The effect of pula devaluation on non-mining export sector in Botswana

By

LEBONE MATSHELANOKA MAKHALE

(202323064)

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Supervisor: Dr L. JEKE

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DECLARATION

I, Lebone Matshelanoka Makhale 202323064, hereby declare that the dissertation for MAGISTER COMERCII in ECONOMICS to be awarded is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

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Lebone Matshelanoka Makhale

ABSTRACT

This dissertation investigates the effects of exchange rate devaluation on non-mining exports in Botswana over the period 1984-2012 and the exchange rate pass-through effect to consumer prices. The economy of Botswana is significantly dependent on mineral exports, particularly the diamond. The dominance and over-reliance on diamond exports in the economy has led to low levels of economic diversification. Bank of Botswana has over the years devalued the pula, in attempt to stimulate growth of non-mining export industries and to enhance non-mining export competitiveness. However, raising export competitiveness this way may be inflationary and have no significant effect on non-mining exports. The study investigates the existence of cointegration between real effective exchange rate and the non-mining exports using the Johansen method of cointegration. The vector error correction model is used, to examine the short-run dynamics of the model.

The results suggest that a positive long-run relationship exists between real effective exchange rate and Botswana's non-mining exports. The results of the exchange rate pass-through suggest that nominal exchange rate has a short term relationship with consumer prices in Botswana. However this relationship does not hold over the long run.

Keywords; Botswana, Non-Mining Exports, Devaluation, Exchange Rate pass-through, Cointegration, VAR, VECM.

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List of Abbreviations

ADF	Augmented Dickey-Fuller
BITC	Botswana Investment and Trade Centre
CEDA	Citizen Entrepreneurial Development Agency
CSO	Central Statistics Office
ECM	Error Correction Model
ERPT	Exchange rate pass-through
FAP	Financial Assistance Policy
GDP	Gross domestic product
MFDP	Ministry of Finance and Development Planning
ML	Marshall-Lerner
NEER	Nominal effective exchange rate
NME	Non-mining exports
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PP	Phillips-Peron
PPP	Purchasing Power Parity
REER	Real effective exchange rate
SACU	Southern African Customs Union
SDR	Special Drawing Rights
TIPA	Trade and Investment Promotion Agency
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
VAR	Vector Autoregression
VECM	Vector Error Correction Model

Chapter 1: Introduction

1.1 Background and Problem Statement

Botswana is developing a national vision that will succeed Vision 2016. A national vision sets out the long-term strategic socio-economic development goals used to guide national development in Botswana. Vision 2016 was formulated in 1996 and set targets the nation expected to attain by the year 2016. One area of focus in the subsequent Vision is economic diversification, which is seen as an important goal due to Botswana's significant reliance on the mining industry. The mining sector historically accounted for about 40% of gross domestic product from 1976 to 2006, while diamond exports averaged 68% of total exports between 2005 and 2010. Mining has contributed less in terms of employment creation due to the capital-intensive nature of the sector (Jefferis, 2009; Central Statistics Office, 2010 and Siphambe, 2013). To attain the goal of economic diversification, export diversification has been identified as a key ingredient. That export diversification has been noted as important indicates the importance of international trade to Botswana as a key driver of growth and development.

The 2008 global economic crisis led to a severe decline in government revenue and economic recession in Botswana (Bank of Botswana, 2009). This was due to a sharp decline in diamond sales; hence the need to diversify the economic base became even more urgent. Economic diversification has been a recurring theme in the National Development Plans from the late 1980s, with little success. A number policies and programmes have been initiated to achieve diversification over the years in Botswana. One of the recurring means of maintaining export diversification has been exchange rate devaluation. The effect of exchange rate changes on enhancing export competitiveness is a subject of great interest in this regard, as Botswana monetary authorities have from time to time adjusted the value of the Botswana pula to maintain the competitiveness of the non-mining sector. In 2005 the monetary authority in Botswana adopted a crawling peg as a way of managing the currency (Bank of Botswana, 2005). Under this method, the Bank of Botswana pegs the pula to a basket of currencies comprising the South African rand and Special Drawing Rights (SDR). The rate of crawl is based on the differential between the inflation objective and forecast inflation of trading partner countries (Bank of

Botswana, 2005). The adjustment in the nominal value of the pula then adjusts the real effective exchange rate (REER), thus maintaining relatively stable currency.

Devaluation has long been appealing to policymakers as a tool for enhancing the international competitiveness of domestic production. Bahmani, Harvey and Hegerty (2013) state that the idea of competitive devaluation was particularly attractive during the Gold Standard period of fixed exchange rates prior to World War 1, but even today countries might view a depreciating currency as advantageous to their export industries. A weak domestic currency relative to that of its trading partners is expected to make domestically produced goods and services to be more competitive relative to those of other countries. This ought to stimulate demand for domestic goods and services and encourage domestic production. On one hand, a weak currency may be beneficial for the exporting sector provided it does not rely significantly on imported goods for inputs. On the other hand devaluation can be detrimental to the export sector when it relies significantly on imports for its inputs.

Eicher *et al* (2009) identify the concept of competitive devaluation as a means used by countries to protect domestic production as well as boosting exports. Kumar (2008) and Salvatore (2004) explain devaluation as a deliberate policy increase in the exchange rate by a country's monetary authorities from one fixed or pegged level to another. Bahmani-Oskooee and Ratha (2004) indicate that devaluations could be motivated by protectionism based on the argument of infant industry. According to Kumar (2008: 251) devaluation raises the domestic price of imports and reduces the foreign price of exports of a country devaluing its currency in relation to another country. Devaluation is referred to as an expenditure-switching policy because it switches expenditure from imported to domestic goods and services.

Devaluation has an effect on the price of export and also the value at which local currency is used to purchase imports. Therefore another issue that requires attention is the effect of devaluation on the domestic prices. Menon (1995) defines exchange rate pass-through (ERPT) as the degree to which nominal exchange rate changes are reflected in the prices of traded goods. In the 2006 monetary policy statement the Bank of Botswana acknowledges the role played by exchange rate movements on domestic prices through their effect on imported prices. Inflation trended downwards in the first four months of 2005, but raised thereafter as a result of higher

import prices following the devaluation of the Pula. However, domestic inflation is projected to remain relatively high in 2006 due to the continuing combined effect of the May 2005 devaluation (Bank of Botswana, 2006). There is a need to evaluate pass-through in Botswana to understand the effect devaluation has on domestic prices and therefore on household welfare.

A lack of sufficient empirical evidence on the relationship between Pula and competitiveness of the non-mining exports (NME) in Botswana means there is no clarity on the effect of devaluation, not only on NME but also on domestic prices and import prices as well. This is a concern as Botswana households depend a lot on imported goods.

1.2 Objectives

The aim of this research is to assess the effect of the devaluation of the Pula has on the international competitiveness in the non-mining exporting industries and the pass-through of the exchange rate.

The objectives of this study are

i. To investigate whether a long-term equilibrium relationship exists between pula REER and Botswana's non-mining export competitiveness,
ii. To examine the short-run dynamics of the relationship between the Pula REER and Botswana's non-mining exports.
iii. To investigate the ERPT to import prices and the consumer price index,
iv. To recommend appropriate policy for raising Botswana's competitiveness of non-mining industry, and also an appropriate exchange rate regime that will serve to protect the welfare of poor households, by maintaining low and stable inflation.

1.3 Relevance of the study

It has often been said that the value of the pula is too high and thus makes it difficult for import-competing sectors to grow, but more importantly it makes Botswana exports expensive. It is also a concern that devaluing the pula creates inflationary pressure on the economy, which harms poor households more. There is a need to find a balance between enhancing NME competitiveness while ensuring stable and low inflation.

The findings of this dissertation can serve as a starting point towards understanding the effects of REER; foreign income has on Botswana's NME merchandise. More specifically, the findings of this research should reveal whether the policy of devaluing the pula will benefit the non-mining sectors or whether other tools should be considered to improve NME competitiveness. Additionally the dissertation will look into the ERPT as a way of understanding the effect devaluation has on prices in the economy. Understanding the nature of the relationships between the pula exchange rate and competitiveness of the NME is essential to economic policy making. This will ensure that appropriate policy tools and instruments are used to improve the competitiveness of Botswana's NME, while at the same time balancing the need to maintain stable prices in the economy. Lastly, the findings may give a guide for areas for further research.

1.4 Methodology

The approach adopted in dissertation is that of finding elasticity of the variables. Van Marrewijk (2005) shows that this approach focuses on the relationship between real exchange rates and the flow of goods and services. The estimation technique will employ Johansen cointegration procedures to establish whether a long-run relationship exists between the variables to be used. There will be two parts in the empirical analysis of this research. The first will deal with estimating the relationship between exchange rate movement and non-mining export output, while the second will investigate the ERPT to imports and consumer prices in Botswana.

A quantitative method employed by Rowbotham, Saville and Mbululu (2014) which is somewhat similar to Galebotswe and Andrias (2011) will be used to estimate the relationship of currency depreciation on export demand. The explanatory variables are exchange rate and world income to indicate the purchasing capacity of the international community. Dummy variables are added to the model to account for structural breaks in the data. Global gross domestic product (GDP) is used as a proxy for world income. The required variables for analysis include annual exports of goods and services, GDP and annual average real effective exchange rate REER from 1981 to 2013. The presence of long-run relationships is estimated using vector auto-regression (VAR) and the Johansen (1991) and (1995) cointegration techniques. A vector error correction model (VECM) is used to estimate the short-run dynamics. Impulse response and variance

decomposition functions are used to understand the effect of shocks explanatory variables have on the dependent variables.

The second aspect of this dissertation will estimate the size and speed of ERPT as well as an analysis of pass-through asymmetry in Botswana using monthly data spanning 14 years (168 observations) from 1998 to 2012. The initial stage is the transmission of fluctuations in the exchange rate to the price of imported goods. Thereafter, the second stage of ERPT entails the pass-through of changes in the exchange rate to import prices and consumer prices. The most popular method for testing and estimating cointegration in ERPT models is the Johansen technique based on Vector Auto Regression. The first stage is estimated using the Johansen (1991) and (1995) cointegration technique and a VECM. The cointegration method will test for long-run cointegrating relationships between the variables. After establishing the existence of long-run relationships, a VECM will be estimated to test for short-run dynamics in the relationships between the variables. The study follows the approach used by Leith (1991) to estimating pass-through but differs in that it uses VAR and VECM techniques. Finally NEER is used to represent the exchange rate whereas Leith (1991) used the pula/rand exchange rate.

1.5 Chapter synopsis

The remainder of this dissertation is organised as follows:

Chapter 2 provides the theoretical and empirical literature review concerning the relationship between exchange rate and exports. It also discusses some of the theory around exchange rates and the balance of trade. Additionally, a literature review regarding ERPT is given along with the findings from other empirical studies.

Chapter 3 gives an overview of Botswana's Macroeconomic environment and the also the structure of the economy. This chapter covers the evolution of export products from Botswana's independence. Also covered are the history of monetary policy with a focus on the exchange rate policy and a history of inflation in Botswana.

Chapter 4 discusses the econometric methodology employed to achieve the objectives of this dissertation. The models to be used are also developed in this chapter. In chapter 5 the data is

analysed using the econometric methodology developed in chapter 4. The chapter then briefly explains the variables used and also reports the estimation results.

In chapter 6, conclusions are drawn based on results from chapter 5 and an attempt to make recommendations for policy is provided. The chapter also discusses the limitations of this dissertation and also provides suggestions of areas of further research.

Chapter 2: A theoretical and empirical literature review: exchange rates, export competitiveness and exchange rate pass-through

2.1 Introduction

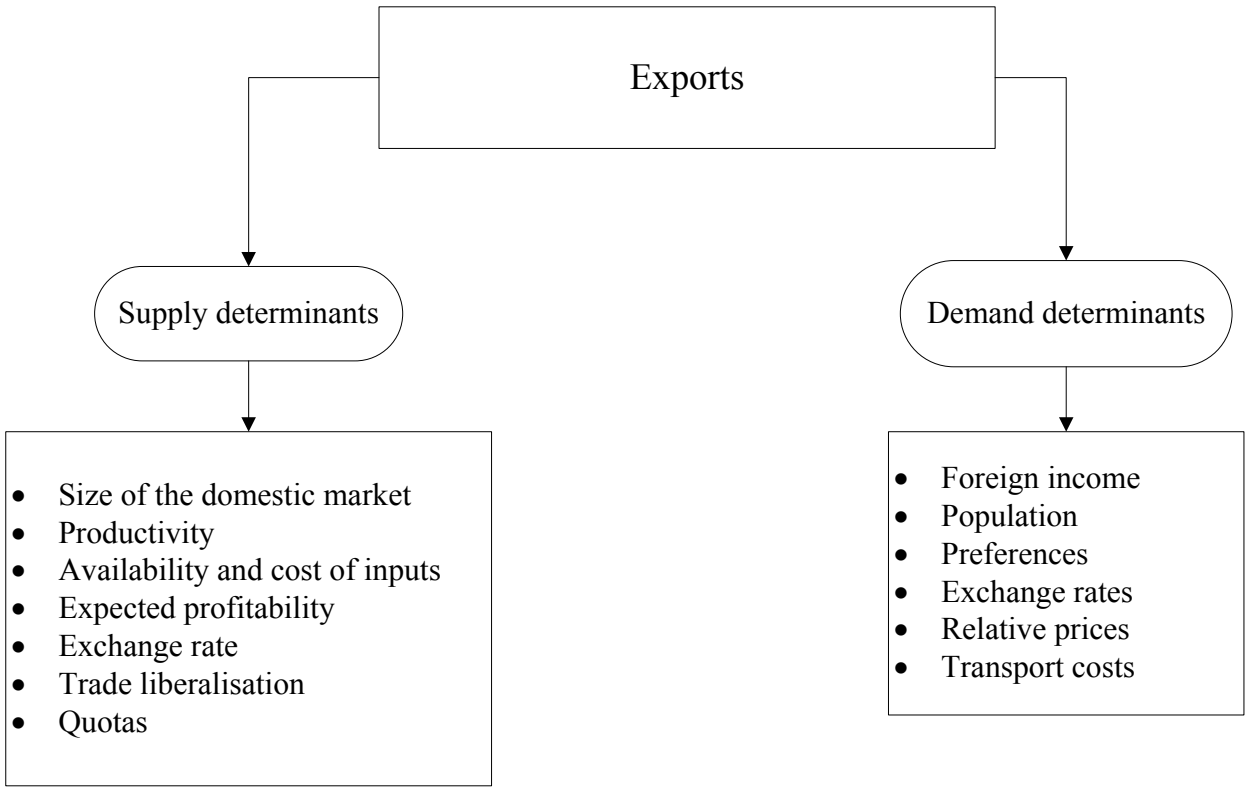
The exchange rate plays an important role in the facilitation of trade between countries that use different currencies. It is important to understand how changes in exchange rate can affect the patterns of international trade. Changes in the exchange rate can also have an effect on price levels of countries that are involved in international trade. It is essential for developing countries such as Botswana, to understand the effect of exchange rates on patterns of trade and domestic price levels. The primary of objective of this chapter is to give a theoretical and an empirical literature review of both exchange rate devaluation effect on export competitiveness and also the ERPT to domestic prices.

The chapter starts by introducing the determinants of exports and the theories that explain the effect of exchange rate on the trade balance. Then a discussion of the theory regarding exchange rate-pass through will be provided. The chapter then outlines the determinants of export demand and supply, this is followed up with a discussion of the Marshall-Lerner condition, the Absorption approach and then the J-curve phenomenon; this is followed by a theoretical discussion of the ERPT. The section that follows provides the empirical findings on the Marshall-Lerner condition, the J-curve and ERPT.

2.2 Determinants of exports

The performance of exports is determined by various economic variables, which can be mainly classified as either supply or demand factors. Furthermore, there are other factors that have an influence on impact on the trade patterns such as trade policies and exchange rate regimes. These policies determine the extent to which a country can engage and benefit from international trade. Smith (2007) investigated how export volumes are influenced by the exchange rate and other factors.

Figure 2.1 Determinants of exports



Source: Smith (2007)

The figure above illustrates some of the economic factors that influence the supply and demand of exports. It has been shown that countries with large domestic markets like the United States of America (US), export far less as a proportion of their GDP as compared with countries with a small domestic market like Botswana. Generally supply side factors influence the availability of goods and service for exports whereas the demand side factors determine how much in the way of goods and services can be bought by foreign consumers. As depicted in figure 2.1 there are a number of factors that affect the supply and demand for exports. The higher the expected profitability from exporting, relative to producing for the domestic market, the higher the supply of exports. More goods and services will be produced for export given a higher rate of return on exporting, relative to returns from other uses for the resources used in exporting. Trade liberalisation is expected to improve the ability of countries to exchange goods, thereby increasing exports and also imports. Quotas put a limit on the amount that can be exported at a given time, so quotas restrain exports.

On the demand side, export demand, as illustrated by figure 2.1, is determined by foreign income, population, preferences, exchange rates, relative prices and transport costs. Foreign income determines the amount of goods and services that foreign customers can consume. Some of the goods and services consumed will include imports; therefore an increase in foreign income may give rise to an increase in exports. This dissertation focuses on effect of exchange rates on exports.

One of the main objectives of this dissertation is however to investigate the relationship between export competitiveness and exchange rate devaluation. A discussion of the theories that describe the relationship between exports demand and currency devaluations will be given and the empirical findings that studied this relationship.

2.2.1 Exchange rate and exports

Foreign exchange is the price of one currency relative to that of another currency – that is, the price of one unit of domestic currency required to purchase a unit of foreign currency. Claassen (1996) defines the exchange rate as the relative price of two differing national currencies. Olney (2011) describes exchange rate as the rate at which one currency exchanges for another. The exchange rate is therefore a medium of exchange that facilitates trade between countries. However these definitions do not consider what a currency can buy in another country, in other words the purchasing power of a currency.

Real exchange rate is a concept that takes into consideration the purchasing power of a currency. Claassen (1996) and Copeland (1989) defines real exchange rate as the price of foreign (goods and services) relative to domestic goods and services. Claassen (1996) and Corden (1994) additionally state that real exchange rate is both the relative price of domestic price of tradables with respect to foreign tradables and also that it is the domestic price of tradables with respect to non-tradables.

The nominal effective exchange rate (NEER) is a weighted average of the domestic exchange rate with respect to currencies of major trading partners of the country. REER adjusts the nominal exchange rate to account for the inflation differentials between the domestic country and its trading partners (Claassen, 1996). REER is therefore a weighted bilateral real exchange rate

of trading partners. REER is used as a measure of external competitiveness of a country. A decline in REER can be described as devaluation or depreciation. If the decline in REER is due to policy intervention by government this would be referred to as devaluation. While a decline of REER of a floating currency would be referred to as depreciation.

According to the orthodox Keynesian school of thought (Snowdon and Vane, 2005), export demand can be described as a function of foreign income and the relative price of exports in comparison to similar goods. The relative price of exports is based on the exchange rate of the exporting country. This theory applies IS-LM model developed by Mundell (1963) and Fleming (1962), to an open economy. The IS-LM model is a general theory of aggregate demand for goods and services (Mankiw, 2009). Devaluation of the domestic currency is therefore expected to stimulate demand for exports because domestic goods and services would be cheaper in comparison to other competing goods. This concept is based on the law of demand, which states that the higher the price of a good the smaller the quantity demanded and the lower the price of a good, the greater the quantity demanded (Parkin, 2008). Devaluation therefore works by making exports cheaper and imports more expensive. If the law of demand then holds, devaluation will increase the quantity demanded for exports. The next section discusses the conditions whereby currency devaluation can have an effect on exports but ultimately the trade balance.

Purchasing power parity (PPP) developed by Swedish economist Cassel (1918) states that any given commodity tends to have the same price worldwide when measured in the same currency, which is sometimes referred to as the law of one price. This means that given a free flow of goods between countries and having taking into account transaction and transportation costs, devaluation would not have any long lasting effect in stimulating demand for exports. According to Arcy (1994) starting from a given base period, the exchange rate between any two currencies will move in line with relative price levels in two economies. Two versions of PPP exist, which are absolute PPP and relative PPP (Appleyard and Field, 2001). Absolute PPP asserts that the equilibrium exchange rate between two countries is determined entirely by the ratio of their national price levels. Relative PPP postulates that the change in the exchange rate over a period of time should be proportional to the relative change in the price levels in the two nations over the same time period. Therefore PPP describes the long run situation, where prices are able to adjust over a long period. This adjustment can be brought about by traders buying where it is

cheap and selling where it expensive. These actions of traders will lead to prices converging and thereby negating the effects of any price differential caused by a change in exchange rates. In the short-run however, REER depreciation/devaluation may have an effect on export demand. This potential short-run effect may be the reason why devaluation may be a tool used by authorities to stimulate demand for exports and consequently employment.

2.2.2 Marshall-Lerner Condition

The view that currency devaluation can improve export competitiveness is based on a concept referred to as the Marshal-Lerner (ML) condition. The ML condition, named after Alfred Marshall and Abba Lerner, provides a description of the specific conditions under which devaluation or depreciation of a currency is expected to improve a country's trade balance. The ML condition stipulates that a devaluation or depreciation of home currency should improve a country's balance of trade provided that the sum of imports and exports price elasticities is greater than one. The ML condition depends on the absolute sum of the long-term demand elasticities of both imports and exports exceeding unity. This means then devaluation will lead to an improvement of the balance of trade (Bahmani-Oskooee and Ratha, 2004). Proponents of this approach argue the ML condition provides both the necessary and sufficient conditions for an improvement of the trade balance. Eicher, Mutti and Turnovsky (2009) further explain that the intuition behind the ML condition is that if demand is highly inelastic, a large change in price will be met by a small change in the quantity demanded. If the currency is devalued, it is expected that the quantity demanded for exports will increase, while the quantity demanded for imports will decrease.

Bahmani, Harvey and Hegerty (2013) briefly explain the ML condition as follows: "A country's trade balance consists of the value of its exports minus the value of its imports. Each value is measured as a price times a quantity. If the country's currency is devalued, the resulting price decrease should increase the quantity of exports and decrease the quantity of imports, but the trade balance can only improve if the export or import quantities respond sufficiently to offset the deterioration in price. Thus, either export quantities must increase or import quantities must decrease".

In the immediate period following devaluation, the response of exports and imports depends on the short-run elasticities of exports and imports. Short-run elasticities are almost always significantly smaller (inelastic) than long-run elasticities, simply because in the long run economic agents have enough time to find substitutes for goods and services facing a price increase. As a result of highly inelastic demands in the short run, the M-L condition may not be satisfied in the short run as elasticities for exports and imports are low. Currency devaluation may then lead to an immediate worsening of the trade balance. However, in the long run as agents find substitutes for foreign goods, the import elasticities then rise and the balance of trade improves (Eicher *et al*, 2009). In the short term, demand is relatively price-inelastic. This means that there will be little or no response to price changes due to devaluation. This sluggish response as Magee (1973), Ahtiala (1983) and Bahmani-Oskooee et al (2004) noted, is due to contracts in place before the devaluation, and inelasticity in supply to meet increased demand brought about by the devaluation.

2.2.3 The Absorption Approach

Another concept that is used to explain the link exchange rates and balance of payments is the absorption approach. The absorption approach explains that devaluation, through its impact on the terms of trade and domestic production, leads to a switch in spending from foreign to domestic goods, and hence, an improvement in the trade balance (Claassen, 1996). Corden (1994) defines absorption as demand generated by expenditure on consumption and investment by the public and private agents while Daniels and VanHoose (2002) define it as expenditure on goods and services.

The Keynesian national income model is used to explain the absorption approach. The mathematical presentation of the model is given below:

$$Y = C + I + G + (X-M) \qquad (2.1)$$

Where, Y = total domestic income

C = final consumption by household

I = investment spending

G = government expenditure

X =exports

M = expenditure on imports

Thompson (2006) shows that the absorption approach to be total domestic spending, where A = C + I + G. Furthermore, (X-M) can be consolidated into one term 'the balance on goods and services (BGS). This means that total output in the economy is the sum of absorption plus the balance on goods and services. Therefore the national income for the national economy is

$$Y = A + BGS \qquad (2.2)$$

Thompson (2006) states that the trade balance (BGS), depends partly on the exchange rate as it is a representation of the domestic price of foreign currency. Additionally depreciation raises BGS given the Marshall-Lerner condition of elastic export and import quantities. That is the adjustment in export minus import quantities must be elastic to raise BGS (Thompson, 2006).

2.2.4 The J-Curve

The J-curve describes a phenomenon in which the trade balance of a country deteriorates before a net improvement following a currency devaluation or depreciation. Magee (1973) mapped the J-curve phenomenon using data based on the trade balance of the US following the devaluation of the US dollar. Bahmani-Oskooee and Hegerty (2010) and Bahmani-Oskooee and Gelan (2012) describe the J-curve as the post-devaluation behaviour of the trade balance in which the trade balance initially deteriorates, followed by an improvement. This is due to adjustment lags – after devaluation or depreciation a country's trade balance keeps deteriorating in the short run and then begins to improve, but only after a while. Eicher *et al* (2009, 395-397) explain the J-curve as a temporary deterioration of a country's balance of trade before improving enough to offset the deterioration after a devaluation or depreciation. This is due to the fact that elasticities are not constant. In their survey of J-curve literature, Bahmani-Oskooee and Ratha (2004) show that devaluation worsens the trade balance at first and improves it later, due to a lag effect in a pat-tern that resembles the letter J, hence the name J-curve effect.

Conventional models examining the relationship between devaluation and exports are based on the J -curve or exchange rate pass through. These suggest that after devaluation exports become cheaper, relative to other exports, while imports become relatively more expensive. As a result, current account deficits are reduced and the growing export market is posited to stimulate the economy. While devaluation will ultimately balance a country's internal and external sector in the face of macro-mismanagement, its ultimate effect may be to hurt overall export values in the long-run if the country's exports are not price sensitive.

Jamilov (2012) distinguishes the two effects that bring about the J-curve resulting from devaluation which are the price effect and the volume effect. The price effect implies that currency depreciation will cause imports to be more expensive and exports to appear cheaper in the short-run for the domestic buyers. The balance of trade may deteriorate in the short run due to the time required for the exports and imports to adjust to the new exchange rate. Also certain goods which have already been purchased or ordered at the time of the devaluation, and the short run are dominated by the completion of old contractual obligations. As the quantity of trade begins to respond to the depreciation, it is believed that the so-called ''volume effect'' of currency devaluation will reverse the trade balance movement and eventually improve it.

2.2.5 Conclusion

This section provided a theoretical review of exchange rates, the ML condition, the Absorption approach and the J-curve as theories that explain the effects of currency devaluation on the trade balance.

Exchange rate is defined to be the domestic currency price of foreign currency. Currency devaluation is a decrease in the relative price of the domestic currency. That is devaluation will lead to less foreign currency to purchase one unit of domestic currency. Real exchange rate is the relative foreign currency price adjusted for price differences. REER is found to be a trade weighted basket of bilateral real exchange rates. REER is used as a measure of country competitiveness.

One of the major deficiencies of the ML condition and the J-curve is that they do not clearly differentiate the conditions under which the trade balance would improve following devaluation

in the case of a large country and a small country. It would be realistic to assume that devaluation for a small country such as Botswana would lead to significantly different outcomes than depreciation for a large country such as the US or China.

Magee (1973) indicated that the currency with which an export contract is denominated has a significant role in determining the effect of devaluation on exports. If export contracts are denominated in the domestic currency, devaluation will result in a lower return for exporting firms in the short run, as agents might not immediately adjust their purchases.

