochastic properties of data. Graphical analysis of the data for this study indicates the existence of stochastic trends. (see appendix B). To test for the presence of unit root the Augmented Dickey- Fuller (ADF) and the Phillips-Perron (PP) tests were employed.

Table 5.1 Unit Root Test

VARIABLES	ADF level τ_μ	ADF level τ_t	Phillip-Perron level τ_μ	Phillip-Perron level τ_t	ADF first difference τ_μ	ADF first difference τ_t	Phillip-Perron first difference τ_μ	Phillip-Perron first difference τ_t
LNFA	-0.154	-8.701[a]	-5.621[a]	-8.703[a]	-10.760[a]	-10.623[a]	-51.882[a]	67.916[a]
LGDP	-2.565	-2.669	-1.593	-4.806[a]	-9.336[a]	-9.846[a]	-21.578[a]	-34.877[a]
LGDPXM	-0.793	-2.832	-0.983	4.253[a]	-13.186[a]	-13.111[a]	-16.535[a]	-16.623[a]
LDCP	-0.878	-4.673[a]	0.386	-2.566	-3.260[b]	-4.037[b]	-3.999[a]	-3.971[b]
PRINT	-0.322	-0.906	-0.047	-0.799	-5.760[a]	-4.864[a]	-5.714[a]	-6.066[a]
EXCR	-2.112	-2.651	-2.078	-2.512	-7.041[a]	-7.102[a]	-6.989[a]	-7.008[a]
INFLA	-1.684	-1.673	-3.360[b]	-3.393[c]	-6.573[a]	-6.505[a]	-6.980[a]	-6.940[a]
Note: a, b and c denote level of siginificance at 1%, 5% and 10% respectively								

Table 5.1 shows stationarity test conducted in levels and first difference under intercept (τ_μ) and intercept with trend (τ_t) specifications. Results of the ADF tests show that all variables

are non-stationary at levels with intercept specifications only. Phillips-Perron test indicate that all variable are non- stationary at levels with intercept only specification except INFLA and LNFA.   Results of both ADF and Phillips-Perron indicate that all variables became stationary after first differenced in both intercept and intercept with trend specification at 1% and 5% significance. This shows that all variables move around a constant mean and are time invariant after first difference. The results of both ADF and Phillips-Perron tests indicate that the series are integrated of order 1 i.e I(1).

5.3 Cointegration Test

Cointegration test is carried out to establish whether two non-stationary variables have a long-term or equilibrium relationship between them. Since the unit root tests results shown above established that the series are integrated of order one, cointegration test had to be carried out. The variables tested for cointegration are log of gross domestic product (LGDP), log of GDP excluding mining contribution (LGDPXM), exchange rate (EXCR), inflation (INFLA), log of domestic credit to private (LDCP), log of net foreign assets (LNFA), and prime interest rate (PRINT).

5.3.1 Estimating long-run relationships (with GDP inclusive of mining)

The Johansen-Juselius Maximum likehood test was employed to determine the cointegration rank. The tests of cointegrating relations showed consistency in the trace and max-eigen for linear with intercept and no trend therefore model is specified under intercept with no trend. The results also showed that the optimum lag specification for Johansen Cointegration test entail the maximum lag length of 2 from Akaike information criteria. Tables 5.2 reports the maximum-eigenvalue and trace statistics and their critical values at 5% level of siginificance.

Table 5.2:Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Max-Eigen Statistics	0.05 Critical Value	Trace Statistics	0.05 Critical Value
r=0	49.312	40.078	113.886	95.754
r ≤ 1	26.374	33.877	64.574	69.819
r ≤ 2	23.729	27.584	38.2	47.856
r ≤ 3	9.908	21.132	14.471	29.797
r ≤ 4	4.442	14.265	4.563	15.495
r ≤ 5	0.121	3.841	0.121	3.841

Max-eigenvalue and trace tests indicate 1 cointegrating equation(s) at the 0.05 level

The table shows Johansen Cointegration test results with LNFA as the dependent variable and LGDP, LDCP, INFLA, PRINT and EXCR are independent variables. The result shows that the null hypothesis r=0 is rejected because the computed statistics for both max-eigen and trace are greater than their respective critical values. The tests fail to reject the null hypothesis of r ≤ 1,2,3 and 5 therefore both tests suggest that there is a long-run relationship among the six variables.