Diaz Alejandro (1963) observed that devaluations in the real world may be puzzling, as several devaluations have resulted in immediate improvements in the balance of trade but were, however, accompanied by decreases in the level of total output in those economies. It could be argued that the decrease in output was due simply to deflationary fiscal and monetary measures adopted simultaneously with the devaluation of the exchange rate. However, it may be of interest to investigate whether at least part of the decreases in output may be explained solely as a direct result of the devaluation.

Gutiérrez de Piñeres and Cantavella-Jordá (2010) suggest that the value of exports in a country is the sum of all commodities in its portfolio. If devaluation has a differential effect across commodities, countries can expect different results depending on their portfolios. Therefore, any accurate analysis of the effects of devaluation must take into account the components of a country's export portfolio.

Magee (1973) developed a taxonomy that describes the importance of the currency used in export transactions following devaluation. If exports are denominated in the foreign currency, after devaluation the value received in foreign currency remains the same whereas there is a gain as measured in the domestic currency. However if the exports are denominated in domestic currency, following a devaluation the value in domestic currency does not change and therefore the gain will be accrued by importers in the destination countries. This analysis is mute on the effect of devaluation on volume of exports.

Abeysinghe and Yeok (1998) present a different view on the effect of devaluation on exports. The authors propose that the presence of high import content, exports are not adversely affected

by currency appreciation because the lower import prices due to appreciation reduce the cost of export production. This cushioning effect outweighs that of the effect of productivity gains on export competitiveness. Service exports, however, with very low import content, tend to suffer from currency appreciation. Edward and Garlick (2008) also have a similar theoretical conclusion that the inflationary effect of a nominal depreciation will also influence the export response. Rising costs erode the improved profitability of export supply or restrict the firm's ability to lower its foreign currency export prices, thus reducing exports. Such increases in per-unit production costs may arise. A nominal depreciation increases the price of imported inputs and domestically produced import-competing goods, raising per-unit production costs for any firm using such inputs. Higher profit margins on exports may spark price hikes by suppliers, particularly if these suppliers themselves face supply constraints. Rising consumer prices, particularly of imported final goods, can also lead to demands for increased wages. The export-enhancing effects of a nominal depreciation may be partially or entirely offset by increases in exporters' production costs. At the extreme, the export response may be offset entirely by rising domestic prices.

Based on the ML condition the Absorption approach and the J-curve as described in this section, it therefore follows that in the short run devaluation will not have an impact on volumes of exports due to supply constraints and demand inelasticity. Therefore in the immediate period following a devaluation of the Pula, there would be little to no effect on the volume of NME but there is likely to be an increase in the profits from exports if such exports are denominated in foreign currency. This means that the value received in Pula would be higher if exports are sold in foreign currency. However, over a longer period following devaluation of the Pula, NME should respond in volume terms as well. This analysis is based on the reasoning that exports do not have significant imported inputs. Abeysinghe and Yeok (1998) showed that exports loose competitiveness following devaluation when a significant amount of inputs are imported items.

2.3 Exchange rate pass-through

Devaluation does not only affect the balance of trade, it also has an effect on the welfare of households through its effect on prices of goods and services. This section provides a discussion of ERPT. Isard (1995) submits that changes in exchange rates have pervasive effects, with consequences for prices, wages, interest rates, production levels and employment opportunities and thus with direct and indirect implications for the welfare of virtually all economic participants. Accordingly, large and unpredictable changes in the exchange rates present major concerns for macroeconomic stabilization policy. The effect that devaluation may have on the general price level in an economy is important to understand due to the costs that imported inflation may pose to households. The general price level that affects residents of a country must encompass all the goods whether they are produced domestically or imported (Ahmad and Ali, 1999).

In an open economy, exchange rate changes affect prices of imported goods and to a certain extent the price of domestically produced goods. This phenomenon whereby a change in exchange rate leads to a change in domestic prices is known as ERPT. Wickremasinghe and Silvapulle's (2004) define ERPT as the extent to which changes in nominal exchange rates are reflected in import prices. ERPT refers to the degree to which a country's prices change in response to a change in its exchange rate. Parsley (2011) defines ERPT as the percentage response of domestic prices to exchange rate changes. Sweidan (2013) defines ERPT as the transmission of exchange rate changes into import (export) prices of goods in the destination-market currency as well as into aggregate domestic prices. Darvas (2001) extends the definition of ERPT as a description of the effects of exchange rate fluctuations on one of the following: 1) import and export prices, 2) consumer prices, 3) investments and 4) trade volumes. Therefore ERPT is the percentage change in domestic currency import prices resulting from a one-percentage-point change in the exchange rate, that is, the change in domestic prices that can be attributed to a preceding change in the nominal exchange rate. That is ERPT can be concisely described as a measure of the responsiveness of import and export prices to a change in the nominal exchange rate.

Since the early 1980s, many less developed countries have been obliged to implement macroeconomic adjustment programs in order to deal with large current account deficits, inflation, and stagnant economic growth. One of the more controversial elements of these programs is currency devaluation. In theory, devaluation addresses the problem of external deficits by raising the price of tradable goods (exports, imports, and close substitutes), thus stimulating production of these goods and dampening demand for them. However is unpopular in developing countries and has been criticized by some researchers for being contractionary, inflationary, ineffective in reducing external deficits, and regressive in its impact on income distribution (Minot, 1998).

The effect of devaluation on households has however, received limited attention. Exchange rate movements can affect domestic prices directly through changes in the price of imported finished goods and imported inputs that are raw materials and capital goods. When the currency of the domestic country, which depends significantly on imported goods and services, depreciates, it will result in higher import prices of finished goods and inputs (Abeysinghe and Yeok, 1998). Likewise, when the currency of the domestic currency depreciates it will result in higher import prices which are more likely to be passed on to consumer prices. Currency depreciation can cause an increase cost of imported inputs which may result in domestic producers increasing their marginal costs therefore leading to higher prices of domestically produced goods. However, there exists a considerable amount of literature on ERPT as an accurate understanding of the adjustment of domestic prices following changes in the exchange rate.

There are two extremes of pass-through: perfect pass-through and zero pass-through. Under a perfect pass-through, domestic import prices increase while domestic export price remains unchanged following an exchange rate change. The resulting effect is deterioration in the trade balance. ERPT to prices is incomplete if exchange rate changes elicit less than equal to proportion of changes in prices. Pass-through to prices can be disproportionate or asymmetric when exchange rate depreciation causes a price response of a different magnitude to an appreciation or when smaller changes elicit a different proportionate response from larger changes (Aron, Farrell, Muellbauer and Sinclar 2012). In zero pass-through situation, domestic export price increases and domestic import prices remain constant hence the real trade balance improves following devaluation.

ERPT can be studied on two levels: The first level deals with the transmission of exchange-rate changes to import and export prices. Literature refers to this transmission as the first stage pass-through. The second level explores ERPT into aggregate domestic prices as measured by the consumer price index, producer price index and wholesale-price (Parsley, 2011).

2.3.1 Determinants of exchange rate pass-through

The type of exchange rate regime plays a critical role in determining the extent to which importers pass on the price change to consumers due to a currency exchange. Mirtala (2014) and Razafimahefa (2012) note that the responsiveness of exchange rates to exogenous price shocks as well as their ability to serve as a traditional vehicle for a transmission of these shocks to domestic prices is affected by exchange rate arrangement adopted by monetary authorities. More specifically that ERPT is higher under a fixed exchange rate regime than a flexible exchange rate regime. The type of exchange rate regime affects pricing behaviour in that under a flexible exchange rate regime agents regard changes in exchange rate to be temporary whereas under a fixed exchange rate regime changes in the exchange rate are regarded as long-lasting movements.

Another important determinant of exchange rate pass-through is the market structure of imported goods and services. Menon (1995) states that the market structure is a key determinant of ERPT. When there is perfect competition, ERPT significantly depends on the elasticities of supply and demand of imports. The change in imports following an exchange rate change will be greater, the larger the elasticity of foreign supply, since this results in a larger proportionate change in price, and the larger are the elasticities of domestic demand and domestic supply (Menon, 1995). That means if the elasticities of supply of imports are large, under perfect competition ERPT will be great. Jooste and Jhaveri (2014) add that pass-through can be expected to be higher in perfectly competitive markets. Firms operating in perfectly competitive markets set prices where marginal revenue is equal to marginal cost, therefore currency devaluation would lead to an increase in marginal cost. As these firms are not making an economic profit, they will have to pass the price increase to consumers.

The characteristics of a product also determines the extent to which changes in price due to a change in exchange rates can be passed on to consumers. Menon (1995) states that homogenous

goods exhibit greater ERPT compared to heterogeneous products. Homogenous products are standardized goods with similar features. The elasticity of homogenous goods is high because they are easily substituted.

One of the factors affecting the size of the pass-through from exchange rate changes to domestic prices is the size and openness of the economy: the larger and less open the economy, the smaller and/or slower will be the pass through. (Atta, Jefferis, Mannathoko and Siwawa-Ndai, 1999). Therefore in the case of Botswana, a small and open economy, pass-through could be expected to be higher and faster.

Higher-income countries exhibit lower pass-through rate than lower-income countries. High inflation environments are associated with a higher pass-through (Razafimahefa, 2012). Taylor (2000) argues that in a stable, low-inflation environment backed by a credible inflation-targeting monetary policy, firms reduce the extent to which they pass on exchange rate-related cost increases. Most developed countries are high-income and have used inflation targeting longer than developing nations. Data provided by the World Bank indicates that high-income countries have generally experienced low and stable inflation environments. Furthermore, most high-income countries have flexible exchange rates which tend to reduce pass-through, as any changes in currency are seen as temporary (Razafimahefa, 2012 and Mirtala, 2014).

Other determinants of exchange pass-through that can be found in Razafimahefa (2012) are summed up this way: ERPT is more pronounced following devaluation than appreciation, as importers would seek to pass on the cost to maintain the profit mark-up, but would not readily pass on the decline in cost due to an appreciation. Prudent monetary policy seems to reduce the magnitude of pass-through. Sustainable fiscal policies are associated with lower pass-through. This can be attributed to the fact that credible monetary and fiscal authorities bring a degree of confidence among traders so that currency changes that could harm the economy will not be allowed to persist. Therefore changes in exchange rates are seen as transient adjustments.

2.4 Conclusion

Theory notes that ERPT is higher under a fixed exchange rate regime than flexible exchange rates. This is because any changes under a fixed exchange rate is seen as permanent, whereas

exchange rate movements under floating exchange rates are viewed as temporary. The market structure is another major determinant of ERPT. Perfectly competitive markets tend to increase the ERPT when compared with imperfect markets. The elasticity of goods and services also determines the extent to which sellers can pass on the effects of exchange rate changes to consumers. This means that ERPT is not uniform across a wide variety of goods and services in a country.

2.5 Empirical literature

2.5.1 Exchange rate and exports

There is a lot of literature examining the long- and short-run relationships between the terms of trade and the trade balance. However there is limited literature focusing on the effect of devaluation on exports only. These studies are however relevant to the topic of this dissertation and use different econometric techniques and variables. The goals are similar across these studies as they seek to examine the short- and long-run effects of exchange rate devaluation on the balance of trade. These studies are centred on investigating whether devaluation/depreciation first results in trade balance deterioration and an eventual improvement prior to devaluation/depreciation. The main focus of this study is on examining the effect of devaluation on the NME in Botswana. However the same techniques used in other studies examining the trade balance remain relevant.

When a country devalues its currency the price of foreign currency increases, which makes imports more expensive and exports cheaper. This causes expenditure to be switched from foreign to domestic goods, a country's export rise and the country produces more to meet domestic and foreign demand for goods with reduction of imports. However, it must be noted that devaluation is a provisional answer to boosting domestic production and exportation, which will only be successful if price elasticity for exports and imports is greater than unity. As pointed out by Bahmani-Oskooee and Hegerty (2010), depreciation or devaluation should help increase a country's exports, while making its imports more expensive, it should in theory result in an improvement in the difference between exports and imports, which is the trade balance.

Bahmani-Oskooee and Gelan (2013) highlight the lack of consensus on economic theories and empirical evidence regarding the outcome of devaluations in developing economies. The M-L condition and J-curve show that in the short run, devaluation will not affect the volume of exports, and the value received will depend on the currency used to price exports. If exports are priced in the home currency, devaluation should have no short-term effect on the volume and value of exports, however if a foreign currency is used the value should increase while the volume remains unchanged.

Devaluation is expected to stimulate demand for exports; however Minot (1998) accepts evidence by Krugman and Taylor (1978) that devaluation leads to economic contractions and inflationary pressures. The empirical results have not yielded any conclusive evidence of the relation between currency devaluation and the trade balance as researchers have used different data and methodology, and have studied different countries. Bahmani-Oskooee and Alse (1994) point out that the results from several studies are not conclusive due to, i) differences in periods of study, ii) use of non-stationary data versus stationary data, and iii) different proxies used for REER.

Bhagwat and Onitsuka (1974) studied non-industrial countries' export-import response to devaluation and found that export performance was significantly better in the post devaluation three-year period, compared with both the pre-devaluation medium-term trend and the three-year period preceding devaluation. Using the bounds testing approach to cointegration to investigate the relationship between devaluation and output for Fiji, Narayan and Narayan (2007) find the presence of a cointegrating relationship and that devaluation is expansionary. However, evidence from Kamin and Rodgers (2000) indicates that the Mexican real currency devaluation of 1994 are associated with persistent high inflation and contraction in economic activity and conclude that targeting the exchange rate at a level too competitive could lead to substantial risks to the economy.

Smith (2007) investigated how export volumes are influenced by the exchange rate and other factors. The study finds that export sectors respond differently to the same exchange rate movement. Exports of services volumes (which include tourism) are found to be more exchange-rate-sensitive than export volumes from the agricultural sector. The study also found that the real

exchange rate effect on export volumes differs by sector. Exports of services volumes respond to the real exchange rate with a lag of 18 months. However, it only takes about a year for the real exchange rate to have an effect on most of food export volumes. Manufacturing export volumes appear to respond to the real exchange rate with a lag of 12 to 15 months (Smith, 2007).

Alam (2010) uses a VAR model with first differenced form to determine whether there is any contribution of real exchange rate depreciation to the export earnings of Bangladesh. The finding shows that no causality runs from real depreciation to export earnings in the case of Bangladesh and concludes, however, that the effect of exchange rate depreciation might not be same for all sub-sectors of exports.

Econometric analysis by Abeysinghe and Yeok (1998) of the Singaporean economy shows that in general, the higher the imported input content, the less the effect of exchange rate changes on exports. At one extreme, exchange rate changes had no effect on re-exports. At the other extreme, service exports, being relatively less intensive in imported inputs, were most affected by currency changes. Gutiérrez de Piñeres and Cantavella-Jordá (2010) analysed short-run effects of real devaluations on disaggregated exports in Latin America for the period 1962 to 2003. Their research shows that real devaluations in the short term worsen exports for about 75% of export sectors in Latin America. Devaluation affects export sectors without distinction as to whether products incorporate more added value or less. Only 5% of these industries experience favourable effects from a real devaluation. Furthermore, their study concludes that it is better to examine each country's export portfolio carefully before instituting a uniform devaluation.

African countries have not received much attention in the literature regarding the effect of devaluation on domestic production. There are however a few studies that have been conducted regarding this topic on Africa. This will be discussed in further sections. The results of a study on the effect of devaluation in African countries by Bahmani-Oskooee and Gelan (2013) employed the bounds testing approach to cointegration and error correction modelling, which yields short-run as well as long-run effects by including short-run dynamics into long-run estimation procedure. This study does not resolve the ambiguity around the effect of currency devaluations as it finds that in some countries devaluation is expansionary, in some contractionary, and has no effect in others. The authors, (Bahmani-Oskooee and Gelan, 2013)

further conclude that contractionary or expansionary effects of devaluation in their sampled countries could be examined more effectively and prudently only by considering the unique experience of each of these countries separately.

Galebotswe and Andrias (2011) used a two-step Engle and Granger error correction model that controls for monetary policy, fiscal policy, base country output and interest rates to test the contractionary devaluation hypothesis in the context of Botswana, a small open economy. Other findings of their study are that, government expenditure dampens economic growth in the short run and promotes it in the long run. As expected, contractionary monetary policy dampens economic activity in the long run. South African output is found to be the main driver of Botswana's non-mining private output in the long run.

There are many studies that tested the Marshall-Lerner condition for both developed and developing countries over the last 70 years. Some studies found evidence in support of the Marshall-Lerner condition. There are also studies which concluded that there was no evidence in support of the Marshall-Lerner condition. The literature assessing the Marshall-Lerner condition in Botswana is non-existent. However there is a study that was conducted on Namibia that shall be discussed briefly. Eita (2013) uses a VAR and VECM and finds that real exchange rate appreciation makes domestic goods less competitive and hurts exports and changes in the exchange rate have significant effects on both imports and exports in Namibia.

Most studies on the J-curve effect have come up with mixed results. Some results are consistent with the J-curve phenomenon (Bahmani-Oskooee, 1985; Freund and Pierola. 2008; Garlick, 2008; Eita, 2013; and Bahmani-Oskooee and Jamilov, 2013). Other studies (Fang, Lai and Miller, 2006; Motlaleng and Paul, 2008; Huchet-Bourbon and Korinek, 2011; Ayen, 2014) depict non-existence or minimal effect of devaluation on creating a J-curve effect. Most studies focusing on investigating the J-curve have done so by employing aggregate data either between the home country and the rest of the world or bilateral trade data with a particular trading partner.

Freund and Pierola (2008) find that exports flow improvements in developing countries tend to be preceded by a large real depreciation, which leaves the exchange rate significantly undervalued and a reduction in exchange rate volatility. In contrast, in developed countries, the role of the exchange rate is less pronounced. Moreover, countries with longer periods of

sustained export growth have experienced relatively larger depreciations and continued/sustained undervaluation. In contrast, in countries where the surge disappeared there was a tendency toward a reversal of the depreciation/devaluation. The more profound conclusions of this study were that depreciation/devaluation is especially effective across all export industries and does not require the government to pick favourites. However, in contrast, real exchange depreciation moves resources out of import-competing sectors into both the export sector and the non-tradable sector.

Using quarterly data Bahmani-Oskooee (1985) imposed an Almon lag structure to estimate the J-curve for four developing countries and finds the presence of a J-curve in all but one of the countries. In the countries studied, devaluation led to an immediate improvement of the trade balance. The study notes that in countries where the evidence supports the presence of the J-curve, there are differences in the duration of the deterioration and then improvement of the trade balance. Furthermore the long-run effect of devaluation is the same as its short-run effect which means that not only does the trade balance deteriorate in the short run subsequent to devaluation, it deteriorates in the long run, too with the exception being the country where devaluation does not seem to create a J-curve effect.

Fang, Lai and Miller (2006) investigated the net effect of depreciation for eight Asian countries with Engle's (2002) dynamic conditional correlation bivariate GARCH-M model that simultaneously estimates time-varying correlation and exchange rate volatility. The countries studied were Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand and the Philippines. The study finds that depreciation generally stimulates exports across Asian economies but its contribution is found to be small. More specifically the study finds that exchange rate risk contributes to export growth in Malaysia and the Philippines. Exchange rate risk generates a negative effect for Indonesia, Japan, Singapore and Taiwan, while it had a zero net effect in South Korea and Thailand. Fang, Lai and Miller (2009) applied a dynamic conditional correlation bivariate GARCH-M model to examine the asymmetric effects of exchange rate risk on exports, using monthly bilateral exports from eight Asian countries to the US over the period 1979–2003. Their findings reveal that exchange rate depreciation exhibits the normal positive effect, but proves insignificant in two countries. Real exchange rate volatility produces significant effect on exports for all countries, negative or positive. The response of

exports to exchange rate depreciation is not similar to exchange rate appreciation. In conclusion, the role of exchange rate in determining export revenue seems less predictable. These two studies find that exports respond asymmetrically to changes in currency changes, that is to say the response to a currency appreciation and depreciation are different.

Huchet-Bourbon and Korinek (2011) examined the impact of exchange rates and their volatility on trade flows in China, the euro area and the US in two broadly defined sectors, agriculture on the one hand and manufacturing and mining on the other. To model the effect of exchange rates and their volatility on imports and exports in the three geographical areas, Huchet-Bourbon and Korinek (2011) employ an autoregressive distributed lag bounds testing approach. The results of their model reveal a higher long-term effect of the real exchange rate, in terms of both significance and magnitude, on exports than on imports in all sectors and all models. Short-run exchange rate movements affect trade but their effect is difficult to interpret. In some cases, coefficients are non-significant. In the cases where coefficients are significant, their effect can move in either direction, positive or negative (Huchet-Bourbon and Korinek, 2011). These results are in line with other studies which conclude that short-run effects do not seem to follow a specific pattern. Another important finding was that the long-run response of exports to exchange rate changes varied across the sectors, where for instance agricultural products were found to be more sensitive to changes in exchange rate levels than manufacturing exports.

Employing a VAR model, Ayen (2014) found that for Ethiopia, currency devaluation has a negative long term consequence, however, notes that monetary policy has a significant role in affecting overall economic performance of the economy in Ethiopia. Another study of a sub-Saharan country was conducted by Edwards and Garlick (2008). The study (Edwards and Garlick, 2008) examined the effects of exchange rate on trade flows in South Africa and found that trade flows are sensitive to real exchange rate movements but nominal depreciations have a limited long-run impact on trade volumes and the trade balance, as real effects are offset by domestic inflation. A real depreciation is found to be effective in raising export volumes, reducing import volumes and improving the trade balance. A real depreciation is also effective in diversifying exports away from primary commodities towards manufacturing and particularly non-commodity manufacturing (Edwards and Garlick, 2008).

Motlaleng and Paul (2008) studied the pula-dollar exchange rates and the purchasing power parity in Botswana and found that there is no trade off in the long-run, between export competitiveness through devaluation and inflation for Botswana. Their study shows that devaluation in Botswana improves export competitiveness; this competitiveness is however found to be transitory. That is, any initial gains in competitiveness are gradually offset by price changes. However, the speed of adjustment in the short-term towards long-term allows for some flexibility in the nominal exchange rate policy. Bahmani-Oskooee and Jamilov (2013) studied Azerbaijan and find a positive relationship between depreciation and non-oil export industry and conclude that devaluation may be a favourable tool for export diversification in a resource rich economy. Azerbaijan shares similarities with Botswana in that they are significantly dependent on a single mineral resource. This resource is the largest contributor to GDP and export revenue. In Botswana this resource is the diamonds.

2.5.2 Empirical evidence on exchange rate pass-through

The theory on ERPT has been tested empirically by various authors to verify the validity of the theoretical propositions put fort The studies have focused on investigating the degree of ERPT to import, producer and consumer prices. Other studies have gone further to look at the response of prices to the direction and size of exchange rate changes; found that the responses are asymmetric or nonlinear price adjustment. Various econometric methodologies with times series or panel data to analyse ERPT on a macro scale for a particular country or region have been employed by different authors. On the other hand some authors on a micro scale have focused on a specific sector or product in the economy in order to emphasize the role of the exporting firms' price setting behaviour.

Wickremasinghe and Silvapulle's (2004) examine the ERPT to yen based manufactured import prices of Japan, using asymmetric unit root and cointegration tests and asymmetric models. The study finds evidence that suggests that depreciation and appreciation affect pass through in differing magnitude and also that different ERPT relationships exist over the pre- and post-recession periods exist.

Campa and Goldberg (2005) provide various country, time series and industry specific evidence of ERPT to import prices for 23 Organisation for Economic Co-operation and Development

(OECD) countries with quarterly data ranging from 1975-2003. The variables include: import prices in each country, money supply, effective exchange rate indices and inflation rate. In the findings the study showed on a cross-country average, import prices in local currencies reflect 46% of exchange rate fluctuations in the short run, and nearly 65% over the long run. By contrast, ERPT into U.S. import prices is approximately 23% in the short run and 42% over the long-run. In general Campa and Goldberg (2005) find incomplete pass-through for OECD countries. Furthermore the study finds that the composition of imports is more significant in explaining the behaviour of pass-through than inflation and exchange rate volatility. Therefore the portfolio of imports plays a more significant role in explaining pass-through. This seems to confirm the theory presented by Menon (1995) that the product characteristics determine ERPT.

Sweidan (2013) employs the bounds testing approach to cointegration and error correction model in a sample of annual data over the period 1976–2011, to investigate the ERPT into import prices on aggregate and disaggregated data in Jordan. The findings from the study led the author to conclude that nominal exchange rate fluctuations and oil prices are the core determinants of import prices either on aggregate or disaggregate data level. The short-run and long-run nominal ERPT elasticities coefficients in Jordan are incomplete. Additionally in the short-run, oil prices have larger effect on Jordan's import prices compared to nominal exchange fluctuations.

Razafimaheda (2012) employs both panel VAR and panel VECM analyses of the ERPT to domestic prices and its determinants in sub-Saharan African countries and finds that the pass-through is incomplete. The pass-through is larger following depreciation than after an appreciation of the local currency. The average elasticity is estimated at about 0.4. It is lower in countries with more flexible exchange rate regimes and in countries with a higher income. A low inflation environment, a prudent monetary policy, and a sustainable fiscal policy are associated with a lower pass-through. The degree of pass-through has declined in the sub-Saharan African region since the mid-1990s following marked improvements in macroeconomic and political environments.

Parsley (2011) uses disaggregated homogenous imported items to estimate pass-through for South Africa using samples of final goods and services, and homogenous imports. Estimated pass-through to consumer goods prices is low, roughly 16 per cent in the two years following an

exchange rate change; surprisingly, it is somewhat higher for services. Deviations from long-run PPP seem to disappear relatively quickly, with a half-life of about 16 months. For imports, pass-through estimates are much higher, averaging around 60%, but with wide source-country variation. Finally, there is no support for a simple linear trend change in either pass-through or in reversion to PPP during the sample period (Parsley, 2011).

Aron *et al* (2012) examine ERPT to the monthly import price index in South Africa during 1980–2009, using the Johansen cointegration procedure and impulse response functions. Pass-through is found to be incomplete at about 50% within a year and 30% in six months, averaging over the sample. There is evidence of slower pass-through under inflation targeting when account is taken of temporary shifts to foreign currency invoicing or increased hedging after large exchange rate shocks in the period. Furthermore, pass-through is found to decline with recent exchange rate volatility and there is evidence of asymmetry, with greater pass-through occurring for small appreciations (Aron *et al*, 2012).

Atta *et al* (1999) used an auto regressive distributed lag model and error correction model to estimate ERPT of South African CPI to Botswana's CPI. The basis of estimating pass-through of South African CPI to Botswana's CPI is due to the high import content of both consumer and producer goods traded in the country. The results of this study find that there is a very strong influence in the long run of South African prices and of the nominal rand/pula exchange rate on Botswana prices. Some 92% of Botswana prices are determined jointly by these two factors. However, it appears that there has been some change in this relationship over time. The relationship appears to have been stronger from the mid-1970s to the mid-'80s than since that time. This is not entirely surprising: the Botswana economy has expanded rapidly over the past 20 years and as it has done so has become more independent from South Africa. The falling proportion of imported tradables in the CPI basket reflects this trend. Furthermore, in recent years the effect of domestic policies on prices has increased, which has weakened the link between domestic and imported inflation.

2.6 Concluding Remarks

This chapter provided theoretical and empirical background on the effect of currency devaluation/depreciation on the trade balance, the response of exports to devaluation/depreciation in the short run and the long run.