5.3.2 Estimating long-run relationship (non-mining GDP)

The variables included in the cointegration test are LNFA, LGDPXM, LDCP, INFLA, EXCR and PRINT, where LNFA is the dependent variable. The tests of cointegrating relations showed consistency in the trace and max-eigen for linear with intercept and trend hence the model is specified under intercept with trend (see appendix B). The Akaike information criteria results showed that the optimum lag specification for the Johansen cointegration test entail the maximum lag length of 2. The maximum-eigenvalue and trace statistics are shown in Table 5.3

Table 5.3: Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	Trace Statistics	0.05 Critical Value
r = 0*	86.061	44.497	193.587	117.708
r ≤ 1*	46.272	38.331	107.526	88.804
r ≤ 2	25.896	32.118	61.254	63.876
r ≤ 3	23.8	25.823	35.358	42.915
r ≤ 4	7.521	19.387	11.558	25.872
r ≤ 5	4.037	12.518	4.037	12.518

Max-Eigen and Trace test indicates 2 cointegrating equation(s) at the 0.05 level
*denotes rejection at 5% level of significance

The maximum-eigenvalue and trace tests results in Table 5.3 indicate two cointegrating equations at the 5% level of significance. This implies that there are two long-run relationships among the six variables. The null hypotheses of at most 2, at most 3, at most 4 and at most 5 equations are cointegrated are not rejected at 5 % level of significance. The study then concludes that there is a long-run relationship among LNFA, LGDPXM, LDCP, INFLA, PRINT and EXCR.

5.3.3 Normalized cointegrating coefficients

The normalized equation shown in Table 5.4 indicates that the effects of all variables on LNFA are statistically significant. All the independent variables appear to have negative relationships with the dependent variable.

Table 5.4: Normalized Cointegration equation

LNFA	LGDPXM	LDCP	INFLA	PRINT	EXCR	@TREND(95Q2
1	-2.155	-3.120	-0.095	-0.284	-6.442	0.171
S.E	-0.213	-0.398	-0.020	-0.035	-3.176	-0.020
t-stat	10.114	7.833	4.666	8.055	2.028	-8.625

2 cointegrating equation(s): Log likelihood 308.988

The results of the normalization equation with the LNFA as the dependent are presented in Table 5.4. The results show that a percentage increase in domestic credit to private sector will reduce the net foreign asset by 3.1%. Credit accessibility to the private sector could induce aggregate demand and hence importation of foreign products. This will become a foreign credit in Botswana's BOP. The increases in aggregate demand fuelled by domestic credit will result in an increase in inflation. The normalization results show that a percentage increase in inflation reduces net foreign assets by 0.10%. This is because inflation is a cost to investment and as such reduces the real value of Botswana's foreign assets and thereby reduces the NFA.

The results of the exclusion of mining contribution to GDP (LGDPXM), highlights the importance of the industry in Botswana's foreign assets. According to the results, an increase in GDPXM by 1% will reduce the NFA by 2.15%. The reduction in NFA could be due to the drawing down of foreign reserves to pay for imports or for use in the economy. This further shows that the country's foreign reserves are accumulated from mining revenue. Furthermore, a percentage increase in prime interest rate reduces the NFA. This may be because the cost of private investment becomes expensive thereby causing capital flight. This

will therefore be recorded as a negative in the balance sheet of the country hence reducing the NFA. An increasing exchange rate could imply domestic currency appreciation (indirect quote). This makes exports relatively expensive and hence reduces reserves.

5.4 The Vector Error Correction Model (VECM)

The error correction model is employed for estimation when the non-stationary series are found to be cointegrated. The cointegration results shown above reveal the existence of a long term relationship between the dependent variable (LNFA) and the independent variables (LGDP(XM), LDCP, INFLA, PRINT and EXCR). Given this evidence, the study examines the short-run and long-run dynamics of the dependent variable and its explanatory variables. The vector error correction model is used to examine this as the model takes into account the cointegration relation among the I(1) variables. The error correction term is used to eliminate any deviation from the long-run equilibrium. The coefficient of the error term represents the speed of adjustment of the explanatory variables in restoring them towards long run equilibrium. The coefficient should be negative and less than unity to show that the model does approach equilibrium.