The effect of such devaluation on the trade balance relies in the Marshall-Lerner condition and the J-curve theory. The Marshall-Lerner condition is a long-run approach and states the condition under which depreciation/devaluation of a currency will improve the trade balance, and it maintains that, for the weakening of the currency to have a positive effect on the trade balance, the (absolute values of) sum of elasticities of the demand for imports and exports must exceed one. The effects seem smaller in the short than in the long run and the trade balance takes time to ad-just to relative price. This is confirmed by the J-curve effect, which states that the weakening of a domestic currency will immediately increase import prices, while volumes remain the same, resulting in deterioration in the trade balance; only in the long run will the trade balance improve. The chapter also isolated the effect of devaluation on exports in the short and long run. Based on the theory presented in this chapter, it therefore follows that in the short run devaluation will not have an effect on volumes of exports due to supply constraints and demand inelasticity. Devaluation will however affect the revenue received, provided exports are priced in the foreign currency, in which devaluation will lead to an immediate increase in the revenue, with a quantity adjustment taking a little longer to be effected.

It was also shown in the discussions by Abeysinghe and Yeok (1998) and Edward and Garlick (2008) that there are conditions under which devaluation may actually be detrimental to export competitiveness. These are when export production uses a significant content of imports, a nominal depreciation increases the price of imported inputs, which leads to a rise in production costs which may, in the final analysis, lead to a reduction in the profit from exports. At the extreme, the export response to a nominal depreciation may be offset entirely by rising domestic prices.

The empirical literature on the effects of devaluation/depreciation provides unclear results, with some countries experiencing an improvement in the balance of trade, whereas it was found to be contractionary in other countries. Studies conducted in African countries also did not provide any

clarity on the effect of devaluation on exports. Bahmani-Oskooee and Gelan (2013) find that in some countries devaluation is expansionary, in some contractionary, while it has no effect in others. Galebotswe and Andrias (2011) found devaluation to have a short-run expansionary effect on Botswana's output, but over the long run devaluation was found to have a contractionary effect on output. Motlaleng and Paul (2008) also indicated that in Botswana's case, devaluation had a short-run positive impact on exports but no effect over the long run. However the aim of their study was to examine whether purchasing power parity (PPP) hypothesis determined the exchange rate between the Botswana pula and the US dollar.

In the 2006 monetary policy statement the Bank of Botswana acknowledges the role played by exchange rate movements on domestic prices through their effect on imported prices. Inflation trended downwards in the first four months of 2005, but raised thereafter as a result of higher import prices following the devaluation of the Pula. However, domestic inflation is projected to remain relatively high in 2006 due to the continuing combined effect of the May 2005 devaluation (Bank of Botswana, 2006).

Most of the empirical studies on ERPT have been on developed countries, whereas very little literature exists on African countries. Atta *et al* (1999) found asymmetric responses to exchange rate changes in Botswana and also that the influence of South African CPI and the rand/pula exchange rate had a significant role in determining Botswana's CPI. Given the limited and dated study (Atta *et al*, 1999) on ERPT in Botswana, this dissertation will add to existing literature by investigating ERPT to import prices and consumer prices.

2.7 Conclusion

This chapter provided economic theory and empirical evidence that studied the relationship of exchange rate to export demand and the balance of trade. The literature reviewed on the effect of exchange rate devaluation on exports and economic growth reached no consensus. Some of the literature found that devaluation improved the balance of trade whereas it was also found to be contractionary in other countries.

The empirical evidence is inconclusive in the studies for the Marshall-Lerner condition and the J-curve; in some studies the evidence supports the theory while in other studies it finds evidence to

the contrary. The studies on the ERPT find enough evidence to support the existence of pass-through; however the degrees vary from study to study

The chapter also gave theory of ERPT and evidence on ERPT based on empirical studies. The importance of looking into these two areas is because it is essential to assess the effects of exchange rate devaluation on export demand and inflation.

The following chapter then provides an overview of Botswana economy, with an emphasis on the evolution of exports and their significance to the overall economy. The chapter then gives a discussion of the history of monetary policy objectives with regard to exports and inflation in Botswana's economy.

Chapter 3: An overview of the Botswana economy

3.1 Introduction

The previous chapter provided a review of literature regarding the relationship between exchange rate and exports and additionally ERPT. It was found that there is no consensus from literature regarding the effect of exchange rate devaluation on enhancing export competitiveness.

This chapter provides an overview of Botswana's Macroeconomic environment and the evolution of the structure of the economy since the country gained independence in 1966. A discussion of the history of monetary policy with a particular focus on exchange rate policy is given. Exchange rates adjustment have been used by policy makers in Botswana as a tool for maintaining exports sector competitiveness longer than any other policy initiatives. The aim of this chapter is to put into perspective the experience of Botswana's development in light of policy interventions put in place to enhance NME competitiveness while maintaining a sensible inflation rate.

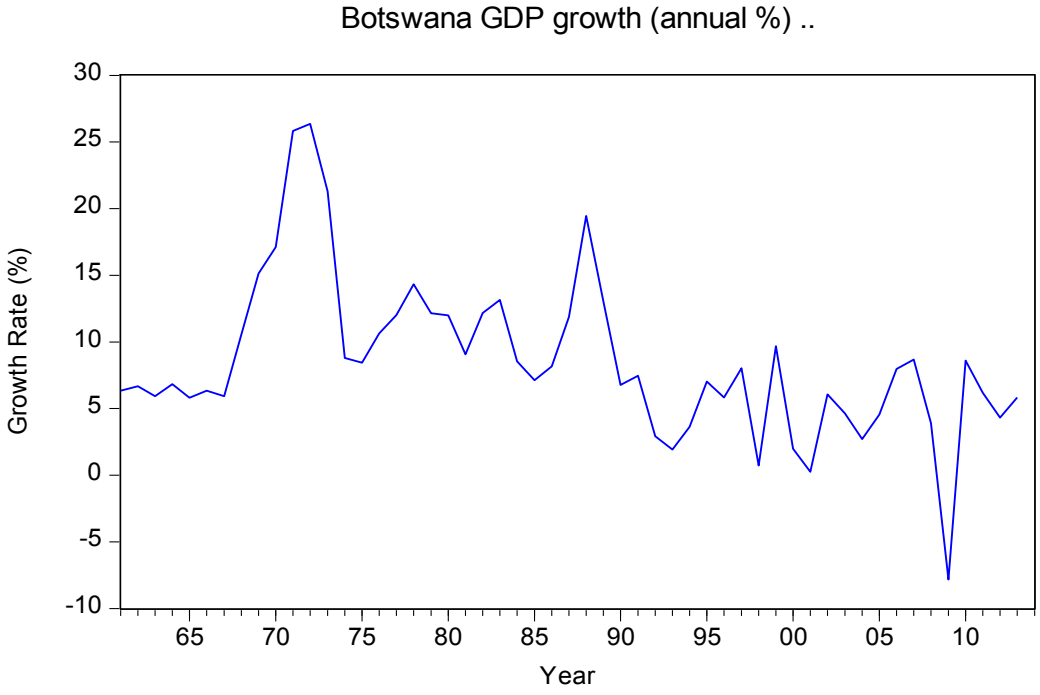
The chapter starts by introducing the history of Botswana's economy since independence and shows how the economy evolved from being dominated by the agricultural sector to being a mining-led economy. This is then be followed by brief discussions of some of the initiatives that the Government of Botswana has undertaken down the years in an attempt to diversify the economy. The use of the exchange rate to boost export sector competitiveness has been an enduring policy tool, whereas other policies were terminated when they were deemed to be ineffective. The following section will discuss monetary policy framework of Botswana, with a particular focus on exchange rate policy. Finally, attention is given to inflation trends globally, in South Africa and Botswana, to provide a background for the examination of ERPT in Botswana.

3.2 Post-Independence Economic Development

Several authors (Lewis and Harvey, 1990; Atta *et al*, 1999; Taylor, 2003; Setlhare, 2004; Leith, 2005; and Grynberg, 2011) describe Botswana post-independence economic growth rates as nothing short of spectacular. Harvey and Lewis (1990) indicate that the growth of Botswana's

economy transformed it from one the poorest in the world in 1966, to a middle-income country. Botswana is currently classified by the World Bank (2015) as an upper-middle-income country. The historical growth rates of Botswana from 1960 to 2013 are shown in figure 1. The average growth rate of GDP per capita from 1965 to '69 was 10%, increasing to 22% from 1969 to '74. This rapid growth was mainly due to a low initial starting point, the end of a major drought in 1965, aid from donors, and the discovery and exploitation of diamonds and copper-nickel. The first important diamond mine was opened in 1971 (Lewis and Harvey, 1990 and Fibæk, 2010). Average growth rate in GDP for the period 1975 to 1989 was 11.5%. Lewis and Harvey, (1990) and Fibæk, (2010) explain that the main reasons for this rapid growth were discoveries of new diamond fields coupled with prudent use of public finances to promote growth, access to the European Community for beef exports at prices above world prices, and a growth in the service sector as a response to construction and operation of mines.

Figure 3.1 Botswana annual growth 1960-2014



Source: World Bank

Figure 3.1 presents the annual growth rates of Botswana from 1960 to 2013. The period between 1990 and 2007 saw a decline in average growth rates when compared to the growth rates

experienced earlier as the average growth for this period was around 5%. The year 2008 saw Botswana experience negative growth for the first time since independence. This recession was caused by the fall in diamond sales due to the global recession. This recession highlighted Botswana's economic vulnerability to external shocks due to its high dependence on diamond revenue. Bank of Botswana (2009) discusses the decline in output as caused by the temporary suspension in diamond mining due to a slump in demand for rough diamond as the reason for the poor performance of the economy.

In 1966, Botswana was among the poorest of the world's least developed countries (Bank of Botswana, 2006). The major economic activities post-independence as shown in table 3.1 below, were agricultural activities, which contributed just over 40% of GDP. When diamonds were discovered the relative importance of the agricultural sector and other economic activities gradually diminished and was surpassed by the mining sector. The exploitation of minerals, initially diamonds and then copper-nickel, transformed the economy (MFDP, 2009). Botswana's economy is significantly reliant on mining, with mining contribution to GDP having averaged 40% to 50% since the 1980s to present. Botswana was primarily dependent upon beef exports and migrant labour remittances, with a few minor mineral exports such as manganese, semi-precious stones and alluvial gold. Since the discovery of the rich diamond mines and the development of copper-nickel deposits, Botswana's economic policy has focused to a very large degree on economic diversification of its export base away from diamonds and other industrial minerals. The output of these mines has dominated the growth, development and economic policy of Botswana since independence. With the notable exception of the development of the tourism sector, economic diversification has largely been unsuccessful since independence, with product export concentration ratios essentially static since the early post-independence era (Grynberg, 2011 and MFDP, 2009).

As can be seen from table 3.1, non-mining sector contribution to GDP has been minimal compared with the mining sector, the growth rates of the non-mining sectors have tended to be lower than that of the mining sector. Statistics from Bank of Botswana (1990, 1996, 2000, 2004 and 2010) show that the level of investment mining has received, has by far, exceeded the level of investment in non-mining sectors. It is possible that non-mining sectors received little attention due the high returns from mining and therefore contributing to the low growth rates in

the non-mining sectors. The non-mining sectors may have also benefited from the spectacular growth of the mining sector. The mining sector has always been geared for export in Botswana, with very little local consumption of mining output or value added. That is Botswana exported its mining output with very little addition of value to the commodities, while many of the non-mining sectors serve the local market which – admittedly a small market (Bank of Botswana, 2002 and Leith, 2005). Bank of Botswana (2002) asserts that trading with the rest of the world gives domestic producers an opportunity to benefit from economies of scale that might not be possible with reliance on the domestic market only. So this may be one of the major reasons for the difference in growth rates experienced by the different sectors in Botswana's economy.

Table 3.1 Share of GDP by economic activity – selected years 1966 to 2007/08 (percentage)

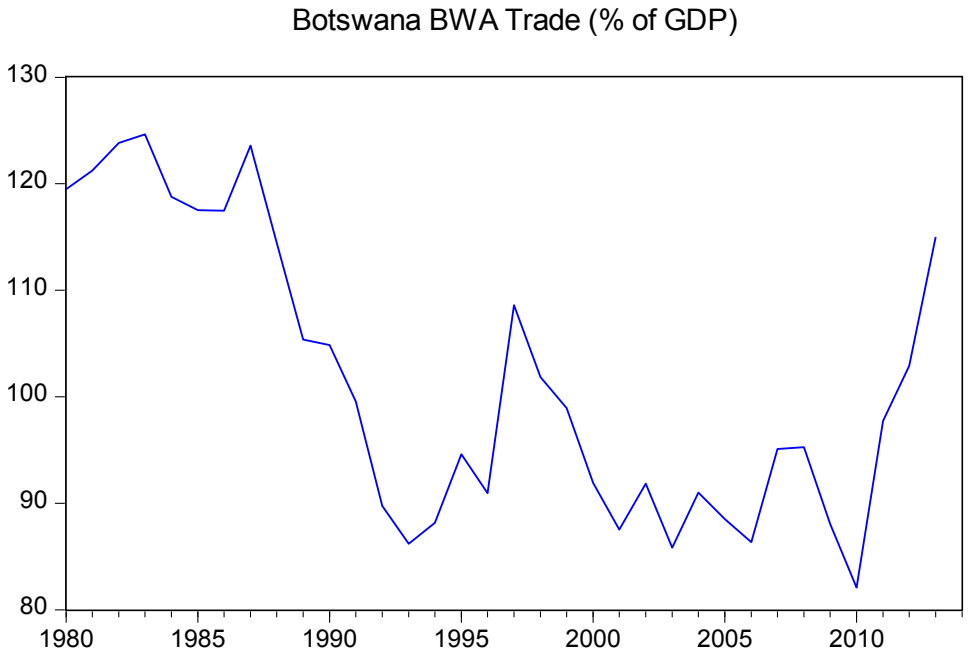
Economic Sector	**1966**	**1985/86**	**1995/96**	**2005/06**	**2012**
Agriculture	42.7	5.6	4.3	1.8	2.7
Mining and quarrying	-	48.9	35.4	43.2	20.0
Manufacturing	5.7	3.9	5.0	3.4	5.8
Water and Electricity	0.6	2.0	2.2	2.3	-0.4
Construction	7.8	4.6	6.5	4.6	6.8
Trade, hotels and restaurant	9.0	6.3	10.4	10.0	15.2
Transport	4.3	2.5	3.8	3.3	5.6
Banks, insurance and business services	20.1	6.4	11.7	9.9	14.5
General government	9.8	12.8	16.1	17.2	15.0
Social and personal services	-	2.5	4.6	4.2	6.2
Adjustment items	-	4.4	-	0.1	8.6
GDP	100.0	100.0	100.0	100.0	100.0
Real GDP growth (%)		11.6	15.8	8.4	5.4
Real GDP growth excluding mining		7.7	15.9	4.0	12.0

Source: Bank of Botswana, World Bank and Central Statistics Office, Botswana

3.2.1 Botswana's external trade

Botswana had to adopt an open economy model due to its unique and challenging circumstances at the time of independence. Botswana had and continues to have a small population given the enormous size of the country. There has been and still remains an insignificant manufacturing sector in Botswana. Table 3.1 shows that manufacturing has always been contributed to less than 6% of the economic activity from 1966 to 2012. Harvey and Lewis (1990:40) indicate that Botswana's economy was, and has remained, very open to foreign trade; but that was largely because Botswana had a small population. Bank of Botswana (2002) states that Botswana's economic policies are outward-looking and predicated on the small size of the economy and the benefits that are normally derived from international trade and financial relations. Harvey and Lewis (1990:40) add that the degree of openness has not changed, but what changed was the way in which imports were financed. The deficit of the mid-1960s was financed primarily by remittances from migrant workers and British grants, which by the mid 1980's had both become relatively minor.

Figure 3.2 Botswana Trade 1980-2014 (% of GDP)



Source: World Bank (2015)

External trade is a very significant part of Botswana's economy, in the period of study (1980 – 2013) external trade has averaged close to 101% of the GDP. Harvey and Lewis (1990:39) show that mineral exports transformed Botswana's balance of payments, and led to a dramatic change in the ratio of visible exports to GDP which has more than doubled since independence while that of imports to GDP remained the same. As a result Botswana changed from having a structural trade deficit in the mid-1960s to a visible trade surplus by the mid-'80s. Table 2 shows this change in ratios of exports and imports as proportions of GDP from independence. It has to be noted that these high proportion of exports and imports to GDP indicate Botswana's high dependence on external trade.

Table 3.2 Exports and Imports as Percentage of GDP (annual average)

	1966-71	1972-76	1977-81	1982-86	1990-95	2000-05	2010-13
Exports/GDP	25	43	50	58	50	50	45
Imports/GDP	57	54	58	56	42	39	54

Source: Harvey and Lewis (1990) and World Bank (2015)

3.2.2 Economic diversification in Botswana

Mining was a form of economic diversification initially, from when the economy depended heavily on beef exports and migrant labour remittances. Since then, government revenue – especially from diamond mining – has been used to build infrastructure and to provide education and training. In this way, the natural advantage of mineral resources has been converted into the basis for more diversified economic growth (MFDP, 2009). Botswana's major exports in recent times are diamonds, meat and meat-related products, copper and nickel, textiles, vehicles and parts, and soda ash. Copper and nickel, diamonds and beef are often referred to as Botswana's traditional exports, probably because they have been an important part of Botswana's exports since the 1970s and have also maintained a consistent contribution to total exports (MFDP, 2009 and CSO, 2010). In 1954 beef was first sold outside the region. In 1966, it accounted for 85% of total export earnings (Fibæk, 2010). From 1980 to 2013 traditional exports (beef, copper and nickel, and diamonds) combined an average of well over 80% of exports even during the economic decline experienced in about 2009 (Statistics Botswana, 2011). The composition has

however changed, so that beef accounts for only a small amount and diamonds are the dominant contributor to export revenue. Table 3.3 below shows the relative contribution of the different commodities to total exports. This table shows that a significant portion of the exports are mining commodities, followed by textiles, while beef has tended to decline in terms of its relative contribution. Zizhou (2009) noted that exports from the automotive sector were significant between 1993 and 2001, when the now non-operational Hyundai motor vehicle assembly plant exported cars, buses and trucks to other Southern African Customs Union countries, mostly South Africa.

Table 3.3 Percentage share of exports of principal commodities, 1980 to 2004

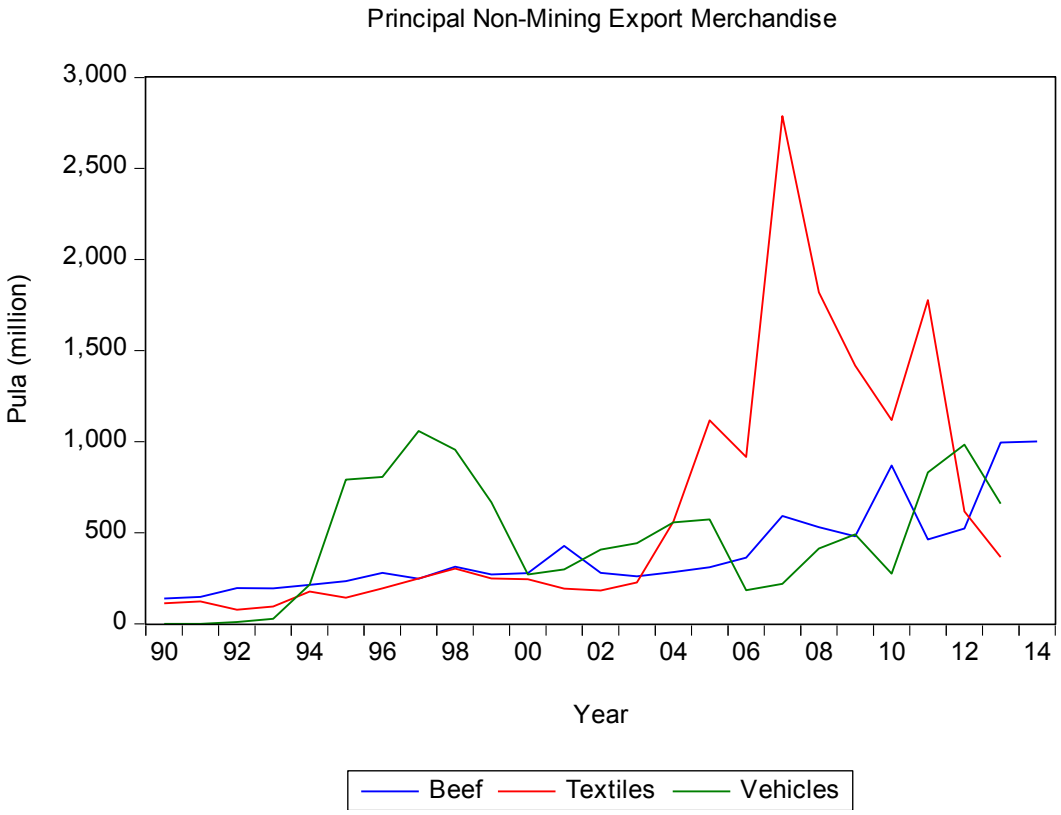
Commodity	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Diamond	60.6	70.4	78.7	67.1	82.3	78.1	66.7
Copper & Nickel	20.8	8.1	8.1	5.5	6.0	10.5	13.7
Beef	7.2	6.5	3.2	3.0	1.9	1.4	3.6
Soda Ash	0.0	0.0	0.0	0.4	0.7	0.0	2
Textiles	4.0	1.9	3.4	2.5	1.8	4.5	3.4
Vehicles & Parts	0.0	0.0	0.0	16.1	2.0	2.6	1.7
Live Animals	0.03	0.02	0.01	0.04	0.01	0.0	0.0
Hides & Skins	0.8	7.8	0.6	0.6	0.3	0.1	0.1
Other Goods	6.6	5.2	5.9	4.8	5.0	2.8	8.8

Source: Central Statistics Office (2010)

The major non-mining export commodities in Botswana are beef (usually referred to as meat and meat-related products) textiles, vehicles, live animals, hides and skins, machinery and electrical equipment. Central Statistics Office has since stopped reporting the export commodity of live animals as a separate category, due to its being so minute that it does not warrant separate reporting. Hence it is included in the "other goods" category in the years subsequent to 2011. As indicated these goods have, since the discovery of diamonds, average about 15% of export

earnings for Botswana. The authorities in Botswana have noticed that in a scenario where mineral exports were excluded, Botswana would run into a balance of payments crisis. The Government of Botswana has over the years undertaken initiatives to raise the contribution of NME, thereby reducing the dominance of mining.

Figure 3.3 Non-mining Export Merchandise



Source: Bank of Botswana Data (2015)

Figure 3.3 shows a trend of selected NME over the period 1990 to 2013. These exports are the three major NME which are beef, textiles and vehicles. There are other factors which have a major effect on the amount of exports sold in any given year. For instance, drought and disease have a huge effect on the sale of beef. In years when there is an outbreak of foot-and-mouth disease, Botswana is not allowed to export beef to the EU until certain cattle production areas are declared disease free.

UNCTAD (2008) reported that most countries in Africa have remained primary product exporters following their liberalisation of trade. In most cases the export sector is dominated by one or two commodities. The report also states that African economies display very low levels of export diversification, with no discernible signs of change. This has been the case in Botswana, where the export sector is dominated by one commodity, diamonds, which have accounted for well over 75% of export revenue since 1982. The Government of Botswana continues to endeavour to diversify its export sector. One of its policies has been the use of the exchange rate to boost non-mining export competitiveness. Gaolathe (1997) in Zizhou (2009) indicated that monetary policy was initially tailored to render imports affordable, especially for the less well-off, by keeping the pula exchange rate strong. By the mid-1980's policy-makers realised that there was a need for a competitive non-traditional export sector; this led to the use of the exchange rate to foster competitive domestic industry. Over the years the Government of Botswana has introduced several programmes in an attempt to diversify the economy away from minerals, with very little success. Bank of Botswana (2002) notes that Botswana remains a mineral-based economy. Since the discovery of diamonds in 1967, the impressive economic growth has largely been a direct result of a boom in the mining, but also indirectly through development policies pursued by the government utilising resources from the mineral sector. A number of programmes, strategies, initiatives and state-owned entities have been set up with the specific aim of encouraging economic development away from minerals.

These include the Financial Assistance Policy (FAP), the Citizen Entrepreneurial Development Agency (CEDA), the Trade and Investment Promotion Agency (TIPA) and recently the Botswana Investment and Trade Centre (BITC) (formed through the merger of the International Financial Services Centre and Botswana Export Development Investment Authority, both state-owned enterprises). FAP was launched in 1982 to facilitate the development of new or expanding export-oriented or import-substituting enterprises as a means of employment creation and the promotion of economic diversification. Zizhou (2009) indicates that FAP also provided capital and labour grants based on labour employed as well as location. FAP was terminated in 2000 following a review in 1999, which found a high failure rate as well as large-scale abuse, wastage and high costs per job created, and has since been replaced by CEDA, which provides financing to citizen businesses in all sectors of the economy in the form of subsidised loans and risk-sharing, as opposed to outright grants (Bank of Botswana, 2002 and Zizhou, 2009). The role

of BITC is in principle a one-stop investment-clearing agency that promotes, facilitates and monitors investment flows in Botswana. Its objectives include the promotion of investment and export development and promotion as well as construction of factory shells for lease to investors.

3.2.3 Trade policy in Botswana

Trade policy includes: customs tariff policy; treatment of non-tariff barriers; trade agreements; export support programmes; export taxes and export bans; trade defence mechanisms such as import bans; safeguard measures, as well as trade restrictive measures such as single-channel marketing (Zizhou, 2009). Botswana is party to several trading arrangements; most importantly it is a member of the Southern African Customs Union (SACU). SACU is the oldest existing customs union in the world, having been founded in 1910. Its current membership comprises Botswana, Lesotho, Namibia, Swaziland and South Africa. Botswana was a member prior to independence (when it was the Bechuanaland Protectorate). Zizhou (2009) indicates that under the 1969 Agreement, South Africa had the sole authority to determine customs, excise and sales duties as well as trade policies for the whole customs area. Leith (2005) adds that as a member of this customs union, Botswana is not free to set its own import tariffs to protect domestic producers. The common external tariff is in fact the South African tariff. This has meant that Botswana has not been free to grant nearly infinite protection to a multitude of import substitution industries. The tariffs in force in Botswana are a reflection of the protection of South Africa's industries. Botswana has been able to establish a foreign trade policy in spite of the requirements of SACU by using a number of measures including trade tariffs, preferential market access and the exchange rate policy. The measure this thesis will focus on is the use of exchange rate policy to support non-mining export competitiveness. The Government of Botswana has since the 1980s used the exchange rate to support the competitiveness of NME. The use of exchange rate policy will be discussed in detail in the following sections.

3.3 Monetary policy framework in Botswana

At independence, Botswana was a member of the Rand Monetary Area and used the South African rand as its currency. With the prospects of growing revenues from minerals, Botswana chose to establish its own currency. It was 1976 when Botswana introduced the pula. From then onwards, Botswana began to have an independent monetary policy. As a long-term goal,

Botswana's monetary authorities use monetary policy as a strategy for promoting economic growth and development by using it to control inflation to reasonable levels (Siphambe, 2013 and Leith, 2005). The fundamental objective of the Bank of Botswana has not changed since its establishment in 1975, namely the achievement of sustainable low inflation. The control of inflation is the means by which monetary policy contributes, along with other government policies, to the ultimate national objective of a stable macroeconomic environment and sustainable rates of growth of incomes and living standards. The bank pursues its monetary policy objective in support of the broader national objectives of economic diversification and export competitiveness. The control of inflation helps Botswana generally maintain competitiveness, but the bank seeks specifically to achieve a rate of inflation that will, at the least, maintain relative stability in the real exchange rate and avoid the need for a devaluation of the pula. The main monetary policy tool used by the bank to achieve its inflation objective is the level of interest rates. Changes in interest rates, along with other factors such as the exchange rate, balance of payments, and the government's fiscal policy, affect the overall level of demand for goods and services in the economy. Therefore the bank exercises its main influence on inflationary pressures in the economy indirectly through its influence on domestic demand relative to a given level of national output. (Bank of Botswana, 2002 and Bank of Botswana, 2010).