Table 5.5: Error-Correction Model (ECM), Original Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP)	0.007	0.469	0.015	0.988
D(LDCP)	-0.409	1.874	-0.218	0.828
D(INFLA)	-0.104	0.043	-2.433	0.018
D(PRINT)	0.320	0.142	2.251	0.028
D(EXCR)	11.303	8.479	1.333	0.187
U(-1)	-0.500	0.109	-4.596	0.000
C	0.077	0.101	0.756	0.452
R-squared	0.310	Prob(F-statistic)		0.000
Adjusted R-squared	0.248	Durbin-Watson stat		2.330
F-statistic	5.012			

The model in table 5.5 shows that the coefficient of the lagged error correction term is negative and statistically significant at 1% level of significance. This indicates cointegration that ties the short-run behaviour of the LNFA to its long-run value. The F-statistic is also statistically significant at 1% which implies that the null hypothesis of insignificant relationship between the dependent and independent variables is rejected. The model also shows that the speed of adjustment back to equilibrium in the long-run is about 50 %.

Although domestic credit, GDP level and the exchange rate display expected signs, their t-statistics imply that they do not play a significant role in the level of reserves. Inflation and prime interest rates are statistically significant in explaining net foreign assets. As is standard practice, the ECM is run again but this time with the exclusion of variables that were statistically not significant.

Table 5.6: Error-correction model, excluding insignificant variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLA)	-0.100	0.042	-2.375	0.020
D(PRINT)	0.286	0.137	2.093	0.040
U(-1)	-0.489	0.106	-4.608	0.000
C	0.034	0.054	0.622	0.536
R-squared	0.290	Prob(F-statistic)		0.000
Adjusted R-squared	0.260	Durbin-Watson stat		2.338
F-statistic	9.543			

The results shown in Table 5.6 indicate that inflation and interest rate have a significant effect on net foreign assets. A 1% increase in inflation results in 0.1% reduction in net foreign assets. As explained earlier, inflation reduces the real worth of foreign investments and hence aggregate NFA is reduced. An increase in the general price level also depresses demand for real balances and this result in excess money supply. Higher domestic prices combined with excess money supply catapults aggregate demand and hence imports and this results in reserve outflows. In this current study the model shows a positive relationship between PRINT and LNFA. This may imply that the domestic interest rate is competitive as compared to alternative sources of borrowing. As such investors will borrow for investments. This could lead to increase in gross investment which also leads to increase in income. An increase in prime interest rates is a contractionary monetary policy, as such is expected to contract domestic money supply. This results in an increase in net foreign assets.

Table 5.7 Error-Correction Model (ECM), (with non-mining GDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLGDPXM	-0.030	0.177	-0.168	0.867
DLDCP	-0.506	1.840	-0.275	0.784
DINFLA	-0.107	0.043	-2.496	0.015
DPRINT	0.319	0.143	2.230	0.029
DEXCR	11.617	8.429	1.378	0.173
U2(-1)	-0.490	0.108	-4.537	0.000
C	0.082	0.098	0.838	0.405
R-squared	0.302	Prob(F-statistic)		0.000
Adjusted R-squared	0.239	Durbin-Watson stat		2.327
F-statistic	4.826			

The model in Table 5.7 shows that the coefficient of the lagged error correction term is negative and statistically significant at 1% level of significance. This indicates cointegration that ties the short-run behaviour of the LNFA to its long-run value. The F-statistic is highly significant at 1% which implies that the model is correctly specified. The model also shows that the speed of adjustment back to equilibrium in the long-run is about 49 %, i.e. it takes about two months for equilibrium to be restored. Only two variables, interest rate and inflation rate have a significant effect on NFA while the rest are insignificant. The log of non-mining GDP (LGDPXM) is statistically insignificant however it has the expected sign. A negative sign as seen on non-mining GDP coefficient could confirm the negative effect of heavy reliance on mining by Botswana economy. This shows that the country's foreign reserves are accumulated from mining. Although domestic credit and the exchange rate display expected signs, their t-statistics imply that they do not play a significant role in the level of reserves. Inflation and prime interests rates are statistically significant in explaining net foreign assets, however only inflation has the expected sign. As is standard practice, the ECM is run again but this time with the exclusion of variables that were statistically insignificant.

Table 5.8 Error-Correction Model - excluding insignificant variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINFLA	-0.101	0.042	-2.400	0.019
DPRINT	0.282	0.137	2.054	0.044
U(-1)	-0.477	0.107	-4.478	0.000
C	0.033	0.055	0.609	0.544
R-squared	0.281	Prob (F-Statistic)		0.000
Adjusted R-squared	0.250	Durbin-Watson stat		2.340
F-statistic	9.117			

After removing the statistically insignificant variables the results show that both inflation and interest rate are still the only variables that have significant effects on the net foreign assets. The results show that changes in inflation and interest rates explain only 28% of changes in the net foreign assets which implies that 72% is explained by variables not included in the model.

5.4 Granger Causality Test

The Granger causality test was conducted to investigate the relationship between the variables in the model. Tables 5.9 and 5.10 show the results of the test.

Table 5.9 Joint Granger Causality using the Wald-test

Model	ΔLNFA	ΔLGDP	ΔLDCP	ΔINFLA	ΔEXCR	ΔPRINT	ECM_{t-1}
Dependent variables			F-statistics (significant level)				t-statistics
ΔLNFA	-	2.58^c	3.11^c	6.49^a	0.21	2.90^c	-0.85^a
ΔLGDP	1.10	-	4.49^b	2.09	0.10	1.32	0.10^c
ΔLDCP	0.97	0.27	-	1.17	0.88	0.19	0.02^c
ΔINFLA	3.80^b	0.07	0.70	-	0.18	0.82	2.19^a
ΔEXCR	1.68	0.08	1.43	0.25	-	0.82	-0.006^c
ΔPRINT	1.23	0.77	0.11	3.90^b	0.17	-	0.34

Note: All variables are in the first difference except the error term obtained from the Johansen order of co-integration tests
a, b and c indicate significance at the 1%, 5% and 10% level of significance

Table 5.9 shows the results of a VECM causality results. The Table reports the F-statistics constructed under the null hypothesis of non-causality. A rejection of the null hypothesis implies that the variable granger causes the dependent variable. The results indicate that

GDP, domestic credit and interest rates granger cause net foreign assets at 10% level of significance while inflation granger causes net foreign assets at 1% significance level. These results confirm MABOP theory which asserts that balance of payments as represented by net foreign assets is influenced by monetary variables.

Table 5.10: Granger Causality using the Wald-test

Model	ΔLNFA	ΔLGDPXM	ΔLDCP	ΔINFLA	ΔEXCR	ΔPRINT	ECM$_{t-1}$
Dependent variables			F-statistics (significant level)				t-statistics
ΔLNFA	-	2.14	1.81	6.87[a]	0.79	9.42[a]	-0.89[a]
ΔLGDPXM	1.02	-	19.58[a]	1.11	1.33	0.63	0.02[c]
ΔLDCP	3.01[c]	0.47	-	3.19[b]	0.60	2.10	1.54[b]
ΔINFLA	1.58	1.77	1.29	-	1.44	0.20	-0.005
ΔEXCR	0.66	1.42	0.15	3.07[c]	-	0.90	0.17
ΔPRINT	3.21[b]	3.89[b]	2.11	0.40	0.94	-	-0.19

Note: All variables are in the first difference except the error term obtained from the Johansen order of co-integration tests
a, b and c indicate significance at the 1%, 5% and 10% level of significance

Replacing GDP with non-mining GDP (LGDPXM) changes the results of the Granger causality test as shown in Table 5.10. The results now indicate that only inflation and interest rates granger cause net foreign assets at 1% level of significance, this is in line with the results obtained from the VECM.

5.5 Dynamic Simulations

In this section the dynamic simulations are used to provide insights into the significance of the variables in the VECM.

5.5.1 Impulse Response Function
This describes the response of each variable in the VAR overtime to a one-time shock in any given variable while keeping others constant. Table 5.11 shows results of the impulse response.

Table 5.11: Response to Cholesky One S.D Innovations

Period	LGDPXM	LDCP	INFLA	PRINT	EXCR
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	-0.0356	0.0695	0.1059	-0.0342	0.0617
3	0.0165	0.0065	-0.0052	0.1103	0.0275
4	0.0159	0.0242	0.0856	0.0344	0.0327
5	-0.0093	0.0180	0.1006	0.0603	0.0288
6	0.0025	0.0167	0.0893	0.0888	0.0238
7	-0.0027	0.0129	0.0917	0.0679	0.0240
8	-0.0047	0.0099	0.0887	0.0708	0.0233
9	-0.0013	0.0117	0.0830	0.0650	0.0263
10	-0.0016	0.0111	0.0780	0.0654	0.0269
Cholesky Ordering: LNFA LGDPXM LDCP INFLA PRINT EXCR LGDP					

According to the table, in the first period, the shock introduced to the explanatory variables has no effect on the explained variable (LNFA). In the second period a percentage shock of the system on the variables will result in different effects on the explained variable. For instance a percentage shock in LGDPXM and PRINT will reduce LNFA by 0.04% and 0.03% respectively. In the last period, a 1% shock in INFLA, PRINT and LDCP will result in 0.08%, 0.07% and 0.01% increase in the LNFA. The system of equations in this study appears to be somewhat stable since most responses are close to zero.