Botswana has a peculiar system in place, that is, the monetary authorities have a domestic inflation objective that they pursue, primarily using the interest rate, while also managing the currency using a crawling peg mechanism. Also there are no exchange controls. This situation is often referred to as the open economy policy trilemma, also often referred to as the impossible trinity. Snowdon and Vane (2005) explain the open economy policy trilemma, saying that a country cannot simultaneously maintain open capital markets (no exchange controls), fixed exchange rates (or manage the value of the currency as in Botswana's case) and an independent monetary policy oriented toward domestic objectives. A government can choose any two of these but not all three. If a government wants to target monetary policy towards domestic considerations like an inflation target, either capital mobility or the exchange rate will have to be abandoned.

After its establishment, Botswana's monetary policy framework has gone through some changes. Setlhare (2004) presents the first of the two major regimes that can be identified in Botswana's monetary history. The first period (1976-88) is best characterised as financial repression, and the second (1989 to the present day) by financial liberalisation. The process of financial liberalisation entailed the complete removal of controls on current account transactions and a substantial reduction of controls on the capital account. All remaining capital account controls were eliminated in 1999 (Setlhare, 2004). A third major regime change would be the crawling peg that was instituted to manage the currency in 2005 after the devaluations of 2004 and 2005.

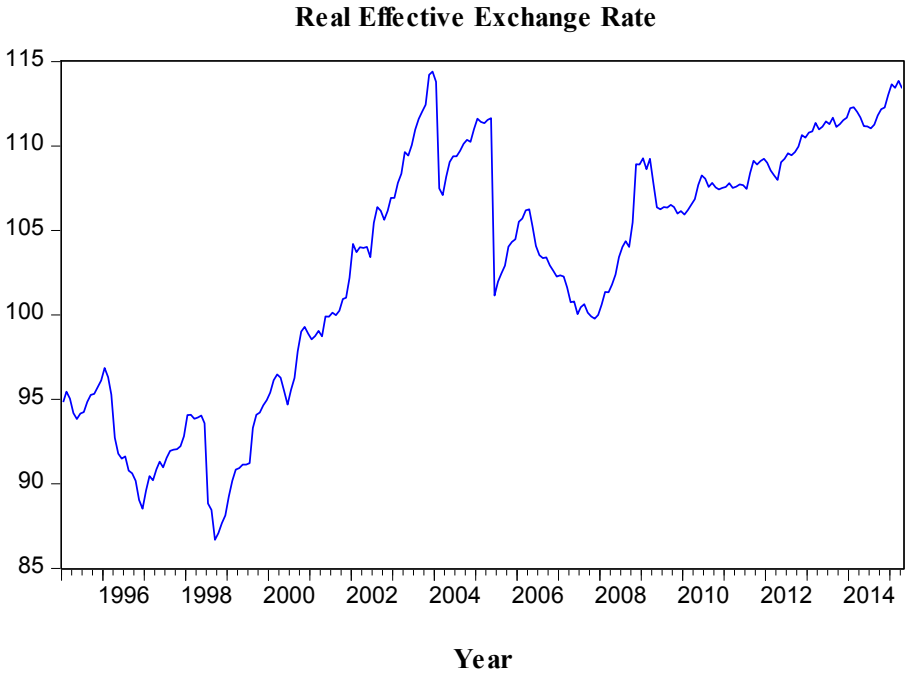
3.3.1 Exchange rate policy in Botswana

The main objective of the exchange rate policy in Botswana has always been, and continues to be, maintenance of a stable and price competitive REER with a view to support NME. Bank of Botswana (2006) states that the objective of the exchange rate policy in Botswana is to maintain the country's competitiveness; this is measured by the REER of the Pula. Siphambe (2013) adds that the main objective of the exchange rate policy in Botswana has been and continues to be maintaining and enhancing international competitiveness of domestic producers by ensuring that the real exchange rate is not misaligned. The exchange rate policy aims to keep the nominal effective exchange rate of the pula constant; this is what is used to develop the bank's annual inflation objective (Bank of Botswana, 2002). The exchange rate policy's aims require that REER remains relatively stable at all times. REER stability is attained through the crawling band exchange rate mechanism as reflected in price stability in Botswana in line with those of trading partner countries (Bank of Botswana, 2006).

Setlhare (2004) states that before 1989, the rand/pula exchange rate was managed so as to control imported inflation from South Africa and, on the other hand, to ensure the competitiveness of NME in the South African market. But since 1989, exchange rate policy has been used only to promote competitiveness of exports by maintaining a stable real exchange rate (Setlhare, 2004). From the end of May 2005, a crawling band exchange rate mechanism was introduced, the rate of crawl based on the differential between the bank's inflation objective and forecast inflation of trading partner countries. In the context of the crawling band exchange rate regime, it is intended that this will be achieved through a continuous adjustment of the trade-weighted nominal

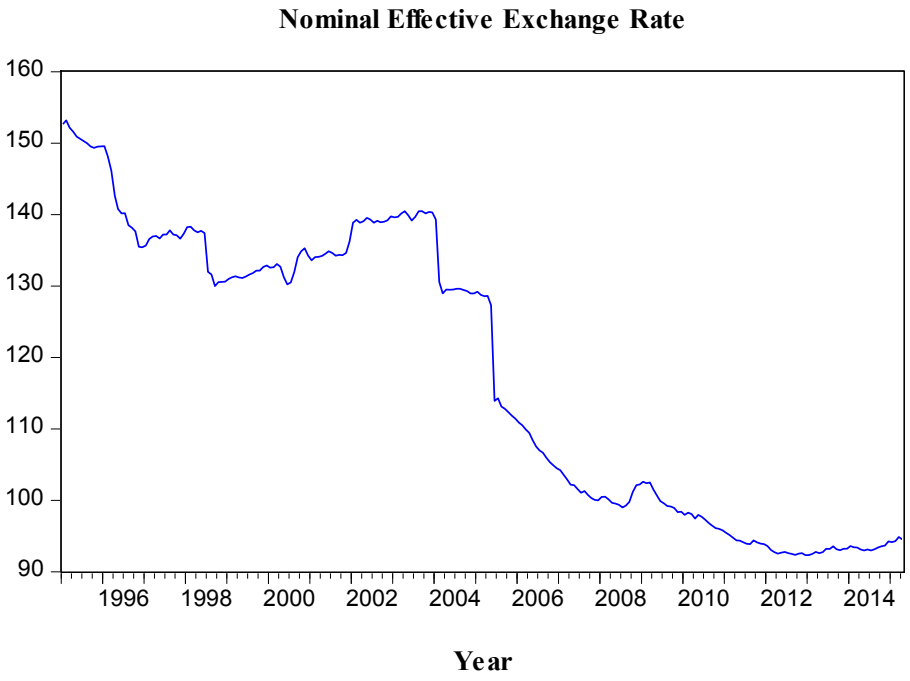
effective exchange rate (NEER) of the pula at a rate equal to the differential between the bank's inflation objective and forecast inflation for trading partner countries (Bank of Botswana, 2005). The competitiveness of traded goods and in particular non-traditional exports is maintained through a stable real exchange rate against the rand and other foreign currencies, namely the SDR basket of currencies (Siphambe, 2013). The bank also monitors pula exchange rate developments regularly with a view to advising the government on ways of maintaining a stable REER and the price competitiveness of domestically produced goods. Siphambe (2013) argues that Botswana has generally kept the exchange rate at reasonable levels through a series of devaluation of the pula by active exchange rate management since 1976. However, as can be seen in figure 3.4, the real exchange rate of the pula has had a tendency to appreciate. This has been addressed by periodic devaluation of the nominal value of the pula over the years. This depreciation of the nominal effective exchange rate can be seen in figure 3.5.

Figure 3.4 Monthly Effective Exchange Rate



Source: Bank of Botswana

Figure 3.5 Monthly Nominal Effective Exchange Rate



Source: Bank of Botswana

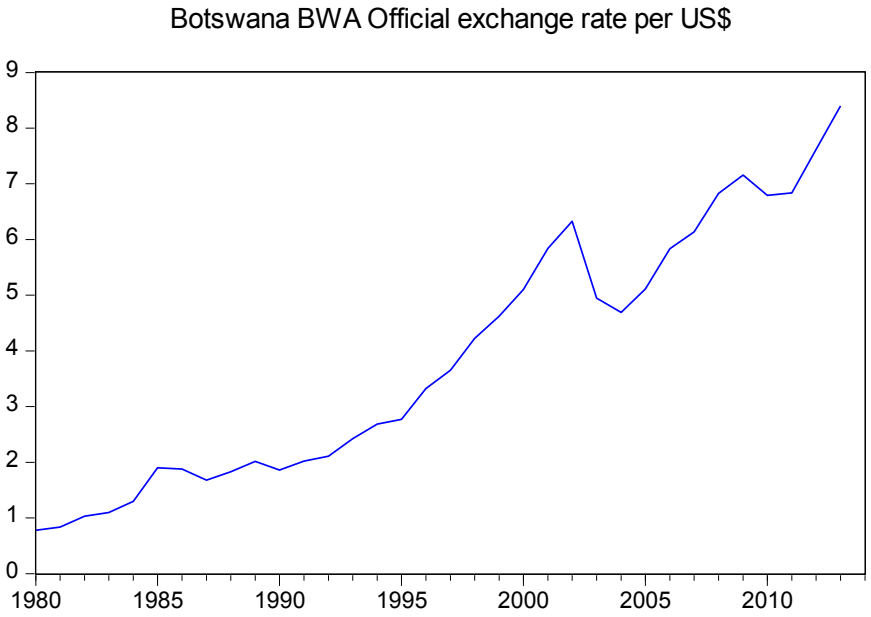
3.3.2 History of exchange rate management in Botswana

In 1976 the South African rand was pegged to the US dollar and Botswana chose to continue with a fixed exchange rate. However in 1979 the rand was floated and this change was fully echoed in the rand/pula exchange rate (Leith, 2005). The pula however, remained a fixed currency, although there was a need to ensure that NME in Botswana maintained competitiveness. Leith (2005) discusses the dilemma faced by monetary authorities in that they had to choose between the pula following the US dollar or the rand, or a combination of the two, because it was not possible for the pula to remain stable against both currencies at the same time. The authorities eventually chose to focus, on the balance, on the rand. Furthermore Leith (2005) adds that at various stages the pula was changed from the original peg against the US dollar to a peg against the basket of regional currencies and the SDR, with a relatively heavy weight on the rand.

In January 1980 the pula was taken off the dollar peg and a basket composed of SDR and the rand were used to determine the value of the pula. This was done to reduce the volatility of the bilateral rand-pula exchange rate. In November 1980 the pula was devalued by 5% as an anti-

inflation measure as imported inflation rose following pula depreciation against the rand. In May 1982 the pula was devalued by 10% as part of a stabilisation measure in response to a balance of payments crisis. In June 1984 the pula was devalued by 5% as a competitive measure following the collapse of the rand and rapid appreciation of the pula against the rand. A 15% devaluation was implemented in January 1985 as an addition measure to bolster competitiveness in response to the pula appreciation against the rand. In January 1989, the pula was devalued by 5% as an anti-inflation measure. The pula was devalued by 5% in August 1990 and subsequently in August 1991 by 5% as a competitiveness measure. February 2004, the pula was devalued by 7.5% as a competitiveness measure, followed by a 12.5% devaluation in May 2005. Following the devaluation of 2005, a crawling peg system was introduced as a mechanism for managing the pula; this was done to avoid discrete adjustments of the exchange rate while maintaining stability in the REER (Bank of Botswana, 2015).

Figure 3.6 Nominal USD/Pula trend

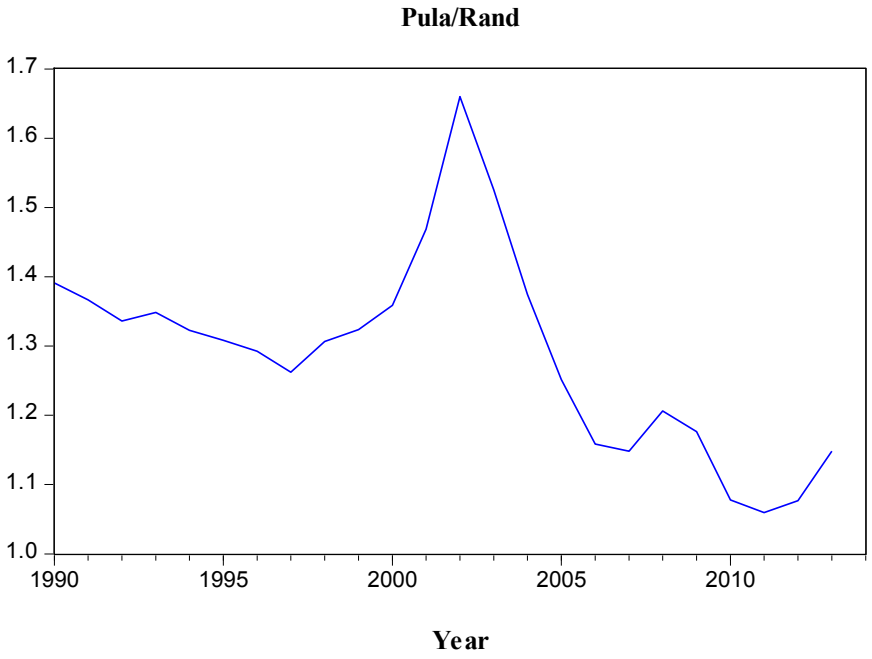


Source: World Bank

Figures 3.6 and 3.7 illustrate the relationship of the US dollar to the pula from 1980 to 2014 and the pula to the rand from 1990 to 2014. The pula has been devalued steadily against the US

dollar over the period shown. Against the rand the pula has lost ground, although there was a sharp decrease in the value of rand against the pula in the 1997-2004 period.

Figure 3.7 Rand-Pula trend



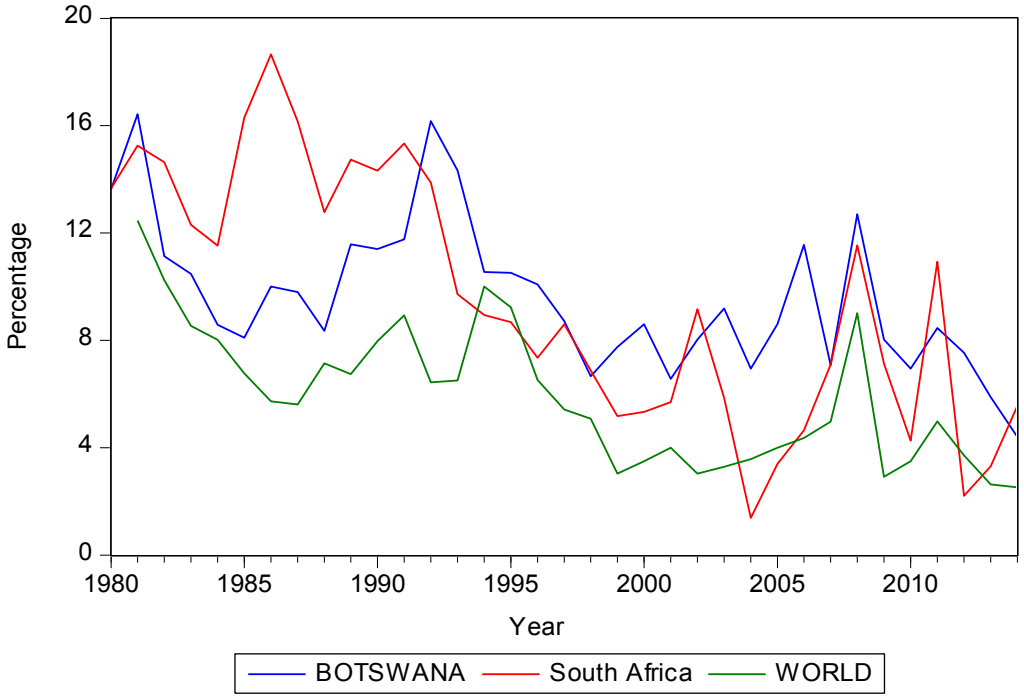
Source: Bank of Botswana

3.3.3 Trends in inflation: Globally and in Botswana

Botswana has not experienced levels of high inflation that is often associated with resource rich developing countries. Leith (2005) asserts that the ultimate test of monetary policy is whether it is able to deliver price stability to an economy. Atta *et al* (1999) and Leith (2005) conclude that Botswana's inflation rate has shown substantial variation over the past 20 years and has not been particularly good compared with industrialised countries, but has never reached the excessively high levels seen in some other developing countries. Given the openness of the economy, it has been subject to a great deal of external influence, particularly from South Africa, but between 1982 and 1992 Botswana's inflation rate remained consistently below that of South Africa – due, it is widely believed, to the appreciation of the pula against the rand. Setlhare, (2004) contends that Botswana's monetary policy has performed well in controlling inflation to around 10%, given the economic growth rates it experienced. Annual inflation in Botswana has never exceeded 20% since 1976, as can be seen in figure 3.8. The decline in inflationary environment

in Botswana has tended to coincide with declining worldwide inflationary trends, as can be seen in figure 3.8.

Figure 3.8 Annual Inflation 1980-2014 Botswana, South Africa and worldwide



Source: World Bank (2015)

Figure 3.8 presents inflation as measured by the consumer price index, which reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The trends in world inflation and those in Botswana and South Africa, which from observation seem to show similarities in the sense that they have trended downward from 1980 to 2014. Global inflation has dropped from 30% to 4%. Figure 6 shows that inflation has largely been trending downward for most of the period from 1980 to 2014. There was a spike in inflation in the late 1980s and early ’90s due to the introduction of value-added tax. Another significant spike in inflation was in the mid-2000s due to the devaluations of the pula in 2004 and 2005. Another significant increase in inflation was in 2008, due to the rapid rise in global energy prices (Bank of Botswana, 2008). Siphambe (2013) concludes that a comparative study of inflation between Botswana and other developing countries shows that for the period 1976-95 Botswana had a more favourable inflationary environment than a broad range of African countries. Additionally

the study finds that within SACU, Botswana has had comparatively low average consumer price index (CPI) inflation from 1976 to ’85. Furthermore, the study also finds that Botswana had the lowest average CPI inflation from 1986 to ’95 and the lowest average inflation in the whole period. Setlhare (2004) further adds that Botswana’s experience differs from that of other developing countries that also enjoyed a boom in commodities or natural resources. For example, in Zambia, economic mismanagement of the mineral-led boom the country experienced led to an inflation problem and a serious economic crisis.

The inclusion of South Africa’s inflation trend is important due to the high dependence of Botswana’s economy on that of South Africa. The level of industrialisation and diversification in Botswana is low, and provides a limited number of goods and services. Bank of Botswana (2002) adds that imported goods and services widen the range of consumer choices in the domestic market and encourage a more efficient allocation of resources through enhancing competition. Among financial relationships, foreign direct investment (FDI) permits technological transfer while also relieving a country of the domestic saving and foreign exchange constraint to development. This has necessitated the need to procure goods and services abroad. Botswana’s major imports are energy, textiles and clothing apparel, vehicles and parts, consumer goods, and food and beverages. Under normal circumstances most of the imports mentioned above would compete with a significant presence of domestic substitutes; however, Botswana has an unusually significant reliance on imports of these goods, particularly from South Africa. Harvey and Lewis (1990) note that Botswana has been criticised for the continued importance of South Africa as a supplier of imports of goods and services and the continued concentration of exports on the three primary commodities (diamonds, copper and nickel, and beef).

It has been noted that the decline in the inflationary trends of Botswana and of South Africa coincides with a general decline in global inflation as seen in figure 3.8. Rogoff (2003) recaps specifically that inflation average in industrialised countries fell from an average of 9% in the first half of the 1980s to an average of 2% since the beginning of the 2000s. Developing countries have also experienced falling inflation: the average inflation rate 1980 to ’84 was 31%; however by 2000 to 2003 the average had fallen to levels below 6%. Africa and Latin America had average inflation levels of 40% and 230% respectively from 1990 to ’94, but by 2003 both regions had average inflation rates of about 10%.

Rogoff (2003) and Levin and Piger (2003) identify the forces that have been driving the disinflation phenomenon. Chief among these forces are the inflation targeting focus of most central banks and the institutional changes that most of these central banks have undergone, which include increasing central bank independence and having the banks governed by conservative anti-inflation oriented central bankers. Other factors include increased economic competitiveness facilitated by deregulation and globalisation, a decreased role for governments in many economies, coupled with more prudent fiscal policies, and higher productivity growth. Rogoff (2003) argues that as more countries become economically competitive, prices become more elastic, thus reducing the effect of unanticipated inflation on output. Furthermore, any incentive the monetary authorities might have to raise output systematically dissipates, resulting in the central bank's anti-inflation credibility being enhanced and subsequently reducing inflationary expectations and inflation itself (Rogoff, 2003).

When the graphs in figure 3.6 and figure 3.8 are superimposed on each it seems to suggest from observation that there is a direct relationship in the devaluation of the pula and the inflation rate as experienced in Botswana. The pula has been losing ground against the dollar whereas inflation over the years has tended to dissipate, which is contrary to expectation. However, visual observation is, of course, not sufficient to determine the rate of pass-through of changes in the nominal effective exchange rate to domestic prices. This will be investigated in successive chapters.

3.4 Lessons from other countries

The International Monetary Fund has advocated for devaluation in Least Developed Countries as a means to achieve economic growth and stabilise the balance of trade. The existing evidence regarding the effect of devaluations on real economic activity is mixed. Some studies suggest that devaluations have an expansionary effect, while studies indicate that they generate a contraction in the economy. This section will examine what a few selected countries did to improve their external competitiveness. The aim of this section is to see if Botswana can draw any lessons from these countries on how to improve the competitiveness of the NME sectors.

Singapore is an example of a country that successfully developed and grew an export-oriented economy by not using its currency devaluation to facilitate external competitiveness. Lan (2001)

argues that Singapore diversified and grew its export sector through a strong, developmental state, which willingly and abundantly provided incentives to attract foreign capital, controlled labour and forced savings, raised wage rates and upgraded labour skills. The encouragement of export-oriented industrial growth finance by foreign capital has been an active policy since 1965, following unsuccessful attempts at import substitution. Singapore government was deliberate in building up capacity of the economy and attracting foreign firms to locate in Singapore. The government also invested in raising the skills of citizens. When the country experienced a shortage of labour, the government opened borders to allow firms to employ expatriates (Lan, 2001).

China underwent reforms that transformed it into a global exporting powerhouse. Silva-Ruete (2006) discusses the reforms that China undertook to transform from an agriculturally based-economy to a manufacturing- and services-based economy. China's structural reforms included the introduction of private incentives that were directed toward enhancing productivity. This reform process was driven by Chinese government, which set goals for central and local levels that were meant to promote continuous improvement in efficiency and competitiveness. The Chinese authorities have implemented this strategy in several progressive stages, and have also introduced compensation programs meant to ease the effect of reforms on those affected adversely by the process. (Silva-Ruete, 2006). It is evident that China embarked on a process of enhancing its domestic capacity to enable its private sector to compete globally, and this process has planned and implemented by government. It is not clear whether exchange rate devaluation was used during the early stages of developing domestic capacity.

In the early 1960s South Korean government established an institutional arrangement in support of an export-led economic development strategy. This strategy targeted reforms of the rural sector to transform national agricultural institutions from instruments of development and export promotion into protectionist mechanisms (Pinkston, 2007). Pinkston (2007) indicates that neoclassical economic school of thought would recommend complete liberalization on grounds of efficiency; the South Korean government took a political decision to protect its agricultural sector. The South Korean government introduced controls on imports and implemented export incentive schemes such as tax exemptions (Frank Jr., Kim and Wesphal, 1975). These measures protected local industries from foreign competition while also capacity to export was being built.

The countries covered above built up their ability to export competitively by reforming traditional institutions and building their capacity by enhancing productivity. South Korea and China used measures that protected domestic industries from foreign competition while enhancing their export capacity. Gains came from enhancing productivity of the agricultural sectors. The government Singapore took deliberate action to build domestic capacity by offering incentives to foreign capital to locate in Singapore. Singapore also invested heavily in raising the skills of citizens.

These countries did not rely on devaluing the exchange rate to raise the competitiveness of their export industries. Their focus was on reforms that raised the levels of productivity in traditional economic sectors and also entrenching an export-oriented industrial development.

3.5 Conclusion

This chapter has provided an overview of Botswana's Macroeconomic environment and the also the structure of the economy with emphasis on the evolution of export sectors.

It is important to note that the discovery of diamonds and prudent management of revenues from diamond mining led to Botswana experiencing rapid economic growth that was unparalleled in the period from 1966 to 1996. The contribution of non-mining sectors has been dwarfed by the mining sector due to the spectacular growth of the mining sector in Botswana.

Botswana has a very open economy which can be observed by the significant amount that external trade accounts for as proportion of GDP. It has been shown that external trade plays a significant role in Botswana's economy. External trade has accounted for a significant proportion of Botswana's GDP from the years 1980 to 2013 with a low of 82% in 2010 as a result of the global financial crisis which subdued demand thereby reducing global trade.

The main objective of the exchange rate policy in Botswana is to maintain a stable and competitive REER with a view to support NME, with a low inflation rate as the overarching monetary policy goal. The maintenance of a stable REER was achieved through discretionary adjustments of the NEER. Since May 2005, a crawling band exchange rate mechanism was introduced. Devaluation of the NEER has been the main tool used to maintain the

competitiveness of NME; however, the effect of exchange rate devaluation on NME and inflation has received very little attention.

The chapter concludes by looking at a few Asian countries that successfully adopted export-led economic growth. It was shown that these countries did not rely on devaluing their currencies to achieve export competitiveness. These countries reformed their institutions and raised productivity of their export-oriented industries.

The next chapter develops the econometric methodology employed to assess the effect of the Pula devaluation on NME and also the effect of devaluing the Pula has had on import and domestic consumer prices.

Chapter 4: Methodology

3.6 Introduction

The previous chapter provided an overview of the macro economy of Botswana with a particular focus on the exchange rate policy, NME competitiveness and inflation. It indicated that exchange rate devaluation has been a policy tool adopted in Botswana to aid the competitiveness of exports in the non-mining sectors. Additionally the chapter looked at the history of inflation in Botswana. The objective of this chapter is to develop the econometric methodology that is to be employed to evaluate the effect of Pula devaluation on NME and also the ERPT.

This dissertation has two objectives: firstly to examine the relationship between devaluing the pula and export competitiveness in Botswana, and secondly to study the effect of devaluation on domestic prices by investigating ERPT in Botswana. This chapter will provide a presentation of the econometric methods that will be used to achieve the objectives of this dissertation.

This study uses a quantitative research methodology to estimate the impact of devaluation of Pula against Botswana's non-mining principal exports. The debate on the effect of exchange rate devaluation on exports dates back to the collapse of the Bretton Woods institutions, and continues today, as theories seem not to provide any conclusive answers as to whether exchange rate devaluation has a positive or negative effect on exports. As discussed in chapter 2, theory suggests that in the short run, devaluation has positive effects on increasing export value, provided the value of the exports is measured in the domestic currency. Over the long run, devaluation is said to have a negative effect on exports, particularly when inputs of exports are balanced by a significant input of imports. Therefore the empirical analysis of this study will seek to establish whether a long-term relationship between pula movement and non-mining principal exports exists in Botswana. Furthermore the effects of these devaluations on inflation in Botswana need to be studied using appropriate econometric techniques; this will be the examination of ERPT in Botswana.

The chapter begins with a discussion of the theoretical framework in which two econometric models are developed to fulfil the first two objectives of this dissertation, which are; (i) to

examine the existence of a long run equilibrium relationship between the Pula and NME of Botswana, and (ii) to assess the ERPT effects to inflation in Botswana. This will be followed by a discussion of the econometric techniques to be employed to carry out the examination of the relationships in the models. In this section the challenge of non-stationarity usually present in macroeconomic time-series is discussed and the methods for overcoming are given. Then the two popular procedures used in determining the existence of long run equilibrium relationship which are the Engle-Granger method and the Johansen procedure will be discussed. Then a discussion of the vector error correction method as a model for finding out the behaviour of the variables in the short-run is given. The chapter ends with a discussion on impulse response functions and variance decomposition, which will be generated to provide a more in-depth understanding of the relationship between these variables.

3.7 Theoretical Framework

3.7.1 Modeling exchange rate and export competitiveness in Botswana

The standard export function as indicated by De Grauwe (1983) shows that the demand for exports is a function of foreign demand, terms of trade as well as exchange rate. Therefore the following equation can be constructed to represent this relationship:

$$Exp = f(FD, TOT, ExcRate) \qquad (4.1)$$

Where Exp is exports and the dependent variable, FD is foreign demand, TOT is the terms of trade which is a proxy of relative price of domestic goods and foreign goods and ExcRate is the exchange rate. An increase in world income would stimulate demand which will ultimately push demand for exports, therefore positive relationship between this variable and the dependent can be expected. As terms of trade and exchange rate represent the pricing of exports it expected that the higher the cost of a product the lower its demand will be. Therefore if the cost of exports in one country increase relative to those of competitors, the quantity of exports demanded should decline (Edwards and Golub, 2003). Choudhury (2001) however indicates that for small country, as is the case for Botswana, export demand depends on world price of the export product, income levels of the countries where the product is sold.

To estimate the effect of currency depreciation on export growth a quantitative causal method as employed by Rowbotham *et al* (2014) and somewhat similar to that of Galebotswe and Andrias (2011) and Choudhury (2001) will be developed. However the model to be employed in this study is a time-series analysis, whereas that employed by Rowbotham *et al* (2014) is a panel data model. Also, instead of the price of the product as in Choudhury (2001) the REER will be used. The explanatory variables in the model are REER and world income to indicate the purchasing capacity of the international community. Changes in global gross domestic product (GDP) are used as a proxy for growth in world income. The required variables for analysis include percentage growth in exports of goods and services, GDP and annual average real exchange rate (REER) from 1984 to 2014. The baseline estimating equation is given in

$$\text{Log } X_t = \alpha + \beta_1 \text{logREER}_t + \beta_2 \text{log } Y_t + \beta_3 D_{t+} \varepsilon_t \qquad (4.2)$$

Where; X_t is a measure on NME at time t, measured in US dollars

REER is the real effective exchange rate at time t,

Y is world income at time t

D is the dummy variable

t indexes a specific (but generic) time period

ε_t is a random error term at time t

The REER is expected to have a negative relationship as stated in chapter 3 that it is devalued to maintain non-mining export competitiveness in Botswana. Therefore a decline in Botswana's REER is expected to lead to a higher demand for Botswana's NME, which means the expected sign for the coefficient of REER is negative. The REER is used because in chapter 3 it was discussed that the Bank of Botswana adjusts the NEER to affect the REER, intending to improve NME sector competitiveness. World income is expected to be positively related to the demand for exports, which means that, the higher the world income the higher the demand for exports, ceteris paribus. The sign of the coefficient for world income is expected to be positive.

The Johansen (1991) and (1995) cointegration method is employed in the succeeding chapter to test for cointegrating relationships between the variables. After establishing the existence of long-run equilibrium relationships, the VECM will be estimated to test for short-run dynamics in the relationships between the variables.

3.7.2 Modelling exchange rate pass-through

The second aspect of this study will estimate the ERPT to inflation in Botswana using monthly data spanning 14 years (168 observations) from 1998 to 2012. Different techniques and models have been used to estimate ERPT. The estimation techniques have ranged from simple classical regression models to variations of the VAR models such as the threshold and momentum threshold autoregressive models, to cointegration based techniques such as the Engle-Granger and Johansen methods. However, as highlighted in the review of empirical literature in Chapter 2, the most prominent techniques used are ordinary least squares (OLS) regression, the VAR technique in conjunction with impulse response and variance decomposition functions, and the Johansen (1988) and Johansen and Juselius (1990) cointegration techniques combined with vector error correction modelling. This dissertation will use the model adopted by Leith (1991) in examining ERPT in Botswana. Whereas Leith (1991) uses OLS to estimate ERPT in Botswana, this dissertation uses VAR and Johansen (1991) and (1995) cointegration methods. Another difference is that Leith (1991) used the pula/rand exchange rate whereas this dissertation will use the NEER of the pula. Additionally VECM is estimated to model the short-run dynamic behaviour of the variables.

The initial stage is the transmission of fluctuations in the exchange rate to the price of imported goods. Thereafter, the second stage of ERPT entails the pass-through of changes in the exchange rate to consumer prices. The most popular method for testing and estimating cointegration in ERPT models is the Johansen technique based on VAR. The first stage is estimated using the Johansen (1991) and (1995) cointegration technique and a VECM. The Johansen cointegration method will test for long-run cointegrating relationships between the variables. After establishing the existence of long-run equilibrium relationships, the VECM will be estimated to test for short-run dynamics in the relationships between the variables.

The model to be used for estimating the long run relationship of the ERPT to consumer prices can be estimated from a log-linear transformation which allows for a constant, given as:

$$\text{Log } CPI_t = \alpha + \beta_1 \text{LogIMP}_t + \beta_2 \text{Log NEER}_t + CPI^* \varepsilon_t \qquad (4.4)$$

Where CPI_t is Botswana consumer price index at time t

IMP_t is imports index at time t

$NEER_t$ is the nominal effective exchange rate at time t

CPI* is the South African consumer price index

ε_t is the random error term

A vector error correction method will be developed in the subsequent chapter once a cointegrating relationship has been established to assess the short run dynamics of the above relationship.

3.8 Estimation Techniques

To achieve the objects of this dissertation, cointegration analysis and vector error correction modelling will be employed to establish the existence of long run relationships between variables and to also examine the short run dynamics of these relationships. Based on the argument presented in the literature review, there is a need to establish whether there exists a long run relationship between the exchange rate and non-mining principal exports. Cointegration analysis is method that is popularly employed by econometric researchers to establish the presence of a long run equilibrium relationship between variables. Once the variables are found to be cointegrated, a vector error correction model is estimated to model the short-run dynamics of the variables. The section discusses the methodology to be applied to achieve the objectives of this dissertation.

3.8.1 Stationarity

Koop (2009) argues that the property non-stationarity (often referred to as the presence of a unit root) seems to be predominant in macroeconomic time series data. Harris and Sollis (2003) explain that a non-stationary series has a different mean at different points in time and its variance increases with sample size where a stationary series tends to return to its mean value and fluctuate around it within a more or less constant range. This means that a stationary series exhibits the property of mean reversion. Hill, Griffiths and Lim (2012), Koop (2009), Gujarati (2003) and Harris and Sollis (2003) all indicate that models containing non-stationary variables will lead to a problem of spurious regression. Harris and Sollis (2003) expounds further that spurious regression is where the results obtained suggest that there is a statistically significant relationship between the variables in the regression model when in fact all that is obtained is evidence of contemporaneous correlations rather than meaningful causal relations. Ogaki (1993) adds that when one or more variables of interest in a model are unit root non-stationary, standard asymptotic distribution theory does not apply to the econometric system involving these variables. This means, then, that variables that exhibit the presence of a unit root should not be used in a regression, as the results could yield misleading conclusions. This then means that variables should be examined for presence of unit roots and making the necessary adjustments before carrying out a regression analysis.

It is therefore important to test for the stationarity in the variables to avoid the problem of spurious results that could yield misleading conclusions. The data is plotted to assess whether the series is mean reverting, prior to a formal test. There are several ways of testing for stationarity or the presence of unit roots commonly used are the Augmented Dickey-Fuller (ADF) approach (Dickey and Fuller, 1979), the cointegration regression Durbin-Watson (CRDW) test and the non-parametric Phillips-Peron test (Harris and Sollis, 2003). The first step is to investigate the unit root characteristic of the variables in the models to be specified based on their levels. If a variable is stationary on their level it is integrated of order zero, denoted as I(0). If a series is stationary after first differencing and second differencing, it is integrated of order one, denoted as I(1) and two I(2) respectively.

3.8.2 Cointegration analysis

Cointegration is a procedure used to ascertain the existence of common trends in multivariate time series; and it provides a reliable methodology for modelling long-run dynamics in a system. The empirical model is estimated using cointegration analysis. The cointegration approach will thus assist in examining the presence or absence of a long-run relationship between exchange rate movement and NME.

The economic interpretation of cointegration is that if two (or more) series are linked to form an equilibrium relationship spanning the long run, then even though the series themselves may contain stochastic trends – that is, non-stationary – they will nevertheless move closely together over time and the difference between them is constant. Thus the concept of cointegration mimics the existence of a long-run equilibrium to which an economic system converges over time. (Harris and Sollis, 2003). Hill, Griffiths and Lim (2012) add that cointegration implies that variables share similar stochastic trends and since the difference in the error term is stationary they never diverge too far from each other. Furthermore a natural way to determine whether variables are cointegrated is to test for the stationarity of the least square residuals using a Dickey-Fuller test. The test for cointegration is ultimately a test for of the stationarity of the residuals. Ogaki (1993) explains that if linear combinations of two or more unit root non-stationary variables do not contain stochastic trends, these variables are said to be cointegrated. The cointegrated vector that eliminates the stochastic trends can be estimated consistently by regressions. If the residuals are stationary, the concerned variables are said to be cointegrated. If the residuals are not stationary, the variables concerned are not cointegrated and any regression between them is said to be spurious (Hill *et al* 2012).

Cointegration tests are performed to assess the existence of a long run equilibrium relationship among a set of variables in a model. The test is important for this dissertation in order to investigate whether there a long-run equilibrium relationship between exchange rate and export competitiveness and inflation.

Harris and Sollis (2003) identify two major approaches to cointegration which are (i) Engle-Granger Approach and (ii) the Johansen Approach. The procedures for carrying out cointegration will be discussed in the following subsections.

3.8.3 Engle-Granger cointegration procedure

The relationship between cointegration and error correction models, first suggested in Granger (1981) and then further extended in Engle and Granger (1987), is an approach that uses the estimated residual from the long-run equation to investigate the existence of a long run relationship (cointegration) among variables which are integrated of the same order. The residuals are tested for the presence of a unit root under the null hypothesis of a non-stationary residual. The null hypothesis of no cointegration is rejected if the ADF test statistic exceeds the MacKinnon critical value. Harris (1995) recommends the use of Mackinnon critical values to examine the unit root of residuals as they provide a more approximate finite sample values as opposed to the ADF test. If the null hypothesis is rejected; this means that the residual has a unit root and that the variables are not cointegrated.

Harris and Sollis (2003) indicate that the Engle-Granger procedure is likely to have low power against alternative tests for cointegration, its finite sample estimates of long-run relationships are potentially biased and the inferences cannot be drawn using standard t-statistics about the significance of the parameters of the static long-run model. Harris (1995) notes that the Engle-Granger method is unable to detect more than one cointegrating relationship in a model, and also that, if there is more than one cointegrating relationship, the method produces incoherent results.

In spite of these shortcomings of the Engle-Granger procedure, it is still popular because is easy to estimate the static model by OLS and then perform the unit root test on the residuals. Also, estimating the static model is only the first stage of the Engle-Granger procedure, with stage 2 comprising estimating the short-run error correction model itself using the estimates of the disequilibrium to obtain information on the speed of adjustment to equilibrium. The error correction model allows for a general dynamic structure to be determined by the data (Harris and Sollis, 2003).

3.8.4 Johansen cointegration procedure

The Johansen (1991) and (1995) procedures use a maximum likelihood approach. The Johansen methodology has an advantage over the Engle-Granger procedure in that the former provides estimates of all cointegrating relationships that may exist with a vector of variables. Johansen's

procedure builds cointegrated variables directly on maximum likelihood estimation instead of relying on OLS estimation. This procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots. Johansen derived the maximum likelihood estimation using sequential tests for determining the number of cointegrating vectors. This method can be seen as a secondary generation approach in the sense that it builds directly on maximum likelihood instead of partly relying on least squares. Johansen (1988) suggests a method for both determining how many cointegrating vectors there are and also estimating all the distinct relationships. In a sense this is no more than a multivariate generalisation of the Dickey Fuller test.

The Johansen test makes use of the VAR methodology which requires that the optimal lag order in the VAR model be selected prior to testing the null hypothesis of no cointegration. The Akaike Information Criterion (AIC) and Schwarz Information Criterion (SC) are used to select the optimal lag length. Having done that, the next step is to use the chosen lag length to determine the number of cointegrating vectors in the system based on the values of the trace test (λ trace) and the maximum eigenvalue (λ max). The trace statistic tests the null hypothesis that there are at most r cointegrating relations against the alternative of m cointegrating relations. The maximum eigenvalue statistic test the null hypothesis that there are r cointegrating relations against the alternative there are r + 1 cointegrating relations. The null hypothesis of no cointegration is rejected if the calculated λ trace and λ max are greater than the corresponding critical values at a specific level of significance.

More attention will be placed on the estimated relationship between the non-mining merchandise export value and the REER of the Pula to establish whether a depreciation of the real exchange rate leads to an increase in the value of NME. The REER to be used in this dissertation is expressed using the indirect method such that a depreciation of the domestic currency; that is a decline in the REER, improves the value of NME. Therefore the expected sign of the coefficient of REER is negative.

The Johansen method assumes that the cointegrating vector remains constant during the period of study. In reality, it is possible that the long-run relationships between the underlying variables change. The reason for this might be technological progress, economic crisis, changes in people's

preferences and behaviour accordingly, policy or regime alteration and institutional development. This is especially the case if the sample period is long (Ssekuma, 2011).

3.8.5 Vector Error Correction Modelling

Ssekuma (2011) defines an error correction model (ECM) as a dynamic model in which the movement of a variable in any period is related to the previous period's gap from the long-run equilibrium. This means that ECMs estimate the speed at which the dependent variable returns to equilibrium following shocks to the independent variable. Although it may be possible to estimate the long-run or cointegrating relationship, $Yt = \beta Xt + \varepsilon t$ economic systems are rarely in equilibrium, as they are affected by institutional and/or structural changes that might be temporary or permanent. If two or more non-stationary time series are cointegrated, then it is possible to develop an ECM. Cointegration is a necessary condition for ECM. ECM describes the long run equilibrium relationship between non-stationary series. Even though individual series are non-stationary, when they are cointegrated, there is a long run equilibrium relationship, and ECM explains this relationship. Koop (2009) provides the following equation as a simple version of an ECM:

$$\Delta Y_t = \varphi + \lambda e_{t-1} + \omega_0 \Delta X_t + \varepsilon_t \qquad (4.5)$$

Where e_{t-1} is the error obtained from the VAR model.

Once the variables are found to be cointegrated using the Johansen procedure, the next step involves estimating the short-run VAR in error correction form, VECM. Harris and Sollis (2003) indicate that short-run structure of the model is important in terms of the information it conveys on the short run adjustment behaviour of economic variables. A VECM is a restricted VAR that has cointegration restrictions built into the specification, so that it is designed for use with non-stationary series that are known to be cointegrated. The VECM specification restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics. The cointegration term is known as the error correction term since deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Koop (2009) indicates that like the VAR, the VECM will have

one equation for each variable in the model. For example if the model has two variable X and Y, the VECM is:

$$\Delta Yt = \varphi 1 + \delta 1t + \lambda 1et\text{-}1 + \gamma 11\Delta Yt\text{-}1 + \ldots + \gamma 1p\Delta Yt\text{-}p + \omega 11\Delta Xt\text{-}1 + \ldots + \omega 1q\Delta Xt\text{-}q + \varepsilon 1t$$

and,

$$\Delta Xt = \varphi 2 + \delta 2t + \lambda 2et\text{-}1 + \gamma 21\Delta Yt\text{-}1 + \ldots + \gamma 1p\Delta Yt\text{-}p + \omega 21\Delta Xt\text{-}1 + \ldots + \omega 2q\Delta Xt\text{-}q + \varepsilon 2t$$

The VECM as presented above is in the form of a classic autoregressive distributed lag model (ARDL). Koop (2009) further adds that in this model, the only right-hand side variable is the error correction term. In long run equilibrium, this term is zero. However, if Y and X deviated from long run equilibrium in the last period, the error correction term is nonzero and each variable adjusts to partially restore the equilibrium relation. The coefficients γ measure the speed of adjustment. The number of cointegrating vectors and the order of the lag lengths found in the Johansen cointegrating steps are used to specify the VECM. The coefficient of interest in the first model will be the REER as it will indicate the long run relationship between REER and NME in Botswana.

3.9 Diagnostic Checks

It important to carry out diagnostic checks to detect model misspecification, this will facilitate an improvement of the model. These checks will include tests for residual serial correlation, stability, normality and heteroscedasticity. Carrying out these tests should assist in improving the validity of the parameter estimation in the models.

3.10 Impulse response functions, variance decomposition and Granger causality/block exogeneity Wald test

Once the models have been determined to be appropriately specified and having been accepted as valid by the diagnostic checks, the next stage will be to generate impulse response functions and variance decomposition. Hill *et al* (2012) indicate that impulse response function and variance decomposition techniques are used to analyse the effect of shocks to a certain variable

on other variables. The primary purpose is to illustrate how variables in a VAR system react to shocks.

3.10.1 Impulse response functions

Pesaran and Shin (1998) explain an impulse response function to be a way to measure the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamic system. Impulse response function shows the effects of shocks on the adjustment path of the variables. Hill *et al* (2012) add that impulse response functions show the effects of shocks on the adjustment path of the variables. Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted (Brooks, 2008). The impulse response functions in this dissertation will reveal the sign, size and persistence of shocks from the exchange rate to NME in the first model and to consumer prices in the second model.

3.10.2 Variance decomposition

Variance decompositions offer a slightly different method for examining VAR system dynamics. They give the proportion of the movements in the dependent variables that are due to their "own" shocks, versus shocks to the other variables. A shock to the i-th variable will directly affect that variable of course, but it will also be transmitted to all of the other variables in the system through the dynamic structure of the VAR (Brooks, 2008). This means that variance decomposition shows the importance of shocks within the dependent variables themselves versus shocks from the independent variables. The variance decomposition will show the importance of shocks within the dependent variables in the models employed in this dissertation versus shocks from the independent variables.

3.10.3 Granger causality/block exogeneity Wald test

It is likely that, when a VAR includes many lags of variables, it will be difficult to see which sets of variables have significant effects on each dependent variable and which do not. A block exogeneity test is used for detecting whether to incorporate an additional variable into a VAR (Brooks, 2008). Such a test can help determine whether changes in one variable may cause

changes in another based on the significance of the effect of the former variable on the latter. Although the block exogeneity Wald tests and other causality tests, identify the variables in the model that have statistically significant influences on the future values of each of the variables in the system, they cannot show whether changes in a value of a given variable have a negative or positive effect on the other variables in the system, neither can they reveal the time taken for the effect to work through the system (Brooks, 2008). Having noted the shortcoming of the Wald test, these will be overcome with the inclusion of the impulse response functions and variance decomposition.

3.11 Conclusion

This chapter outlined the econometric techniques that will be used in carrying out the data analysis in the subsequent chapter. The chapter began with a discussion of the analytical framework and two models were developed for the achieving objectives of the dissertation. The first models looks into the relationship between NME and REER, the second model looks into the ERPT.

This is followed by a discussion on the issue of non-stationarity and the tests for assessing its presence in data. Then the two popular cointegration techniques are discussed along the strengths and shortcomings of each procedure. Then a discussion of the VECM is provided, also indicating that the Johansen cointegration procedure will be used to carry out the data analysis in the succeeding chapter. The VECM was shown to be important in understanding the short run adjustment behaviour of the variables. This was followed by indicating the diagnostic checks that will be undertaken to ensure that the models are properly specified.

The chapter concludes with a brief discussion regarding impulse response function and variance decomposition. The impulse response function is important for this dissertation as it provides the information necessary to understand the effect of shocks to the exchange rate on the NME. Variance decompositions highlight the proportion of the movements in the dependent variables that are a result of their own shocks, versus shocks from the other variables. This is useful for ascertaining the extent to which movements in the dependent variables can be attributed to shocks in the independent variables.

The following chapter reports the results obtained from this estimation of the equations using Botswana data, using the methods outlined in this chapter, so as to achieve the objectives of this dissertation.

Chapter 5: Empirical analysis

5.1 Introduction

In the previous chapter the econometric techniques to be used to analyse the data were outlined. This chapter will present the empirical findings of this study using data the methodology outlined in the previous chapter. The first section of this chapter investigates the effect of Pula devaluation on the NME sector. The same methodology is employed to assess the ERPT in Botswana.

A VECM is used the long- and short-run causality coefficient for the studied variables. VECM is a restricted VAR model that has cointegration restrictions built into the specification, so that it is designed for use with non-stationary series that are known to be cointegrated. The VECM specification restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics. There are four steps involved in this procedure which are; 1) First the variables are tested for unit roots, 2) to determine the order of their integration, 3) then the Johansen (1991) and (1995) cointegration test is conducted to examine the number of cointegrating equations in the data set. Once the variables are found to be cointegrated, the third step is to estimate VECM equations. Finally Granger causality link and their directions are identified. These steps will be applied to each of the models.

5.2 Exchange rate and Non-Mining exports

5.2.1 Data

This dissertation uses annual data covering the period from 1981 to 2013. The NME data and the REER are provided by Bank of Botswana and the Central Statistics Office of Botswana, while the data on World GDP is sourced from the International Monetary Fund database. All the variables transformed to their natural logarithm form to control the variance and maintain the uniformity in the data. REER is used as a proxy for real exchange rate and World GDP is used as a proxy for foreign income. There are two dummy variables is added to account for structural

breaks in the time series, the first dummy variable, Dummy 1, accounts for the introduction of the crawling peg mechanism from 2005, the second dummy, Dummy 2, accounts for the world economic recession which had a major effect on world trade and affected Botswana's export performance severely and led to a recession in Botswana as well.

5.2.1.1 Non-mining exports

NME is the dependent variable, being total exports excluding exports from the mining sector. The total has been constructed from statistical reports of various Bank of Botswana annual reports and various Central Statistics Office merchandise trade reports. A key non-mining sector not included is the tourism industry. The sector is excluded due to lack of data and also it is difficult with the data available to differentiate the value from domestic tourists and foreign tourists.

5.2.1.2 Real effective exchange rate

The REER is taken from the various Bank of Botswana annual reports. The REER is used in the model as it takes into account inflation differentials and a good indicator of real competitiveness of a currency. Chapter 3 noted that the Bank of Botswana aims to maintain a stable and a competitive REER so as to boost non-mining export sector competitiveness. The Bank of Botswana calculates the REER using headline inflation (Bank of Botswana, 2008). The REER consists of the South African Rand and the SDR basket as these two currencies represent Botswana's major trading partners. An increase in REER reflects an appreciation of the Pula whereas a decrease indicates a devaluation of the Pula.

5.2.1.3 World Gross Domestic Product

GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used. The time series is sourced

from the World Bank national accounts data, and OECD National Accounts data files. A rise in foreign income is expected to induce an increase in Botswana's non-mining export demand; therefore the coefficient for the World GDP is expected to have a positive sign.

5.2.1.4 Dummy variables

The structural breaks in the time series necessitated the addition of dummy variables to the equation. D_1 (Dummy 1) accounts for a policy shift in the exchange rate determination, which was the adoption of a crawling peg mechanism in 2005, from a fixed exchange rate regime. D_2 (Dummy 2) accounts for the global economic recession that began in 2009. This event led to a severe decline in world trade and this affected Botswana's economy significantly.

5.2.2 Research hypothesis

The purpose of the empirical assessment in the section is to examine if REER and NME have a long-run equilibrium relationship and also the direction of causality. Equation (4.2) developed in chapter 4 is:

$$\text{Log NME}_t = \alpha + \beta_1 \text{logREER}_t + \beta_2 \text{logWorldGDP}_t + \beta_3 D_t + \beta_4 D_t + \varepsilon_t \qquad (4.2)$$

The hypothesis for this examination is summed up in table 5.1 below;

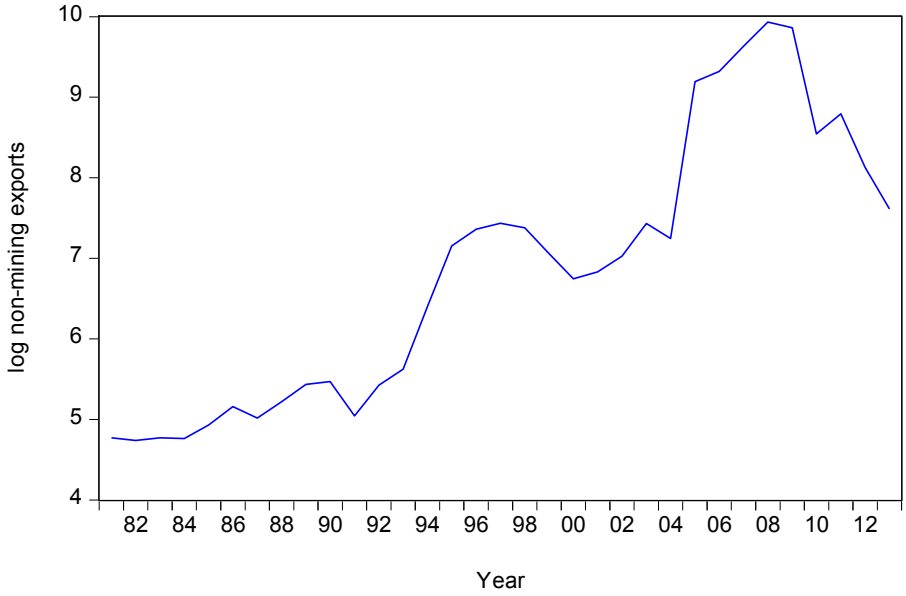
Table 5.1 Research hypothesis

Null Hypothesis	**Alternative Hypothesis**
Log REER does not cause Log NME	Log REER causes Log NME
Log World GDP does not cause Log NME	Log World GDP causes Log NME
D_1 does not cause Log NME	D_1 causes Log NME
D_2 does not cause Log NME	D_2 causes Log NME
Log NME does not cause Log REER	Log NME exports causes Log REER
Log World GDP does not cause Log REER	Log world GDP causes Log REER

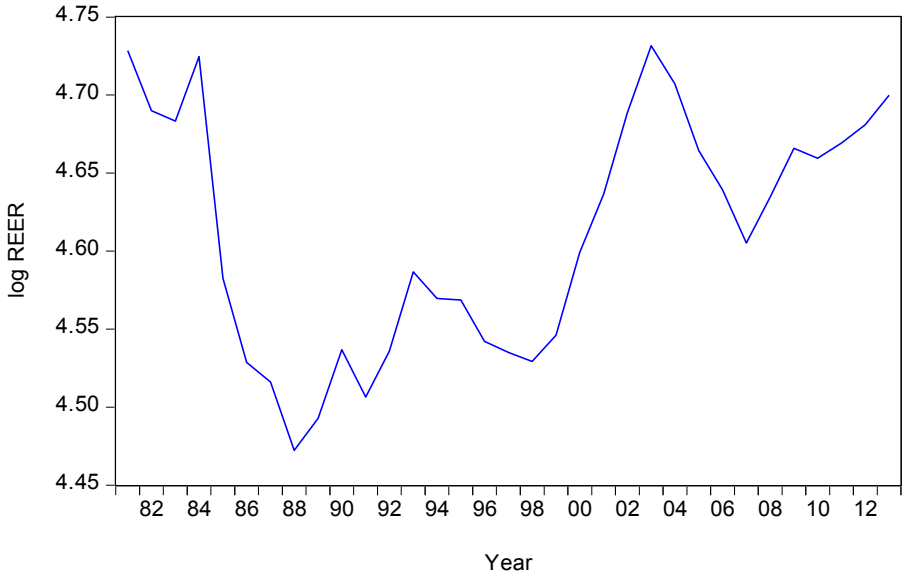
5.2.3 Unit root test

The formal tests carried out in the analysis of the time series data are the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests to determine the presence of unit roots and therefore determine the order of integration of the variables.