5.5.2: Variance Decomposition

The forecast error variance decomposition looks at the proportion of variance in one series due to its own shock, policy shock and any identified shocks. It shows how much the forecast error variance decomposition is performed to assess the extent to which gross domestic product (mining and non- mining), domestic credit to private sector, inflation, interest rates and exchange rates affect net foreign assets for Botswana overtime. The following tables present the results for variance decomposition.

Table 5.12: Variance Decomposition of LNFA

Period	S.E.	LNFA	LGDP	LDCP	INFLA	PRINT	EXCR
1	0.342629	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.396319	76.12888	6.426231	5.403400	11.87511	0.132865	0.033512
3	0.421413	68.25071	7.761436	4.989750	10.50435	7.733337	0.760418
4	0.457399	62.05238	6.595093	4.463538	19.64016	6.569223	0.679605
5	0.496693	57.78941	6.340644	3.853492	25.02598	5.925037	1.065431
6	0.532674	55.66318	6.097066	3.515962	28.18601	5.432369	1.105414
7	0.564184	54.82380	5.741731	3.382525	29.90747	5.044156	1.100324
8	0.593678	54.56139	5.662385	3.328416	30.60663	4.758995	1.082186
9	0.619897	54.26155	5.595785	3.401805	31.05931	4.611139	1.070415
10	0.643572	53.88760	5.567197	3.463885	31.48729	4.524168	1.069854

In comparison to other variables own shocks make up a significant source of variation in net foreign assets forecast errors declining from 100% in the first period to about 54% in the 10th period. This is followed by inflation which increases as the period progresses explaining at most 31% of the net foreign assets by the 10th period. GDP accounts for about 7% of net foreign assets in the 3rd period but declines to about 3% in the last period. Interest rates component in the net foreign assets variation also declines from around 8% in the short term to about 5% by the 10th period. Domestic credit to private sector follows closely by explaining 5% of the net foreign assets variation in the short term and declining to about 3% in the long-run. Exchange rates influence net foreign assets the least in the long-run as they account for 1% of the source of variation in net foreign assets.

According to the results of the variance decomposition shown in Table 5.13, the standard error of the results from period 1 to 10 increases from 0.357 to 0.586. This implies that as the period progresses the variance decomposition of most explanatory variables increases or rather go further from the mean. For instance, the variance decomposition of inflation increases from 6.6% in the 3rd period to 25% in the 10th period. The same pattern of decomposition takes place in all the other variables except PRINT.

Table 5.13: Variance Decomposition of LNFA

Period	S.E.	LNFA	LGDPXM	LDCP	INFLA	PRINT	EXCR
1	0.357364	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.388554	85.85892	1.123026	4.834314	7.887024	0.173341	0.123377
3	0.427414	71.47713	3.902002	4.866487	6.604807	12.73549	0.414085
4	0.457097	65.62602	4.756699	4.254993	13.59780	11.34373	0.420758
5	0.481050	61.78341	4.508635	4.289692	18.25816	10.44960	0.710494
6	0.506689	59.29691	5.457166	4.243518	20.78096	9.439006	0.782444
7	0.528391	58.20130	5.647316	4.294104	22.30503	8.681074	0.871178
8	0.547917	56.91554	6.077863	4.652932	23.43734	8.073432	0.842894
9	0.567114	56.18046	6.355986	4.916979	24.14865	7.554632	0.843288
10	0.585792	55.18315	6.646387	5.233241	25.02291	7.082887	0.831423

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Introduction

The main aim of the study was to establish the theoretical basis or applicability of monetary approach to balance of payments in Botswana. The role of monetary variables on balance of payments equilibrium in Botswana was estimated by means of vector error correction model, impulse response function and variance decomposition. Causality test accounted for the stabilization test on the model. The chapter summarizes the findings of the study and presents the conclusions and policy implications. The chapter discusses the limitations of the study and finally areas of further research.