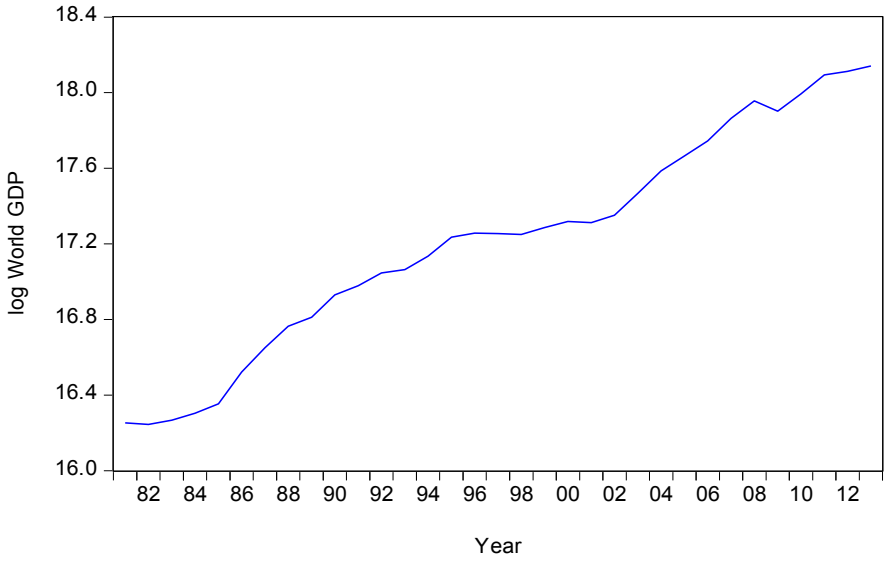
Figure 5.1: Graphical presentation of variables



Source: (Bank of Botswana data: 1990-2014).



Source: (Bank of Botswana data: 1990-2014).



Source: (World Bank data: 2015).

Table 5.2 ADF and the PP test

Variable	**Specification**	**ADF Test**		**PP test**		**Decision**
		Level	1st difference	Level	1st difference	
Log NME	Intercept	-1.25399	-4.513390***	-1.34708	-5.009001***	I(1)
	Trend and intercept	-5.30975***		-2.01682	-5.020621***	I(0)
	None	2.097148	-4.856475***	0.19829	-4.971116***	I(1)
Log REER	Intercept	-1.822047	-4.850453*	-1.98988	-4.409140*	I(1)
	Trend and intercept	-6.73464*		-2.43419	-4.560246*	I(0)
	None	0.897748	-4.501248*	-0.13516	-4.491786*	I(1)
Log World GDP	Intercept	-0.466441	-4.145878*	-0.47411	-4.102797*	I(1)
	Trend and intercept	-4.37085*		-1.84533	-4.033892*	I(0)

	None	6.547676	-2.22548**	5.61481	-2.12742**	I(1)

***, **, * denotes significance at 1%, 5% and 10% respectively.

Source: (Bank of Botswana data: 1990-2014, World Bank data: 2015).

Table 5.2 gives the results of the unit root test according to the ADF test and PP test, all variables are integrated of order 1 given any specification, whereas the ADF tests finds the variables to be stationary at level only if the variables are specified to have a trend and intercept. This data is found to be stationary with a trend and an intercept at level and will not be differenced to run a VAR model for the cointegration test.

5.2.4 Cointegration analysis

The ADF unit root test performed on each variable has shown that all the variables are stationary at their levels. In the following section, the results of the cointegration test to determine whether the variables in equation 4.2 have a long run equilibrium relationship are reported. The Johansen (1991) and (1995) cointegration rank (trace value and maximum eigenvalue) tests are conducted to know the number of cointegrating equations in the data set. The test results are shown in table 5.2.

Table 5.3 Johansen Cointegration rank test with optimal lag length 2

(i) Trace test

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob. **
None *	0.732669	100.9472	69.81889	0.0000
At most 1*	0.545881	61.36919	47.85613	0.0017
At most 2*	0.511355	37.68730	29.79707	0.0050
At most 3*	0.403685	16.20374	15.49471	0.0391
At most 4	0.022873	0.694146	3.841466	0.4048

Trace test indicates 4 cointegrating equations at 5% level

Source: (Bank of Botswana data: 1990-2014, World Bank data: 2015).

(ii) Maximum Eigenvalue

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob. **
None *	0.732669	39.57798	33.87687	0.0094
At most 1	0.545881	23.68189	27.58434	0.1462
At most 2*	0.511355	21.48356	21.13162	0.0446
At most 3*	0.403685	15.50959	14.26460	0.0316
At most 4	0.022873	0.694146	3.841466	0.4048

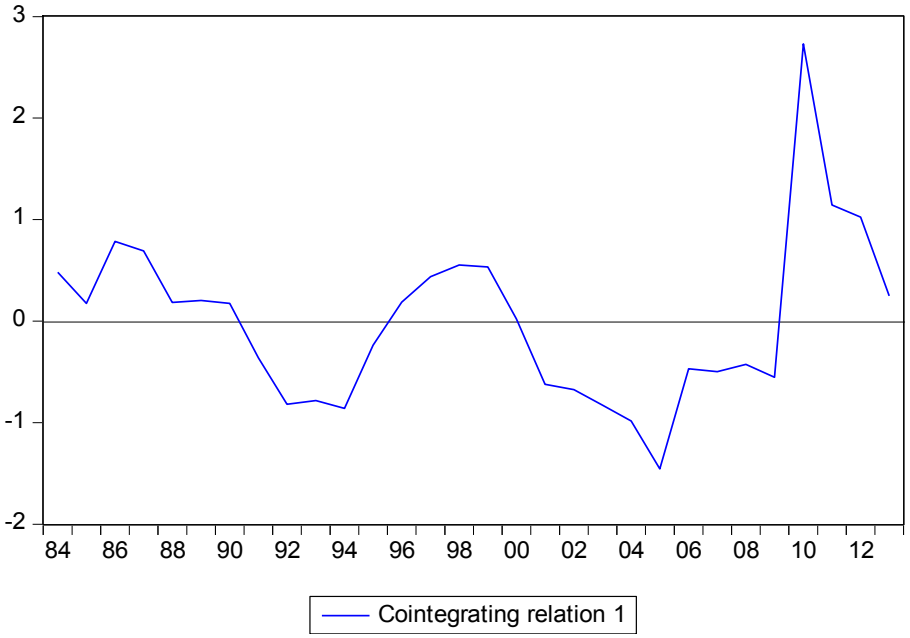
Max-eigenvalue test indicates 1 cointegrating equation at the 5% level

* denotes rejection of the hypothesis at the 5% level

Source: (Bank of Botswana data: 1990-2014, World Bank data: 2015).

The cointegration results presented in table 5.3 indicate that the null hypothesis of no cointegration could not be rejected as both the trace test and maximum eigenvalue statistics are found to be greater than the critical values at the 5 per cent level of significance. The trace statistics suggests that there are 4 cointegrating equations while the maximum eigenvalue statistics suggests that at least one cointegration equation exists in the data set at the 5% significance level. Both tests indicate that there is at least one cointegrating equation at the 5 per cent level, which shows that there is a long run relationship between the variables, NME, REER, world GDP, D_1 and D_2. Figure 5.2 gives an illustration of the cointegrating relationship.

Figure 5.2 Cointegrating graph



Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

5.2.5 Long-run Dynamics

The Johansen cointegration procedure presented in table 5.3 shows that a long-run relationship seems to exist among the variables included in the VAR model. This section reports the results of the estimated cointegrating NME demand equation of Botswana. The normalised cointegrating coefficients are presented in table 4.

Table 5.4 Normalized Cointegrating Coefficient

Log NME	Log REER	Log World GDP	D_1	D_2
1.000000	-4.259982 (1.10134)	-3.265922 (0.21801)	-0.885758 (0.33618)	3.324099 (0.35093)

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

The estimated long run equation when normalized by the coefficient of NME can be written as follows:

$$\text{Log NME} = 68.79 - 4.26\text{logREER} - 3.27\text{logWorldGDP} - 0.89D_1 + 3.32D_2 \qquad (4.2)$$

[3.87]** [14.98]** [-2.63]** [9.44]**

The values in parenthesis are the t-statistics of the estimated coefficients while ** denotes significance at 5 per cent level. Equation 4.2 represents the estimated long run relationship between NME, REER, and World GDP. The structural breaks in the time series necessitated the addition of dummy variables to the equation. Dummy 1 accounts for a policy shift in the exchange rate determination, which was the adoption of a crawling peg mechanism in 2005 from fixed exchange rate regime. Dummy 2 accounts for the global economic recession that began in 2009; this event led to a severe decline in world trade and this affected Botswana's economy significantly. All the long run coefficients have been found to be statistically significant.

The estimated coefficient of log REER at 4.26 is negative and significant, showing that there is a negative relationship between REER of the pula and NME. This means that an increase in the REER index, which is an appreciation of the domestic currency, has a negative effect on NME in Botswana. This is because an appreciation of the domestic currency makes domestic exports less competitive if they are priced using in domestic currency. A decline in the REER index reflects devaluation in the pula and could boost NME. Based on the long-run equation, the coefficient of REER shows that a 1-percentage-point increase of the REER leads to a roughly 4.23% decline in NME. Explained differently, a 1-percentage-point decline in REER of the pula (devaluation) could improve NME by 4.23%. The estimated coefficient of log world GDP is negative and significant, which is -3.27, indicating that a 1% increase in world GDP reduces NME by 3.27%. This sign is against expectations, as an increase in foreign income was expected to stimulate demand for exports. The estimated coefficient of Dummy 1 is negative and significant. This coefficient indicates that the introduction of the crawling peg had the effect of reducing NME by 0.89 percentage points. The crawling peg as discussed in chapter 3 was introduced to increase stability of the exchange rate and therefore support export competitiveness. The estimated coefficient for Dummy 2 is positive and significant, which indicates that the global economic recession had the effect of increasing Botswana's NME by 3.32 percentage points.

5.2.6 Short-run Dynamics

Having investigated the long run cointegrating coefficients of NME in Botswana, the next step is to develop a short-run model so as to study the short-run dynamics of these variables. This is done by estimating a VECM which provides the analysis of the adjustment process in the short run towards long run equilibrium. In estimating the VECM, the number of cointegrating vectors and the optimal lag length used in the Johansen cointegrating procedure are also used. The results of the VECM are presented table 5.5 below:

Table 5.5 VECM results

Error Correction	D(NME)	D(REER)	D(World GDP)	D(Dummy1)	D(Dummy 2)
CointEq1	-0.687742 (0.17666) [-3.89312]***	-0.040372 (0.02079) [-1.94158]*	-0.008570 (0.02388) [-0.35885]	-0.147294 (0.08883) [-1.65821]*	-0.072377 (0.10249) [-0.70616]

***, **, * denotes significance at 1%, 5% and 10% respectively.

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

In the estimated VECM it is important to note the signs and magnitude of the error correction terms as they measure the speed of adjustment to long run equilibrium. The four estimated error correction terms all have the correct negative signs and the values of the term lies within the range of 0 and -1. This means that a shock in the variables included in the model will result in the values of these variables eventually returning to equilibrium. However, not all the error correction terms are well defined because the log world GDP and Dummy 2 estimated terms are not significant. Only the NME, REER and Dummy 1 estimated terms are well defined as they are negative and statistically significant at 10%. Furthermore, the results of the estimated VECM show that about 68% of the disequilibrium in NME is corrected each year. The estimated error correction terms show that the speed of adjustment in returning to equilibrium for the rest of the variables is very slow. For REER the speed of adjustment is 4% per period, 0.8% for world GDP, 14.7% for Dummy 1 and 7.2% for Dummy 2.

5.2.6.1 VECM for Non-Mining Exports

A VECM equation for NME is developed with a view that NME is a function of REER, world GDP and the method of managing the currency. The VECM equation expresses the long- and short-run associations between exchange rate and world income. It consists of two parts, namely the cointegration and short run association. Cointegration part represents the long-run association between the variables. The first term C(1) represents to speed of adjustment to long run equilibrium. It should be negative and significant for correctness of the model.

D(NME) = C(1)*(NME(-1) -4.25998179248 *REER(-1) - 3.26592205306*WORLD_GDP(-1) - 0.88575799846 *DUMMY_1(-1) + 3.31409857142*DUMMY_2(-1) + 68.7857640575) + C(2)*D(NME(-1)) + (3)*D(NME(-2)) + C(4)*D(REER(-1)) + C(5)*D(REER(-2)) + C(6)*D(WORLD_GDP(-1)) + C(7)*D(WORLD_GDP(-2)) + C(8)*D(DUMMY_1(-1)) + C(9)*D(DUMMY_1(-2)) + C(10)*D(DUMMY_2(-1)) + C(11)*D(DUMMY_2(-2)) + C(12)…(equation 5.1)

Where C(1) is long run adjustment coefficient. C(2) to C(11) are short run causality coefficients of respective variables and C(13) is a constant term. The values of all coefficients and their probabilities are presented in Table 5.4

Table 5.6 Coefficient and Probability Values

	Coefficient	Std. Error	t-Stat.	Prob.
C(1)	-0.687742*	0.176656	-3.893115	0.0011
C(2)	0.284646	0.255131	1.115685	0.2792
C(3)	0.119545	0.199982	0.597776	0.5574
C(4)	-6.468642*	2.155614	-3.000835	0.0077
C(5)	-0.838337	2.367767	-0.354062	0.7274
C(6)	-2.289105	2.202377	-1.039379	0.3124
C(7)	1.107299	1.805076	0.613436	0.5473
C(8)	-1.080095	0.673910	-1.602730	0.1264
C(9)	-0.499973	0.511309	-0.977830	0.3411
C(10)	0.445307	0.663289	0.671362	0.5105

C(11)	1.570417*	0.708687	2.215953	0.0398
C(12)	0.103041	0.146745	0.702174	0.4916

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

5.2.7 Wald Test

The combined short-run causality analysis is conducted by testing the Wald Statistic for the respective restrictions. Table 5.8 presents the causality linkages for log non-mining, log REER, log World GDP, Dummy 1 and Dummy 2. The null hypotheses are rejected on the basis of Chi square and p-value of Wald test. The criterion for rejection of the null hypothesis is a p-value should be less than the level of significance i.e. 5%.

Table 5.7 Results of Causality tests

Null hypothesis	Restrictions	p-value
Log REER does not cause Log NME	C(4) = C(5) = 0	0.0225

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

The causality analysis identifies the direction of linkage among the concerned variables. Based on the results presented in table 5.8 it would seem that log REER granger cause log NME and this is the only instance where the null hypothesis can be rejected. In all other hypothesis tests the null cannot be rejected which means there is failure to establish causality of log NME by other variables in the equations. This indicates that in the short run changes in real exchange rate has an effect on the NME.

5.2.8 Diagnostic Checks

Table 8 below shows three parameters: the R-square, the Durbin-Watson (DW) value and the F-Statistic. These parameters are used to test the strength, efficiency and correctness of a model. The explanatory power of the independent variables is shown by the R-square. A high R-square may lead to a conclusion that the model is good and fit an estimate. The R-square must be less than the D.W. for the model to be considered accurate. The DW value has to be around 2 as a

rule of thumb. The F-Statistics should be significant; it indicates that all the explanatory variables jointly influence the dependent variable.

Table 5.8 Estimated model equation results

Parameters	**NME VECM**
R-square	0.719967
D. W	2.225073
F - Statistics	4.207101
Probability	0.003518

Source: (Bank of Botswana data: 1990-2014, World Bank data: 2015).

Table 5.10 indicates that the VECM of NME has good explanatory power as indicated by the R-square of 0.72. The estimated VECM is technically correct because the R-square is less than the D.W. and the value of the D.W. is close to 2. The F-statistic is significant. This check indicates that the VECM of NME is technically correct. The next step is to test if the residual are unbiased and may not lead to spurious results. This will be testing to see if the residuals are not serially correlated and whether there is a presence of heteroscedasticity.

Table 5.9 Diagnostic tests for NME VECM

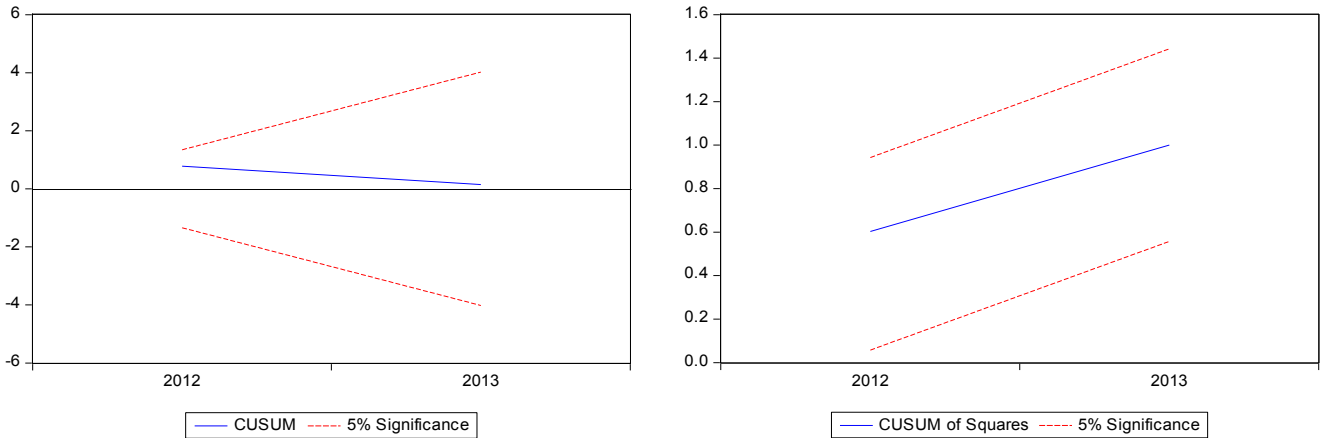
Diagnostic test	p-value	Decision
Breusch-Godfrey Serial Correlation LM test	0.1825	No serial correlation
Heteroscedasticity ARCH test	0.2909	No heteroscedasticity
Normality – Jarque-Bera test	0.0707**	Non-normal

** denotes rejection of null hypothesis at 5 per cent level of significance

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

The Breusch-Godfrey Serial Correlation LM Test is used to examine the residual serial correlation with the null hypothesis of no serial correlation in the residual series. The results indicate that there is no significant statistical evidence to reject the null hypothesis when using the Chi-square probability. The probability of Chi-square is greater than the 5% significance level. Using the ARCH test to test for heteroscedasticity the null hypothesis of no heteroscedasticity cannot be rejected; this implies that the residuals in the NME estimated VECM are homoscedastic. In addition, the stability test depicted in figure 5.3 below suggests that the short run model for NME is correctly specified and stable

Figure 5.3 NME VECM's Stability Test



Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

5.2.9 Impulse Response Function

The dissertation uses impulse response functions to show the effects of shocks on the adjustment path of the variables. Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to each variable (Brooks, 2008). The impulse response functions in this dissertation reveal the sign, size and persistence of shocks from the REER, world GDP to NME. Having established that the variables in the VECM are cointegrated and that the model is stable and well specified the next step is to generate the impulse response functions. Emphasis is placed on how NME responds to a one standard deviation increase in the error term in REER and World GDP. Figure 5.4 below presents the results of the impulse response functions. The impulse

response functions show that the shock of the two explanatory variables does not result in the impulse response coefficients converging to zero.

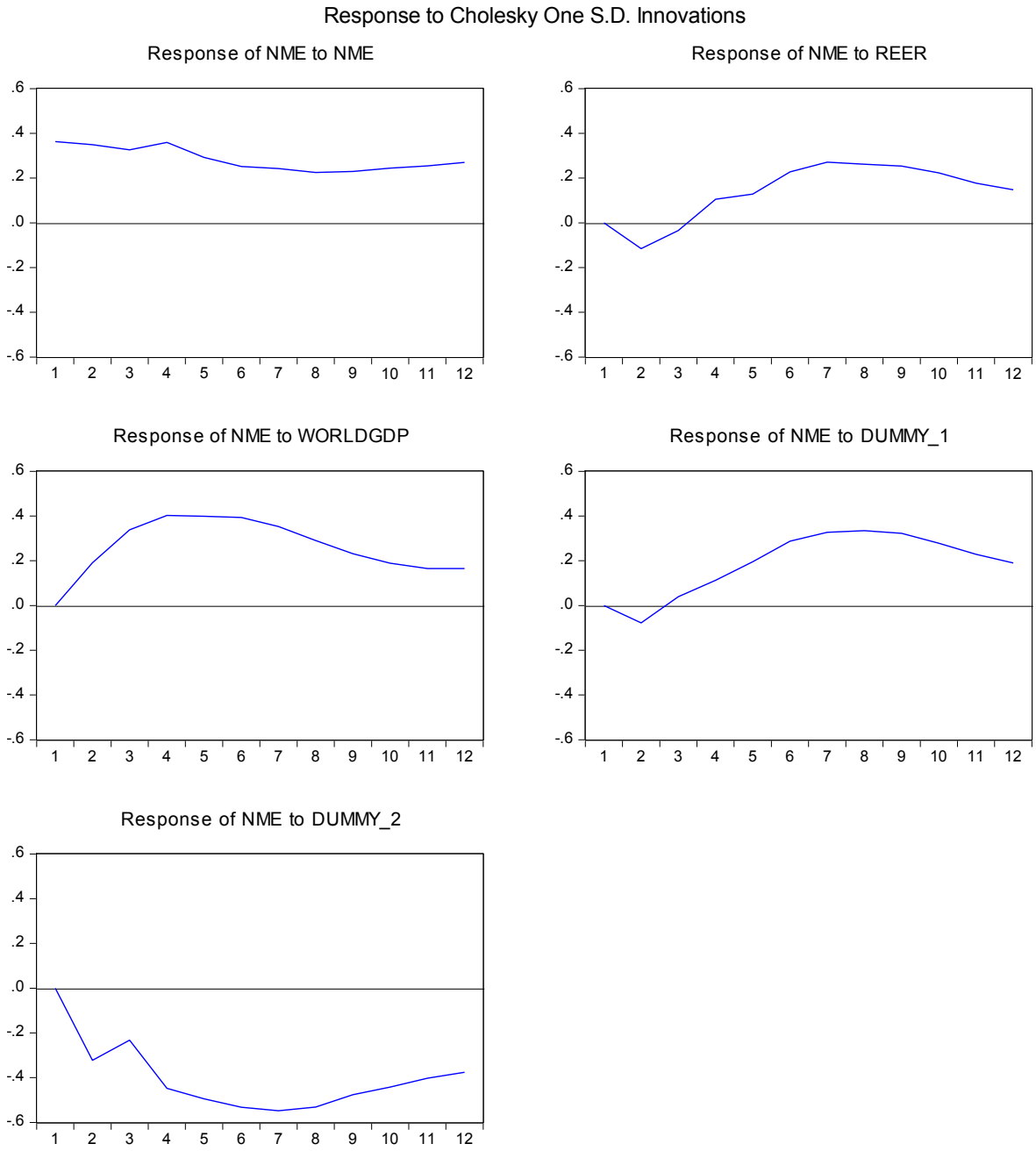
Analysis of the impulse response functions indicates that NME deteriorate initially in the first period following shocks to REER. This deterioration is reversed in the second period and continues to have a positive effect afterwards.

A shock to world GDP leads to a positive impact which persists over time; though it starts to decline after 6 periods it does not converge to zero.

A shock to the D_1 variable leads to a negative deterioration in NME in the first period following the shock. This deterioration is reversed in the subsequent period and persists in the positive without any indication of returning to zero.

The response to a shock in the D_2 variable leads to a negative deterioration in NME which persists throughout the period analysed. The response is immediate and does not show any indication of a convergence towards zero. This indicates that the global economic recession had a negative impact on NME.

Figure 5.4 Impulse Response Functions



Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

5.2.10 Variance Decomposition

Variance decomposition gives the proportion of the movements in the dependent variables that are due to their "own" shocks, as against shocks to the other variables (Brooks, 2008). The

importance of shocks in REER, world GDP, Dummy 1 and Dummy 2 on NME is examined through an analysis of the results of the estimated variance decomposition. Table 5.12 below presents the results.

Table 5.10 Variance decomposition of non-mining exports

	Period S.E.	NME	REER	World GDP	Dummy 1	Dummy 2
1	0.363016	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.643058	61.37809	3.246803	8.825332	1.445862	25.10392
3	0.831265	52.15073	2.111393	21.81454	1.086138	22.83720
4	1.098277	40.57337	2.130981	25.95950	1.669074	29.66707
5	1.322563	32.85620	2.410028	26.98349	3.327573	34.42271
6	1.544088	26.75781	3.942736	26.27455	5.900618	37.12429
Cholesky Ordering: NME REER WORLDGDP DUMMY 1 DUMMY 2						

Source: (Bank of Botswana data: 1990, 1996, 2000, 2006, 2014 and World Bank data: 2015).

Table 5.12 shows that 100% forecast of the error variances of NME is explained by its own innovations during the first year. This declines to about 61% in the second year and declines gradually over time. Of the three determinants, Dummy 2 seems to be the main determinant of non-mining exports, as its relative importance in affecting NME is higher when compared with other variables. The REER explains a very small proportion of the variation in NME. Dummy 2, which accounts for the 2009 global recession, explains a significant proportion of the variations in NME.

5.2.11 Summary

This section analysed the data using the econometric techniques outlined in chapter 4 to meet the objectives of the dissertation. The primary objective is to investigate whether long run equilibrium exists between the REER and NME in Botswana.

The next section examines the relationship between nominal prices and the nominal exchange rate to assess the effect that devaluation can have on consumer prices and imported prices.

5.3 Exchange rate pass-through to consumer prices in Botswana

5.3.1 Data

This dissertation also endeavors to assess effects of nominal exchange rate on nominal prices in Botswana. The data used in this section is monthly data covering the period of January 1998 to December. 2012. The data used was extracted from various Bank of Botswana annual reports spanning from the year 2000 to 2014 and the Statistics South Africa website. Each data series is converted into natural logarithm form to control the variance and maintain the uniformity in the data. CPI is the Botswana consumer price index, IMP is the imported tradeables index, CPI* is the South African consumer price index and the NEER is the nominal exchange rate of the Pula. All the indices used in testing the ERPT of Botswana have September 2006 as a base.

5.3.2 Research hypothesis

The purpose of the empirical assessment in the section is to examine if IMP, CPI* and NEER have a long term equilibrium relationship and also the direction of causality. Additionally, this section also assesses the relationship between NEER and IMP. Equation 4.4 developed in chapter 4 is given below;

$$\text{Log } CPI_t = \alpha + \beta_1 \text{LogIMP}_t + \beta_2 \text{Log NEER}_t + CPI^* + \varepsilon_t \qquad (4.4)$$

The hypothesis is summed up in table 5.11 below

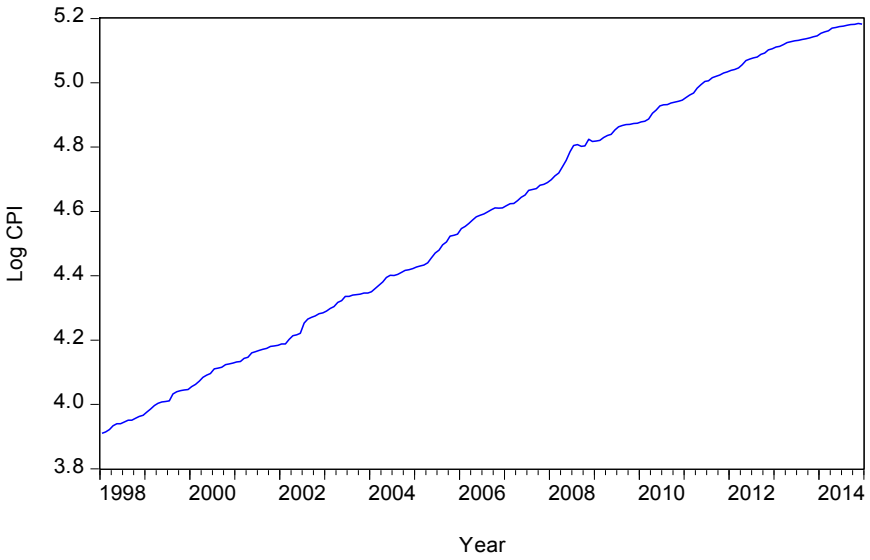
Table 5.11 Research hypothesis

Null Hypothesis	Alternative Hypothesis
Log NEER does not cause Log CPI	Log NEER causes Log CPI
Log IMP does not cause Log CPI	Log IMP causes Log CPI
Log NEER does not cause Log IMP	Log NEER causes Log IMP
Log CPI does not cause NEER	Log CPI does not cause IMP
Log CPI does not cause Log NEER	Log CPI causes Log NEER
Log CPI* does not cause Log CPI	Log CPI* causes Log CPI

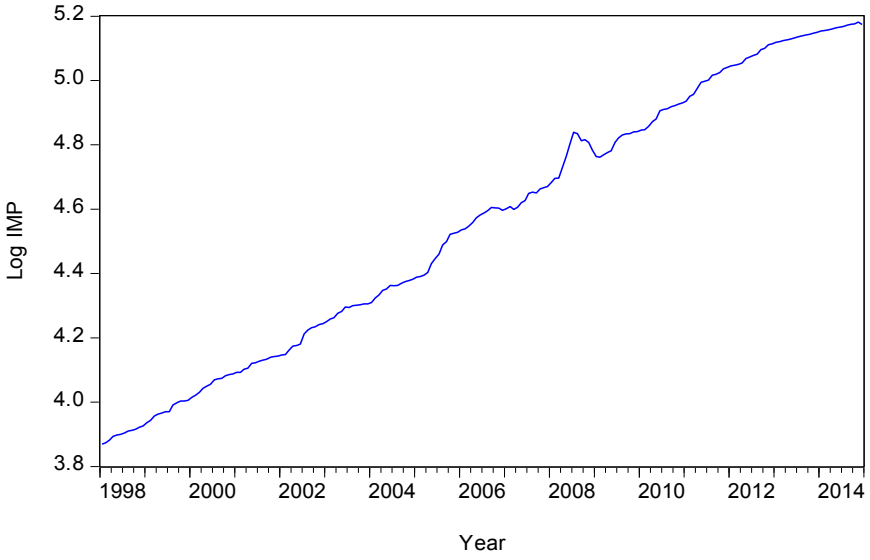
5.3.3 Unit root test

The variables used in equation are tested for the presence of unit roots because macroeconomic time series data has been shown to contain properties of non stationarity. The variables will be examined graphically. The formal tests used to carry out unit root analysis of the time series data are the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP). The results of the formal tests are presented in table 5.12; figure 5.3 presents the graphical illustration of the variables.

Figure 5.5 Graphical presentation of variables

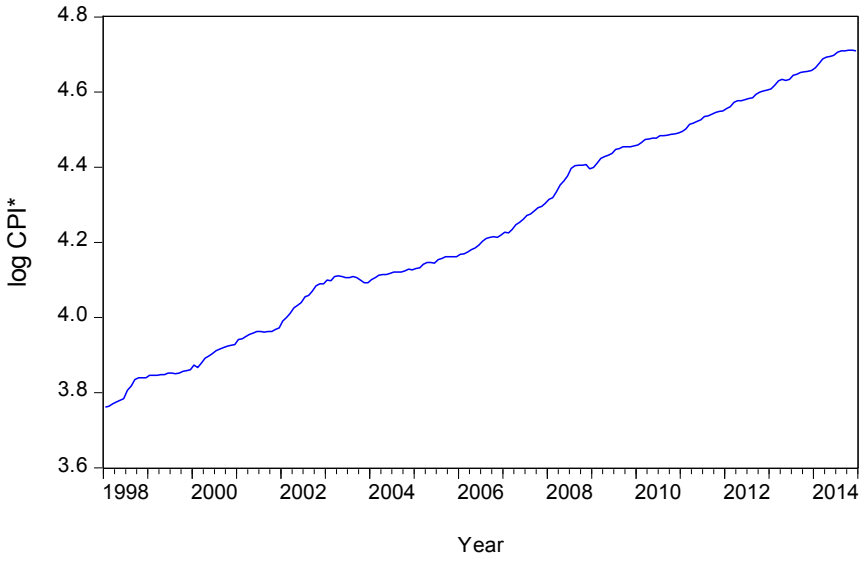


Source: (Bank of Botswana data, 2006)



Source: (Bank of Botswana data, 2006)

Source: (Bank of Botswana data, 2006)



Source: (Statistics South Africa data, 2015)

Table 5.12 ADF and PP test

Variable	**Specification**	**ADF Test**		**PP test**		**Decision**
		Level	1st difference	Level	1st difference	
Log CPI	Intercept	-1.235587	-10.6497***	-1.16097	-10.7378***	I(1)
	Trend and	-0.764982	-10.7247***	-0.77980	-10.7622***	I(1)

	intercept					
	None	7.800239	-3.269846***	12.2596	-6.21703***	I(1)
Log IMP	Intercept	-0.906844	-9.155107***	-0.82278	-9.13730***	I(1)
	Trend and intercept	-2.341334	-9.172331***	-2.13905	-9.15614***	I(1)
	None	5.481918	-5.013538***	7.81914	-6.94349***	I(1)
Log NEER	Intercept	-0.690351	-12.11159***	-0.734158	-12.1506***	I(1)
	Trend and intercept	-1.188700	12.08892	-1.246317	-12.1278***	I(1)
	None	-2.54681**		-2.19488**		I(0)
Log CPI*	Intercept	-0.547550	-9.972524***	-0.430204	-10.19500***	I(1)
	Trend and intercept	-2.095165	-9.955162***	-2.186105	-10.17937***	I(1)
	None	6.685986	-3.600093***	8.891510	-7.195664***	I(1)

***, **, * denotes significance at 1%, 5% and 10% respectively.

Source: (Bank of Botswana data, 2006; Statistics South Africa data, 2015).

Table 5.12 shows that all the variables are integrated of order 1, which means they become stationary after being differenced once. Log NEER is found to be stationary without an intercept and trend. Therefore to run the VAR model, the other variables being – log CPI, log IMP log CPI* – will be differenced.

5.3.4 Cointegration analysis

The results of the cointegration test to determine whether the variables in equation 4.4 have a long-run equilibrium relationship are reported below. The Johansen (1991) and (1995) cointegration rank (Trace value and maximum eigenvalue) tests are conducted to find out if there is cointegration amongst the variables and also the number of cointegrating equations in the data set. The test results are shown in table 5.13.

Table 5.13 Johansen cointegration rank test with optimal lag length 5

(i) Trace test

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob. **
None *	0.235710	113.2383	47.85613	0.0000
At most 1*	0.183687	60.28303	29.7907	0.0000
At most 2*	0.096190	20.30052	15.49471	0.0087
At most	0.001910	0.376596	3.841466	0.5394

Trace test indicates 3 cointegrating equations at 5% level

(ii) Maximum Eigenvalue

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob. **
None *	0.235710	52.95525	27.58434	0.0000
At most 1*	0.183687	39.98251	21.13162	0.0000
At most 2*	0.096190	19.92392	14.26460	0.0057
At most 3*	0.001910	0.376596	3.841466	0.5394

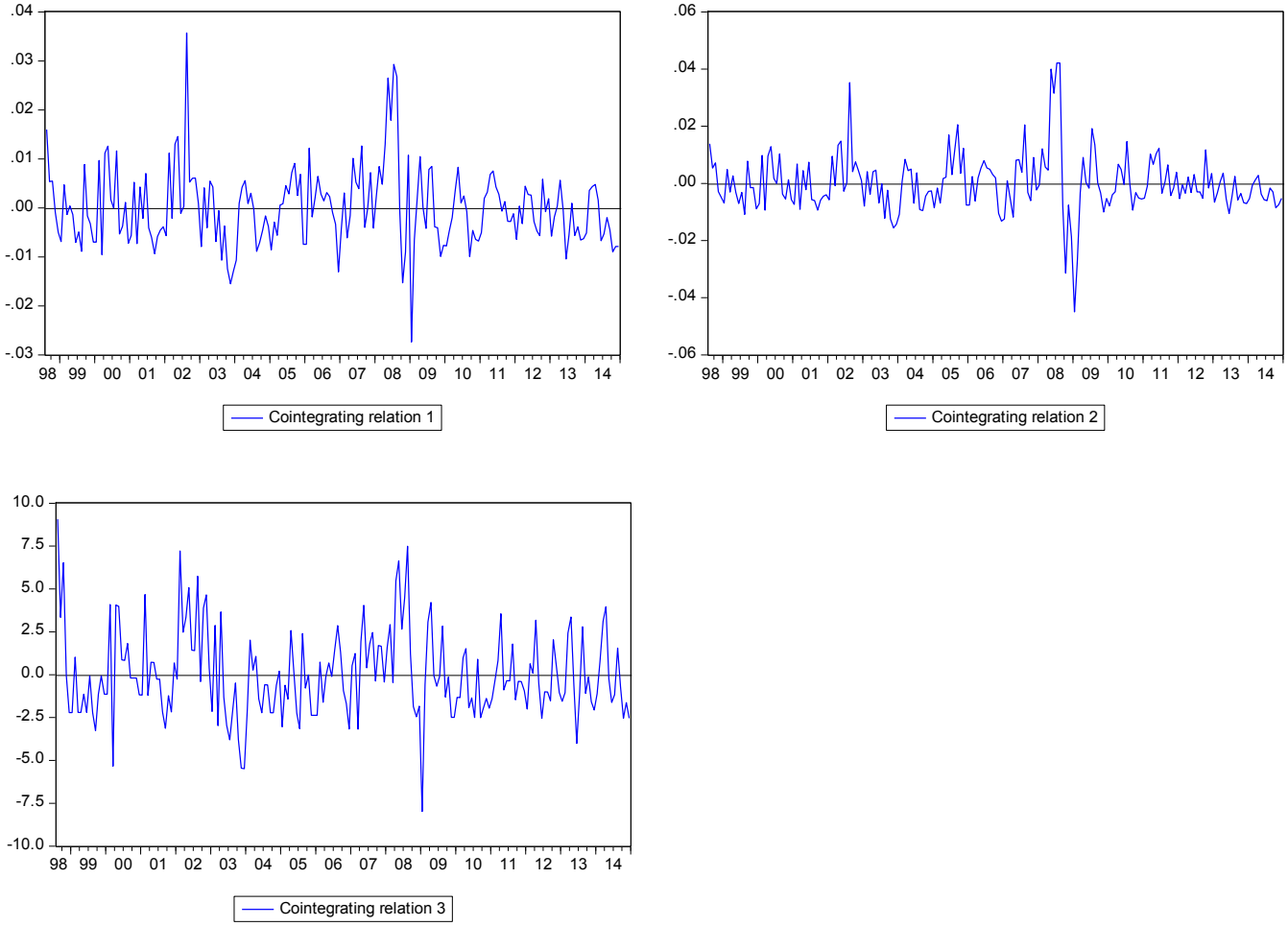
Max-eigenvalue test indicates 3 cointegrating equation at the 5% level

* denotes rejection of the hypothesis at the 5% level

Source: (Bank of Botswana data, 2006)

The cointegration results presented in table 5.13 indicate that the variables are cointegrated at the 5 per cent level of significance. The trace statistics suggests that there are three cointegrating equations while the maximum eigenvalue statistics also suggests that are three cointegrating equations in the data set at the 5% significance level. This means that there is a long run relationship between the variables, log CPI, log IMP, log CPI* and log NEER. Figure 6 gives an illustration of the cointegrating relationship.

Figure 5.6 Cointegrating graphs



Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

5.3.5 Long-run Dynamics

The Johansen cointegration procedure presented in table 13 shows that there is a long run relationship among the variables included in the VAR model. This section reports the results of the estimated cointegrating ERPT equation of Botswana. The normalized cointegrating coefficients are presented in table 14 below.

Table 5.14 Normalized Cointegrating Coefficient

	D(log CPI)	D(log IMP)	log NEER	D(log CPI*)
Cointegrating equation 1	1.0000	-0.686531 (0.06494)	0.001252 (0.00155)	-0.331933 (0.09495)
Cointegrating equation 2	1.0000	0.0000	-0.002588 (0.00234)	-0.370144 (-0.13293)
	0.0000	1.0000	-0.001946 (0.00390)	-0.055658 (0.22153)
Cointegrating equation 3	1.000000	0.00000	0.00000	0.927548 (0.31143)
	0.00000	1.00000	0.00000	0.920097 (0.33409)
	0.00000	0.00000	1.00000	501.3613 (106.826)

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

The estimated long run equation when normalized by the coefficient of CPI can be written as follows:

$$D(\log CPI) = 0.00562 - 0.6865\, D(\log IMP) + 0.0013 \log NEER - 0.3319 D(\log CPI^*) \qquad (5.2)$$

$$[-10.63]^{***} \qquad [-0.81] \qquad [-3.51]^{***}$$

The values in parenthesis are the t-statistics of the estimated coefficients while *** denotes significance at 1% level. Equation 5.4 represents the estimated long run relationship between CPI, IMP, NEER and CPI*. The estimated equation indicates that NEER is not significant in either cointegrating equations. The estimated long-run coefficient of IMP is negative and significant, indicating that there is a negative relationship between imported tradeables index and consumer price index. The coefficient of CPI* is also negative and significant, indicating that there is a negative relationship between South African consumer index and Botswana consumer price index The results from table 14 indicate that long run pass-through is very low.

5.3.6 Short-run Dynamics

Having established the long run cointegrating coefficients of ERPT in Botswana, the next step is to develop a short run model so as to study the short run dynamics of these variables. This is done by estimating a VECM which provides the analysis of the adjustment process in the short

run towards long run equilibrium. In estimating the VECM, the number of cointegrating vectors and the optimal lag length used in the Johansen cointegrating procedure are also used. The results of the VECM are presented table 5.15 below:

Table 5.15 VECM results

Error Correction	D(CPI,2)	D(IMP,2)	D(NEER)	D(CPI*,2)
CointEq1	-1.211963 (0.24675) [-4.91171]	-0.458227 (0.35668) [-1.28469]	0.259338 (0.51308) [0.48915)	0.104745 (0.23507) [0.44559]
CointEq2	0.251587 (0.15133) [1.66254]	-0.550014 (0.21875) [-2.51439]	-0.259308 (0.32515) [-0.79751]	-0.117596 (0.14416) [-0.81571]
CointEq3	0.002385 (0.00047) [5.10053]	0.002279 (0.00068) [3.37232]	0.000864 (0.00100) [0.85994]	-0.000966 (0.00045) [-2.16839]

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

There are three cointegrating equation and therefore three VECMs. In the estimated VECMs it is important to note the signs and magnitude of the error correction terms as they measure the speed of adjustment to long run equilibrium. The estimated error correction term in the first VECM is correct and negative sign with respect to D(CPI,2) and D(IMP), but the values of the term for D(CPI,2) lies outside the range of 0 and -1. This means that a shock in the variables included in the model will result in the value of CPI overshooting equilibrium until it eventually returns to equilibrium.

In the second VECM (CointEq2) the error correction terms are well defined because the estimated terms for D(IMP,2), D(NEER) and D(CPI*) however, only the term for D(IMP,2) is significant. The estimated error term for D(CPI) lies outside 0 to 1 range.

The third VECM (CointEq3) shows that only the error correction term for D(CPI*) is correctly specified as it has a negative sign and lies within the range of 0 and -1. It also found to be statistically significant.

5.3.7 VEC Granger Causality/Block Exogeneity Wald Tests

The test for combined short run causality analysis is conducted by running a granger causality/block exogeneity Wald test. Table 5.16 presents the causality linkages for log CPI, log IMP, log NEER and log CPI*. The null hypotheses are rejected on the bases of Chi-square and p-value of Wald test. The criterion for rejection of the null hypothesis is a p-value should be less than the level of significance i.e. 5%.

Table 5.16 VEC Granger Causality/Block Exogeneity Wald Test Results

Null hypothesis	Restrictions	p-value
Log IMP does not cause Log CPI	C(9)=C(10)=C(11)=C(12)=C(13)=0	0.0150
Log CPI* does not cause Log CPI	C(19)=C(20)=C(21)=C(22)=C(23)=0	0.000
Log NEER does not cause log IMP	C(38)=C(39)=C(40)=C(41)=C(42)=0	0.0318
Log CPI* does not cause log IMP	C(43)=C(44)=C(45)=C(46)=C(47)=0	0.0036

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

The causality analysis identifies the direction of linkage among the concerned variables. Based on the results presented in table 5.16 it would seem that log IMP and log CPI* granger cause log CPI. Log NEER and log CPI* granger cause log IMP. In all other hypothesis tests the null cannot be rejected which means there is failure to establish causality of log NEER and log CPI. This may indicate that in the short-run changes in nominal exchange rates has effect on the imported tradeables prices, but not on domestic consumer prices. The South African consumer prices are shown to have an effect on Botswana consumer prices and imported tradeables.

5.3.8 Diagnostic Check

Table 5.17 below shows three parameters which are that are used to test the strength, efficiency and correctness of a model. These tests will be applied to the VECMs of CPI. The model has low explanatory power indicated by the low R2. The estimated VECM is technically correct because the R2 is less than the D.W. and the value of the D.W. is close to 2. The F-statistic is significant. This check indicates that the VECM for CPI is technically correct. The next step is to test if the

residual are unbiased and may not lead to spurious results. This will be the tests to determine if the residuals are not serially correlated and whether there is a presence of heteroskedasticity.

Table 5.17 Estimated model results

Parameters	**CPI VECM**	**IMP VECM**
R-square	0.525914	0.490422
D. W	1.956046	1.941617
F - Statistics	8.344028	7.238990
Probability	0.000000	0.000000

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

The results presented in table 5.17 suggest that the residuals are no serially correlated and are homoscedastic. However the results indicate that the residuals in both VECMs are not normally distributed as the test for normality fails to reject the null hypothesis of non-normal distributed residuals.

Table 5.18 Diagnostic tests for CPI VECM

Diagnostic test	p-value	Decision
Breusch-Godfrey Serial Correlation LM test	0.6595	No serial correlation
Heteroskedasticity ARCH test	0.6404	No heteroskedasticity
Normality – Jarque-Bera test	0.0000**	Non-normal

** denotes rejection of null hypothesis at 5 per cent level of significance

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

Table 5.19 Diagnostic tests for IMP VECM

Diagnostic test	p-value	Decision
Breusch-Godfrey Serial Correlation LM test	0.2249	No serial correlation
Heteroskedasticity ARCH test	0.4907	No heteroskedasticity
Normality – Jarque-Bera test	0.0000**	Non-normal

Source: (Bank of Botswana data, 2006 and Statistics South Africa data, 2015)

5.3.9 Summary

The objective of this section is to investigate whether long run equilibrium exists between the nominal effective exchange rate and consumer price index in Botswana. The results of the long run indicate that NEER does not have a statistically significant relationship with either CPI. The Wald test reveals that NEER causes imported price, South African CPI causes Botswana CPI and the imported prices observed in Botswana. The imported price index is also found to granger cause Botswana CPI.

The VECMs for CPI and IMP are found to have weak explanatory power but are otherwise technically correct. The residuals are found to be homoscedastic and not serially correlated. However both models fail the normality test.

5.4 Conclusion

The primary objectives of this chapter were 1) carry out an empirical assessment of the long- and short-run relationships of the export demand equation for Botswana as outlined in chapter 4, and 2) assess the ERPT in Botswana using the equation developed in chapter 4.

The second section of this chapter focused on the export equation whereby NME is defined as a function of REER, world GDP and the exchange rate policy. A dummy was added to the function so as to account for the structural break due to the global economic recession. The Johansen cointegration test results show that NME, REER, world GDP, exchange rate policy are cointegrated. The estimated cointegrating equation indicates that Botswana's NME have a negative long run relationship with REER, world GDP and the crawling peg. These findings

suggest that a decrease in the REER of the Pula can increase the non-mining export in the long run.

A VECM was estimated so that the short run dynamics could be incorporated with the long-run dynamics in order to determine the speed of adjustment to long-run equilibrium. The error correction term that measures the speed of adjustment for NME was estimated with the correct sign and found to be significant. Only the error terms for NME, REER and Dummy 1 were well specified as their t-statistics were found to be significant.

The short run elasticities of the explanatory variables were estimated using the OLS method where the difference of NME was regressed as a function of the lagged first difference and lagged second difference of the explanatory variables. The Wald test show that only REER is significant in explaining NME in the short run, with an estimated negative relationship. The impulse response functions reveal shocks to REER are initially negative and correct after the second period and continue to be positive long after. The shocks to world GDP are positive and remain positive without any indication of converging to zero. The results of the variance decomposition show that fluctuations in REER explain a small proportion of the forecast error variance of the NME over time when compared to the other variables in the model.

The results indicate that there is a long-run negative relationship between REER of the Pula and Botswana's NME. This leads to the conclusion that depreciation in the Pula will over time lead to an improvement in the non-mining export sector's competitiveness.

The third section of this chapter focused on the ERPT equation where CPI is defined as a function of IMP, NEER and CPI*. The Johansen cointegration test results show that CPI, IMP, NEER and CPI* are cointegrated. The estimated cointegrating equations indicate that Botswana's CPI has a negative long-run relationship with imported tradeables. These findings suggest that a decrease in the imported tradeables prices can increase the consumer prices in the long-run. The relationship that the nominal exchange rates has with either imported tradeables prices and CPI are not statistically significant, this suggests that in the long run nominal exchange rate changes do not have an effect on consumer prices and imported tradeables prices.

An assessment of the error correction terms show that in the first cointegrating equation, the error term for CPI is statistically significant with the correct sign; however it is greater than 1. This means that a shock in the variables included in the model will result in the value of CPI overshooting equilibrium until it eventually returns to equilibrium. In the second cointegrating equation only the error term for IMP is statistically significant with the correct sign and in the range of 0 to 1.

The results indicate that in the long run, imported tradeables prices have a negative relationship with consumer prices and that nominal effective exchange rate only affect imported tradeables in the short run, but do not have an effect on CPI. South African CPI and the imported tradeables index have significant effect on Botswana CPI.

Overall, the results indicate that real devaluation of the Pula will have a positive impact on the non-mining sector exports over the long run period; this devaluation if it is achieved through nominal devaluation will have short term inflationary effect on prices of imported goods. The next chapter highlights the major findings of this dissertation and discusses the policy implications of these findings. Policy recommendations are made and areas for further research are also suggested.

Chapter 6: Conclusion and policy recommendations

6.1 Introduction

The purpose of this dissertation was to investigate whether a long-run relationship between the pula REER and Botswana NME exists, with a view to understand whether REER devaluation can improve Botswana's NME competitiveness. In particular, the study focused on the effect of exchange rate devaluation on the performance of Botswana's NME. The dissertation also examined the short-run effects of this relationship. The dissertation also examined the relationship that the nominal effective exchange rate of the pula has with consumer prices and those of imported tradables. Devaluation has been used as a means of improving Botswana's non-mining exporting industries' competitiveness. The Bank of Botswana has over time devalued the pula to maintain the competitiveness of the NME. The effect these devaluations have had on improving the NME industries has not been studied. Furthermore the effect these devaluations have had on consumer prices has also not been examined adequately. Therefore this dissertation also examined first stage ERPT using the VAR approach.

Similar studies that seek to establish the relationship between exchange rate devaluation and exports have used either aggregated data or disaggregated data. The use of disaggregated data is motivated by the argument that the use of aggregated data fails to take into account that elasticity of demand may vary across sectors and exports. Use of aggregated data does not take into account the differing characteristics of exporting sectors, as some sectors may rely significantly on imported inputs, which may alter the competitiveness of products and services of these sectors in comparison with sectors which have a minimal imported input. It was also shown in chapter 2 that the response to devaluation of service industries to devaluation is different from that of goods industries. This dissertation uses non-mining aggregated data because the exchange rate policy in Botswana uses REER devaluation as a means for maintaining competitiveness on NME.

Economic theory provided in chapter 2 states that the performance of exports is determined by various economic variables, which can be classified mainly as either supply or demand factors. There are also other factors that have an influence on trade patterns, like trade policies and

exchange rate regimes. Theories on the effect of currency devaluation conclude that devaluation should improve export demand. This is supported by the Marshall-Lerner condition and the J-curve phenomenon. These theories do not, however, distinguish the effects of such currency devaluation between a large economy and a small economy. Furthermore, empirical studies on the effects of devaluation on exports and the trade balance have yielded inconclusive results. There are studies that find that devaluation improves export competitiveness, while there are those that find that devaluation leads to a decline in export competitiveness.

The dissertation employs the Johansen (1991) and (1995) procedure of maximum likelihood approach to investigate the presence of cointegrating relationship with variables in the export demand function for Botswana and also on the ERPT function. A short run model in the form of a VECM is used to examine the short-run adjustment behaviour of the variables. The study on the effect of devaluation on NME covers a period from 1981 to 2013 using annual data.

The dissertation contributes to existing literature by examining the relationship that Botswana's NME has with exchange rates and world GDP. The dissertation also examined the effects the nominal exchange rate change has on prices in the domestic economy. This part of the study uses monthly data from January 1998 to December 2014.

6.2 Conclusion

The initial findings show that REER has a long run relationship negative with NME, which means REER devaluation causes an increase in NME. These findings validate policy action taken by the Bank of Botswana in that devaluation of the pula leads to an improvement in non-mining export output. Impulse response functions and variance decomposition analysis indicate that the effect of REER on NME is weak. This shows that the use of REER to raise NME competitiveness is not very effective and that Botswana needs to find other ways of raising NME competitiveness.

World GDP is found to have a negative long run relationship with NME; this means that an increase in World income reduces Botswana's NME. As World income increases the demand for Botswana's NME declines. This finding does not fit the expectations, as it was expected that an increase in world income, proxied by world GDP, would increase the quantity demanded for

Botswana's NME holding all else constant. The negative long-run relationship found between Botswana's NME and World GDP suggests that Botswana's NME are inferior goods. Besanko and Braeutigam (2015) and Baumol and Blinder (2006) define an inferior good as a commodity whose quantity demanded falls when the purchaser's real income rises, all things remaining constant. Baumol and Blinder (2006) add that this phenomenon often occurs when consumers buy these goods and services only because they cannot afford anything better.