6.2 Conclusion and Policy Implications

The empirical results from this study showed that monetary variables do not play an overwhelming role in determining the balance of payments in Botswana. This finding corresponds to studies by Fleermuys (2005) of Namibia, Boateng and Ayetimi (2013) of Ghana and Bobai (2013) of Nigeria who all found that the determination of BOP in their respective countries is not solely a monetary phenomenon. The findings of the study indicate that only two of the original explanatory variables are significant in explaining changes in net foreign assets. Inflation was found to be negatively related to net foreign assets, a finding which is in line with the expectations of the monetary approach theory, however interest rates are positively related to net foreign asset, an outcome which contradicts expectations as stipulated by the approach. This outcome may imply for instance that although Botswana's interest rates increased during the period under study they remained competitive and hence attracted foreign investments which contributed to net foreign assets. It could further imply that the contractionary monetary policy during the time was successful in reducing money supply and hence the increasing net foreign assets.

Although most empirical studies have found that domestic credit is negatively related to and plays a significant role in determining net foreign assets, this current study shows that domestic credit does not play a significant role in determining balance of payments in Botswana. A negative coefficient of domestic credit however supports the prediction from the

approach that credit creation leads to loss of reserves. Non-mining GDP was found to be insignificant in explaining net foreign assets; however what became of particular interest was the sign of the coefficient. The study indicated that non-mining GDP is negatively related to net foreign assets. This confirmed the fact that the Botswana economy is highly dependent on mineral revenues and that mining revenues make up a good percentage of net foreign assets

The VECM model established that there is a long-run relationship between net foreign assets monetary variables. Causality results strongly confirmed that indeed inflation and interest rates have effects on or granger cause net foreign assets while the results of accumulated impulse response found interest rates and inflation to be relatively the most responsive in the long run. Variance decomposition results also found interest rates and inflation were the two variables that explained the most variation in net foreign assets, further emphasizing the importance of the variables in determining balance of payments in Botswana. This paper suggests that monetary authorities in Botswana should use interest rates and inflation to correct discrepancies in balance of payments. It also points out the significance of mineral revenues in foreign reserve accumulations and the economy. It however encourages the use of mixed policies in determining balance of payments in Botswana. Inflation and interest rates are the only significant variables and this does not completely comply with the strong assumptions of the monetary approach to balance of payments.

6.3 Limitations

The study was also meant to find the impact of monetary variables on BOP deficit in Botswana. However, data on net foreign assets that excludes mining revenues could not be obtained and thus non-mining GDP was used to investigate the effect on net foreign assets.

6.4 Areas of Further Research

It would be of interest to test all approaches of BOP determination and make a decision based on the outcome of empirical results from all the three approaches. Should data on net foreign assets that excludes mining be available in future it would make an interesting study to find out the role of monetary variables on net foreign assets that do not have mining contribution. This would give policy makers an idea of what policies to undertake to correct balance of payments deficit.

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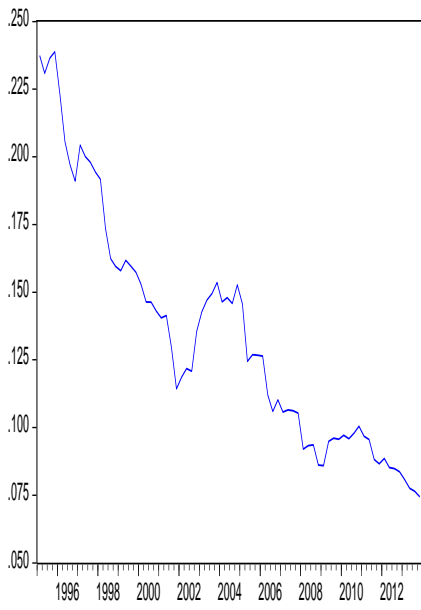
Umer, M., Muhammad, S.D., Abro, A.A., Sheikh, Q.A., & Ghazali, A. (2010). "The Balance of Payments as a Monetary Phenomenon: Econometric Evidence from Pakistan," International Research Journal of Finance and Economics, 38 (2010): 210-218

APPENDIX A

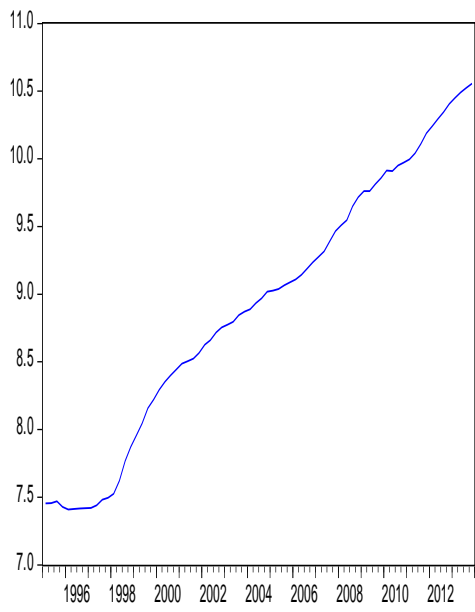## Graphical Presentation of Unit Root Tests at level and first difference

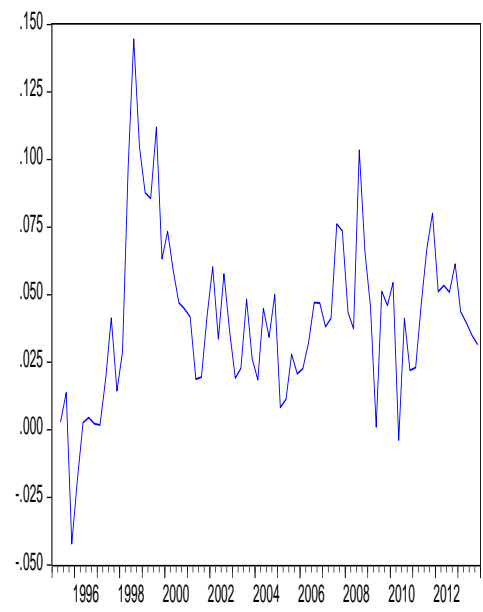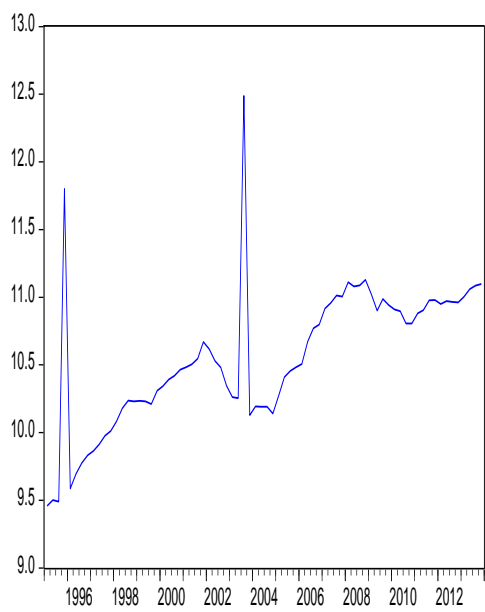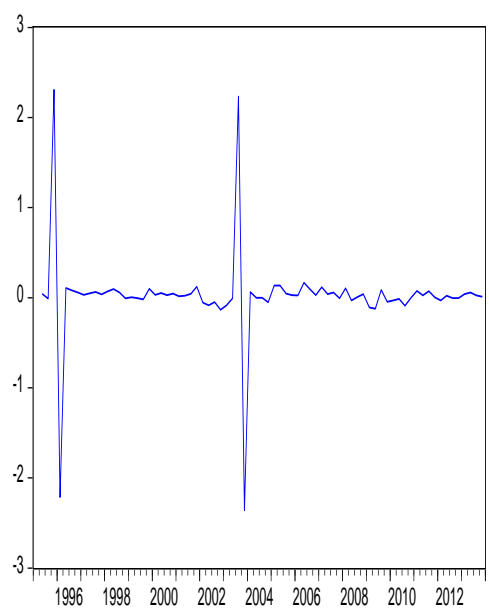LGDP

DLGDP

GDPXM

DGDPXM
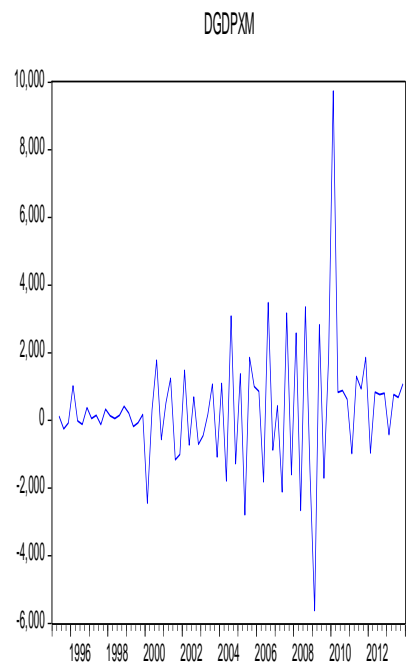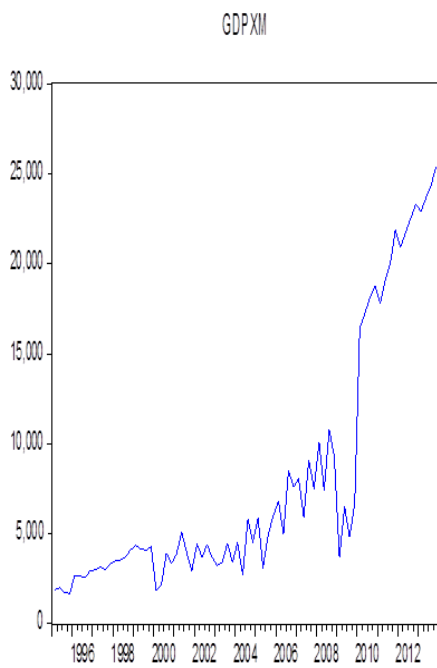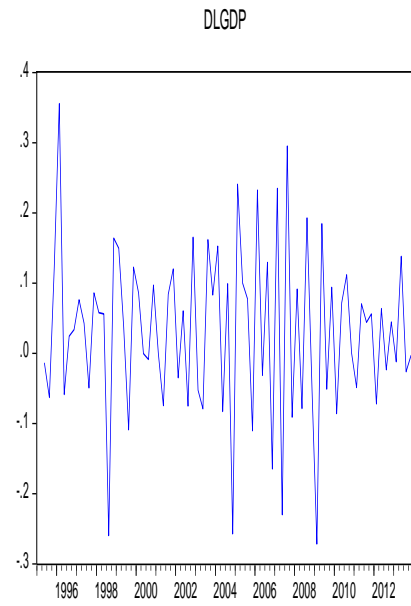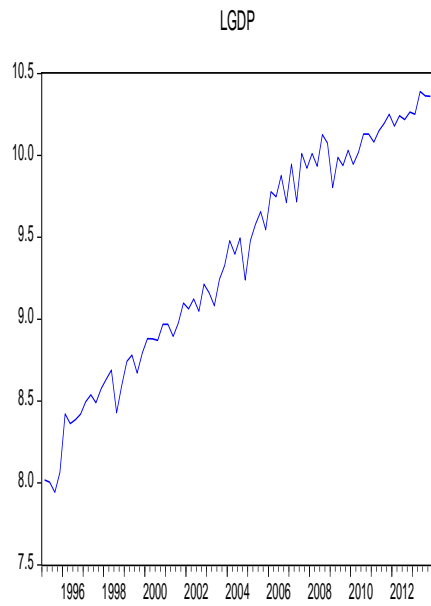
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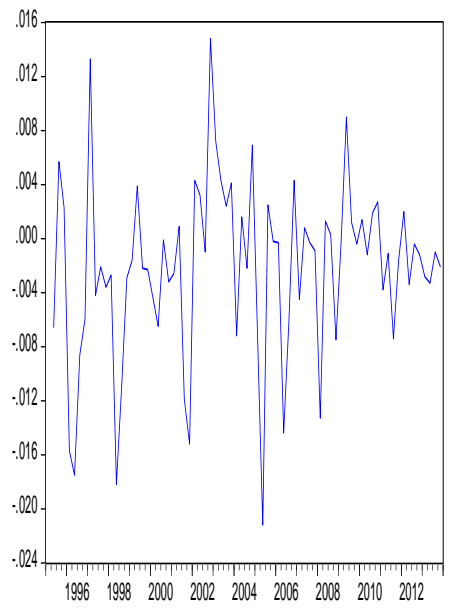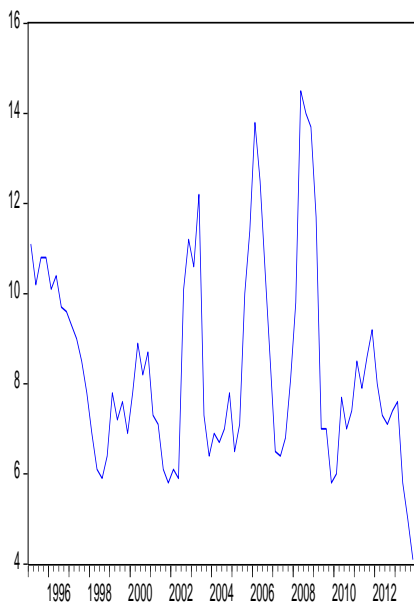
INFLA

DINFLA

LDCP

DLDCP

LNFA

DLNFA

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PRINT

DPRINT

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