The estimated coefficient for Dummy 1, which represents the introduction of a crawling peg, has a negative long-run relationship with NME. This means that the introduction has resulted in a decline in NME. That is, NME are lower in the period after the introduction of the crawling peg when compared to be period before. This implies that the introduction of the crawling peg mechanism has adversely affected the NME sector. A change in exchange rate regime from a fixed exchange rates to a crawling peg introduced some level of exchange rate uncertainty, which has been pointed out that exchange rate risk has an adverse effect of international flows. Smith (2007) supports the view that exchange rate volatility depresses international trade particularly when traders are risk averse. Therefore exporters in Botswana's non-mining sectors chose to reduce their exposure to exchange rate volatility by exporting less after the adoption of the crawling peg.

Another reason the introduction of crawling peg caused a decline in NME is that the NME have a significant input of imported goods. Abeysinghe and Yeok (1998) notes that devaluation is detrimental to exports if export production significantly depends on imported inputs. Edward and Garlick (2008) are of the view that devaluation may impair export competitiveness due to the inflationary impact of a nominal depreciation. Rising costs erode the improved profitability of export supply or restrict the firm's ability to lower their foreign currency export prices, thus reducing exports. Motlaleng (2009) found that since the adoption of the crawling peg, the Pula has persistently depreciated against other currencies. Botswana's NME depends significantly on imported inputs; therefore the persistent depreciation of the Pula since the introduction of the crawling peg has driven costs higher for exporters, thereby reducing profit margins and their ability to compete. It was shown in chapter 3 that Botswana is highly dependent on imports for many consumer goods, and also that imports are a significant proportion of GDP.

The estimated coefficient for Dummy 2, which represents the period after the global economic recession of 2009, has a positive relationship with Botswana's NME. This suggests that the conclusion reached earlier that Botswana's NME are inferior is probably correct. A recession reduces disposable income. Hence if a decline in incomes leads to an increase in demand for a good it holds then that such a good would experience a decline in demand when income rises. Such a good as noted is defined as an inferior good. This means that Botswana's NME will not benefit from a global economic boom.

Analysis of the short-run establishes the presence of a causal relationship only between REER and NME. However, analysis of impulse response functions and variance decomposition indicate that REER accounts for an insignificant amount of shocks to NME. This leads to the conclusion that REER has a weak influence on NME.

The findings further confirm the presence of a long-run equilibrium relationship between NEER and imported tradeables prices. This leads to the conclusion that in the short run nominal exchange rate changes causes changes to imported tradeables prices. Therefore in the short run shocks to the nominal exchange rate have an effect on the prices of imported goods.

In conclusion, results imply that devaluation of NEER have no long-term effects to prices, does not have led to significant changes in demand for NME. This devaluation rather erodes the competitiveness of non-mining sector that uses a significant amount of imported goods in its products.

6.3 Limitation of the study

This study assessed the effect of exchange rate on non-mining merchandise exports and also on consumer prices and imported tradable prices. The dissertation does not include tourism and other service related exports due to lack of data. Therefore there is need to view the results of this study only relevant to non-mining merchandise export sectors.

6.4 Recommendations

The results indicate that there is need for a cost benefit analysis of currency devaluation in Botswana. The costs of currency devaluation should be balanced with the associated benefits,

because the study shows that indeed in the long run REER devaluation improves NME. However, in the short run this devaluation is inflationary. Additionally the improvement of NME as a result of devaluation a minimal and therefore devaluation is not a suitable tool to improving export competitiveness in Botswana's non-mining sector.

It is concluded that Botswana's NME falls into a category of goods that can be classified as inferior goods. This means that as world income increases the demand for Botswana's NME will continue to decline. To address this situation requires that Botswana addresses the perceived quality of its NME. Chapters 1 and 3 noted that Botswana has not given priority to building capacity in the non-mining sectors due to the spectacular growth of the mining sector. Botswana is still a primary commodity based economy and will therefore need to give emphasis on value addition of non-mining products. Studies show that manufacturing sector products have a positive relationship with world income. This means that Botswana will have to develop manufacturing sectors around the existing non-mining industries. To address this Botswana needs to diversify NME to be high value-added products will use the current exports as raw material. This form of diversification will require upgrading of labour skills, productivity and technology.

Based on these results, the Government of Botswana should focus on implementing economic diversification and find other means of improving NME industries with minimal use of devaluation. Devaluation does not serve Botswana's non-mining industry well because it raises costs as Botswana is an import dependent country. Devaluation acts as a barrier to entry to new firms due to its input cost raising effect. To build capacity in the non-mining exporting sectors, government of Botswana should either find incentives to bring down barriers of entry through subsidies on capital goods.

Chapter 3 noted that countries that have export-led economies achieved this through concerted government programmes that built capacity and raised productivity. Botswana can benefit from a programme that would build in ability to supply exports by enhancing the productivity and competitiveness of the non-mining export sectors.

Bank of Botswana (2007:130) admits that REER devaluation may not yield long-lasting effects on the real economy. It further states that in the long run, competitiveness will be achieved by

improvements in factors that affect productivity. This means that in order for Botswana to diversify and improve export demand it will have to improve productivity of the non-mining export industries.

6.5 Areas of further study

Further research could extend this study by including more variables such as terms of trade, income of trading partners and Botswana's output. Another study can investigate the supply side equation of Botswana's non-mining export industries to examine the critical factors that determine the sector's ability to produce competitive products.

This study used aggregated data. It has been noted that the use of aggregated data fails to take into account that elasticity to demand may vary across sectors and exports. Therefore a study that uses disaggregated data could provide more information on the various sectors, which means that a study of the export demand function could be carried out of each product separately.

Another study could look into the services sectors in Botswana as this dissertation does not account for service exports. Chapter 3 showed that tourism, which is classified as "Trade, hotels and restaurants", is the second largest contributor to GDP after mining in Botswana. A more comprehensive study would take into account the effect of devaluation on the total welfare of Batswana.

List of References

Abeysinghe, T. and Yeok, T.L. (1998). Exchange Rate Appreciation and Export Competitiveness: The Case of Singapore. *Applied Economics*, Vol 30, No 1, pp51-55. Available online: http://dx.doi.org/10.1080/000368498326137 [Accessed 11 March 2015].

Agung, I.G.N. (2009). *Time Series Data Analysis Using EViews*. Singapore: John Wiley & Sons (Asia).

Ahmad, E. and Ali, S.A. (1999). Relationship between Exchange Rate and Inflation. *Pakistan Economic and Social Review,* Vol 37, No 2, pp139-154. Available online: http://www.jstor.org/stable/25825193 [Accessed 17 April 2015].

Ahtalia, P. (1983). A note on the J-curve. *The Scandinavian Journal of Economics*, Vol 85, No 4, pp541-542. Available online: http://www.jstor.org/stable/3439951 [Accessed: 10 April 2015].

Alam, R. (2010). The Link between Real Exchange Rate and Export Earning: A Cointegration and Granger Causality Analysis on Bangladesh. *International Review of Business Research Papers,* Vol 6, No 1, pp205-214.

Appleyard, D. R. and Field, JR. A. J. (2004). *International Economics*. 4th Edition. New York: McGraw-Hill.

Aron, J., Farrell, G., Muellbauer, J. and Sinclair, P. (2012). *Exchange Rate Pass-through to Import Prices, and Monetary Policy in South Africa*. South African Reserve Bank Working Paper WP/12/08.

Atta, J.K., Jefferis, K.R., Mannathoko, I. and Siwawa-Ndai, P. (1999). *Exchange Rate Policy and Price Determination in Botswana*. African Economic Consortium, AERC Research Paper 93 Available online: http://dspace.africaportal.org/jspui/bitstream/123456789/32133/1/RP93.pdf?1 [Accessed 15 April 2015].

Ayen, Y.W. (2014). The effect of currency devaluation on output: The case of the Ethiopian economy. *Journal of Economics and International Finance*, Vol 6, No 5, pp103-111.

Bahmani, M., Harvey, H. and Hegerty, S.W. (2013). Empirical tests of the Marshall-Lerner condition: a literature review. *Journal of Economic Studies*, Vol 40, N0 3, pp411-443. Available online: http://dx.doi.org/10.1108/01443581311283989 [Accessed 11 March 2015].

Bahmani-Oskooee, M. (1985). Devaluation and the J-Curve: Some Evidence from LDCs. *The Review of Economics and Statistics*, Vol 67, No 3, pp500-504. Available online: http://www.jstor.org/stable/1925980 [Accessed 10 April 2015].

Bahmani-Oskooee, M. and Alse, J. (1994). Short-Run versus Long-Run Effects of Devaluation: Error-Correction Modelling and Cointegration. *Eastern Economic Journal*, Vol 20, No 4, pp453-464. Available on http://www.jstor.org/stable/40325598 [Accessed on: 10 April 2015].

Bahmani-Oskooee, M. and Gelan, A. (2012). Is there J-Curve effect in Africa? *International Review of Applied Economics*, Vol 26, No 1, pp73-81. Available online: http://dx.doi.org/10.1080/02692171.2011.619972 [Accessed on: 10 April 2015].

Bahmani-Oskooee, M. and Gelan, A. (2013). Are Devaluations Contractionary in Africa? *Global Economic Review,* Vol 42, No 1, pp1-14. Available online http://dx.doi.org/10.1080/1226508X.2013.769798 [Accessed on: 10 April 2015].

Bahmani-Oskooee, M. and Hegerty, S.W. (2010). The J- and S-curves: a survey of the recent literature. *Journal of Economic Studies*, Vol 37, No 6, pp580-596. Available online: http://dx.doi.org/10.1108/01443581011086639 [Accessed on: 10 April 2015].

Bahmani-Oskooee, M. and Ratha, A. (2004). The J-Curve: A literature review. *Applied Economics*, Vol 36, No 13, pp1377-1398. Available online: http://dx.doi.org/10.1080/0003684042000201794 [Accessed on: 30 March 2015].

Banerjee, A., Dolado, J., Galbraith, J.W. and Hendry, D.F. (1993) *Co-integration, Error Correction, and the Econometric Analysis of Non-stationary Data*. Oxford, Oxford University Press.

Bank of Botswana (1990). *Annual Report 1990*. Gaborone, Botswana.

Bank of Botswana (1994). *Annual Report 1994*. Gaborone, Botswana.

Bank of Botswana (1996). *Annual Report 1996*. Gaborone, Botswana.

Bank of Botswana (1998). *Annual Report 1998*. Gaborone, Botswana.

Bank of Botswana (2000). *Annual Report 2000*. Gaborone, Botswana.

Bank of Botswana (2002). *Annual Report 2002*. Gaborone, Botswana.

Bank of Botswana (2004). *Annual Report 2004*. Gaborone, Botswana.

Bank of Botswana (2005). *Annual Report 2005*. Gaborone, Botswana.

Bank of Botswana (2006). *Annual Report 2006*. Gaborone, Botswana.

Bank of Botswana (2007). *Annual Report 2007*. Gaborone, Botswana.

Bank of Botswana (2008). *Annual Report 2008*. Gaborone, Botswana.

Bank of Botswana (2009). *Annual Report 2009*. Gaborone, Botswana.

Bank of Botswana (2010). *Annual Report 2010*. Gaborone, Botswana.

Bank of Botswana (2011). *Annual Report 2011*. Gaborone, Botswana.

Bank of Botswana (2012). *Annual Report 2012*. Gaborone, Botswana.

Bank of Botswana (2013). *Annual Report 2013*. Gaborone, Botswana.

Bank of Botswana (2014). *Annual Report 2014*. Gaborone, Botswana.

Baumol, W.J. and Blinder, A.S. (2006). *Microeconomics: Principles and Policy*. Singapore: Thomson South-Western.

Besanko, D., Braeutigam, R. and Rockett, K. (2015). *Microeconomics*. 5th Edition. Singapore: John Wiley & Sons.

Bhagwat, A. and Onitsuka, Y. (1974). Export-Import Responses to Devaluation: Experience of the Nonindustrial Countries in the 1960s. *Staff Papers - International Monetary Fund*, Vol 21,

No 2, pp414-462. Available online: http://www.jstor.org/stable/3866471 [Accessed on 10 April 2015].

Brooks, C. (2008). *Introductory Econometrics for Finance*. 2nd edition. New York: Cambridge University Press.

Campa, J.M. and Goldberg, L.S. (2005). Exchange Rate Pass-through into Import Prices. *The Review of Economics and Statistics*, Vol 87, No 4, pp679-690. Available online: http://www.jstor.org/stable/40042885 [Accessed 17 April 2015].

Cassel, G. (1918). Abnormal Deviations in International Exchanges. *Economic Journal*, Vol 28, pp413–415. Available on: http://www.jstor.org/stable/2223329 [Accessed on 09 March 2015].

Choudhury, R. Z. (2001). Export Demand Function of Bangladesh: An Econometric Exercise. *The Bangladesh Development Studies,* Vol 27, No 3, pp. 67-90. Available online: http://www.jstor.org/stable/40795636 [Accessed 14 August 2015].

Claassen, E. (1996). *Global Monetary Economics*. Oxford: Oxford University Press.

Copeland, L. S. (1989). *Exchange Rates and International Finance*. Reading, Massachusetts: Addison-Wesley.

Corden, W. M. (1994). *Economic Policy, Exchange Rates and the International System*. Oxford: Oxford University Press.

Daniels, J. P. and VanHoose, D. (2002). *International Monetary and Financial Economics.* 2nd edition. Cincinnati, Ohio: South-Western College Publishing.

Darvas, Z., (2001). *Exchange Rate Pass-Through and Real Exchange Rate in EU Candidate Countries*. National Bank of Hungary. Discussion paper 10/01. Economic Research Centre of the Deutsche Bundesbank. Available online: http://opus.zbw-kiel.de/volltexte/2006/4156/pdf/200110dkp.pdf [Accessed 15 April 2015].

De Grauwe, P. (1983). *Macroeconomic theory for the open economy.* Gower publishing company limited, England.

Diaz Alejandro, C. F. (1963). A Note on the Impact of Devaluation and the Redistributive Effect. *Journal of Political Economy*, Volume 71, Number 6, pp. 577-580. Available online: http://www.jstor.org/stable/1828441 [Accessed: 30 March 2015].

Edwards, L. and Golub, S. (2006). South Africa's International Cost Competitiveness in Manufacturing. *World Development*, Vol 32, N0 8, pp473-500.

Edwards, L. J. and Garlick, R. (2008). *Trade Flows and the Exchange rate in South Africa*. University of Cape Town, 2008. Available on: http://mpra.ub.uni-muenchen.de/36666/ [Accessed 11 March 2015].

Eicher, T. S., Mutti, J. H. and Turnovsky, M. H. (2009). *International Economics*. 7th Edition. New York, USA and London, UK. Routledge.

Eita, J. H. (2013). Estimation of the Marshall-Lerner Condition for Namibia. *International Business & Economics Research Journal*, Vol 12, No 5.

Engle, R.F. and Granger, C.W.J. (1987). Co-Integration and Error Correction: Representation, Estimation and Testing. *Econometrica*, Vol 55, No 2, pp251-276. Available online: http://www.jstor.org/stable/1913236 [Accessed 25 June 2015].

Fang, W., Lai, Y. and Miller, S.M. (2006). Export Promotion through Exchange Rate Changes: Exchange Rate Depreciation or Stabilization? *Southern Economic Journal*, Vol 72, No 3, pp611-626. Available online: http://www.jstor.org/stable/20111836 [Accessed 22 April 2015].

Fang, W., Lai, Y. and Miller, S.M. (2009). Does exchange rate risk affect exports asymmetrically? Asian evidence. *Journal of International Money and Finance,* Vol 28, pp215–239.

Fibæk, M. (2010). *Botswana's modern economic history since 1966. Has Botswana reached the last stage of Modern Growth Regime*? University of Copenhagen. Available online: http://www.econ.ku.dk/okojwe/filer/UGT%20Seminar%202010/Maria_Fibaek%20The%20modern%20economic%20history%20of%20Botswana].pdf [10 April 2015]

Fleming, J.M. (1962). Domestic Financial Policies under Fixed and under Floating Exchange Rates. *Staff papers (International Monetary Fund)*, Vol 3, No 3, pp369-380. Available online: http://www.jstor.org/stable/3866091 [Accessed 02 October 2015].

Frank Jr., C.R., Kim, K.S. and Westphal, L.E. (1975). Foreign Trade Regimes and Economic Development: South Korea. National Bureau of Economic Research. Available online: http://www.nber.org/books/fran75-1 [Accessed 19 November 2015]

Freund, C. and Pierola, M. D. (2008). *Export Surges: The Power of a Competitive Currency*. The World Bank Development Research Group & Poverty Reduction and Economic Management Network. Policy Research Working Paper 4750.

Galebotswe, O. and Andrias, T. (2011). Are Devaluations Contractionary in Small Import-dependent Economies? Evidence from Botswana. *Botswana Journal of Economics*, Vol 8, No 12, pp86-98.

Grynberg, R. (2011). *Botswana's Export Competitiveness Policy and Non-Traditional Exporting Firms*. Southern African Development Research Network; Working Paper Series.

Gujarati, D. N. (2003). *Basic Econometrics*. 4th Edition. McGraw-Hill, US.

Gutiérrez de Piñeres, S.A. and Cantavella-Jordá, M. (2010). Short-run effects of devaluation: a disaggregated analysis of Latin American exports. *Applied Economics*, Vol 42, No 2, pp133-142. Available online: http://dx.doi.org/10.1080/00036840701579259 [Accessed 10 April 2015].

Harris, R. (1995). *Using Cointegration Analysis in Econometric Modelling*. London, Prentice Hall.

Harris, R. and Sollis, R. (2003). *Applied Time Series Modelling and Forecasting*. West Sussex, England. John Wiley and Sons Inc.

Harvey, C. and Lewis, S. R. (1990). *Policy Choice and Development Performance in Botswana*. Publisher: Macmillan.

Hill, R. C., Griffiths, W. E. and Lim, G. C. (2012). *Principles of Econometrics*. 4th Edition, International Student Version. John Wiley & Sons Inc.

Huchet-Bourdon, M. and Korinek, J. (2011). To What Extent Do Exchange Rates and their Volatility Affect Trade? *OECD Trade Policy Papers*, No. 119, OECD Publishing. Available online: http://dx.doi.org/10.1787/5kg3slm7b8hg-en [Accessed 15 April 2015].

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, Vol 59, No 6, pp1551-1580. Available online: http://www.jstor.org/stable/2938278 [Accessed 29 June 2015].

Johansen, S. (1995). *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*. Oxford, Oxford University Press.

Jooste, C. and Jhaveri, Y. (2014). The Determinants of Time-Varying Exchange Rate Pass-Through in South Africa. *South African Journal of Economics.* Vol 82, No 4, pp603-615.

Kamin, S.B. and Rodgers, J.H. (2000). Output and the real exchange rate in developing countries: an application to Mexico. *Journal of Development Economics,* Vol 61, pp. 85–109.

Kandil, M. (2014). On the Pass-through of Exchange Rate Fluctuations to the Macroeconomy: Imports in Developing and Advanced Countries. *International Journal of Finance and Economics,* Vol 20, pp28-47. Available online: wileyonlinelibrary.com DOI: 10.1002/ijfe.1499

Koop, G. (2005). *Analysis of Economic Data*. 2nd edition. Hoboken, New Jersey: John Wiley.

Koop, G. (2009). *Analysis of Economic Data*. 3rd edition. Hoboken, New Jersey: John Wiley.

Kumar, R. (2008). *International Economics*. New Delhi: Excel Books.

Lan, C. (2001). Singapore's export promotion strategy and economic growth (1965-84). Working paper No. 116, ISSN 1474-3280.

Leith, J.C. (1991). The Exchange Rate and the Price Level in a Small Open Economy: Botswana. *Journal of Policy Modeling*, Vol 13, No 2, pp309-315.

Leith, J.C. (2005). *Why Botswana Prospered*. McGill-Queen's University Press, Montreal and Kingston.

Magee, S.P. (1973). Currency Contracts, pass through and devaluation. *Brooking Papers on Economic Activity*, Volume 1, pp303–25.

Mankiw, N.G. (2009). *Macroeconomics*. 7th edition. New York; Worth Publishers.

Menon, J. (1995). Exchange Rate Pass-Through. *Journal of Economic Surveys*. Vol 9, No. 2, pp197-231.

Minot, N.W. (1998). Distributional and Nutritional Impact of Devaluation in Rwanda. *Economic Development and Cultural Change*, Vol 46, No 2, pp379-402. Available online: http://www.jstor.org/stable/10.1086/452343 [Accessed: 17 February 2015].

Mirtala, R. (2014). *Exchange Rate Pass- Through to Domestic Prices under Different Exchange Rate Regimes*. William Davidson Institute Working Paper Number 1070.

Motlaleng, G.R. (2009). Botswana's Crawling-Peg Exchange Rate System: Trends and Variations in the Pula Exchange Rate. Botswana Books. *Botswana notes and records*, Vol 41. Available online: http://www.ubrisa.ub.bw/bitstream/handle/10311/1008/Motlaleng_BNR_2009.pdf?sequence=1 [Accessed 03 March 2015].

Motlaleng, G.R. and Paul, T.M. (2008). The Pula-Dollar Exchange Rate and the Purchasing Power Parity in Botswana. *The Journal of Developing Areas*, Vol 41, No 2, pp205-231. Available online: http://www.jstor.org/stable/40376185 [Accessed 17 February 2015].

Mundell, R.A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science,* Vol 29*,* No 4 pp475-485. Available online: http://www.jstor.org/stable/139336 [Accessed 20 September 2015].

Narayan, P.K. and Narayan, S. (2007). Is devaluation expansionary or contractionary? Empirical evidence from Fiji. *Applied Economics*, Vol 39, No 20, pp2589-2598. Available online: http://dx.doi.org/10.1080/00036840600707266 [Accessed on 30 March 2015].

Ogaki, M. (1993). Unit Roots in Macroeconometrics: A Survey. *Bank of Japan Monetary and Economic Studies*, Vol 11, No 2, pp131-154.

Olney, M.L. (2011). *Macroeconomics: As a Second Language*. Hoboken, New Jersey: John Wiley.

Parkin, M. (2008). *Economics*. 8th edition. Boston, Massachusetts: Pearson Addison-Wesley.

Parsley, D.C. (2011). Exchange Rate Pass-through in South Africa: Panel Evidence from Individual Goods and Services. *Journal of Development Studies*, Vol 48, No. 7, pp. 832-846.

Pinkston, D.A. (2007). The Evolution of South Korea's Rural Institutions: The Political Economy of Export Promotion and Market Protection. *Journal of East Asian Studies*, Vol 7, No 1 pp61-92. Available online: http://www.jstor.org/stable/23418719 [Accessed 19 November 2015].

Razafimahefa, I.F. (2012). Exchange Rate Pass-Through in Sub-Saharan African Economies and its Determinants. *International Monetary Fund Working Paper*, WP/12/141.

Razmi, A. (2007*).* The Contractionary Short-Run Effects of Nominal Devaluation in Developing Countries: Some Neglected Nuances. *International Review of Applied Economics*, Vol 21, No 5, pp. 577–602

Republic of Botswana Central Statistics Office (2010). Statistical Year Book 2010. Gaborone, Botswana: Government Printing and Publishing services.

Republic of Botswana Central Statistics Office, (2010). Botswana External Trade Monthly Digest Issue No 11 of 2010/11. Gaborone, Botswana: Government Printing and Publishing services.

Republic of Botswana, Central Statistics Office (2010). External Trade Statistics 2010. Gaborone, Botswana: Government Printing and Publishing services.

Republic of Botswana, Ministry of Finance, Development and Planning, (2009). National Development 10, 2009. Gaborone, Botswana.

Rogoff, K. (2003). Globalization and Global Disinflation. *Federal Reserve Bank of Kansas City Economic Review*, Fourth Quarter, 2003, pp45-78. Available online: https://www.kansascityfed.org/Publicat/Econrev/PDF/4Q03Rogo.pdf [Accessed 25 May 2015].

Rowbotham, N.K., Saville, A. and Mbululu, D. (2014). Exchange Rate Policy and Export Performance in Efficiency-Driven Economies. *Economic Research Southern Africa*, working paper 469.

Salvatore, D. (2004). *International Economics*. New Jersey: John Wiley & Sons Inc.

Setlhare, L. (2004). Bank of Botswana's Reaction Function: Modelling Botswana's Monetary Policy Strategy. *South African Journal of Economics*, Vol 72, No 2, pp384-406.

Silva-Ruete, J. (2006). The development of China's export performance. Conference paper of 7 March 2006, Central Bank of Peru, Lima: Peru. Available on: http://econwpa.repec.org/eps/it/papers/0309/0309014.pdf [Accessed 07 November 2015].

Sims, C.A. (1972). Money, Income, and Causality. *American Economic Review,* Vol 62, No 4, pp540-552.

Siphambe, H. (2013) in Selolwane, O. (Ed.). *Poverty Reduction and Changing Policy Regimes in Botswana*: *Developmental Pathways to Poverty Reduction*. Palgrave Macmillan.

Smith, M. (2007). Impact of the exchange rate on export. *Reserve Bank of New Zealand Bulletin,* Vol 67, No 1.

Snowdon, B. and Vane, H.R. (2005). *Modern Macroeconomics: Its Origins, Development and Current State*. Cheltham, UK and Northampton, USA: Edward Elgar.

Ssekuma, R. (2011). *A Study of Cointegration Models with Applications* (Master's Dissertation). Pretoria: University of South Africa.

Statistics Botswana (2010). Botswana Statistical Year Book 2010. Gaborone, Botswana: Government Printing and Publishing services.

Statistics Botswana (2011). Botswana International Merchandise Trade Statistics: Annual Report 2011. Gaborone, Botswana: Government Printing and Publishing services.

Statistics Botswana (2012). National Accounts 2011. Gaborone, Botswana: Government Printing and Publishing services.

Statistics South Africa, (2015). CPI from 1960 onwards. South Africa. Available online: http://www.statssa.gov.za/publications/P0141/CPIHistory.pdf? Accessed 06 July 2015

Sweidan, O.D. (2013). Exchange Rate Pass-Through into Import Prices in Jordan. *Global Economy Journal,* Vol 3, No 1, pp109-128.

Taylor, I. (2003). As Good as It Gets? Botswana's 'Democratic Development'. *Journal of Contemporary African Studies*, Vol 21, No 2, pp215-231. Available online: http://dx.doi.org/10.1080/02589000305446 [Accessed on 02 May 2015].

Taylor, J. (2000). Low Inflation, Pass-Through and the Pricing Power of Firms. *European Economic Review*, Vol 44, No 7, pp1389–1408.

Thompson, H. (2006). *International Economics: Global Markets and Competition*. 2nd edition. Singapore: World Scientific Publishing.

United Nations Conference on Trade and Development, (2008). Economic Development in Africa 2008, Export Performance Following Trade Liberalisation. Geneva. Available online: http://unctad.org/en/Docs/aldcafrica2008en.pdf [Accessed 27 May 2015].

Van Marrewijk, C. (2005). Basic exchange rate theories. Discussion paper No. 0501. Center for International Economic Studies. Australia: University of Adelaide.

Wickremasinghe, G. and Silvapulle, P. (2004). *Exchange Rate Pass-through to Manufactured Import Prices: the Case of Japan*. Mimeo: Monash University. Available online: http://129.3.20.41/eps/it/papers/0406/0406006.pdf

World Bank (2015). World development indicators. Available online: http://databank.worldbank.org/data/reports.aspx?source=2&Topic=3

Zizhou, F. (2009). *Linkages between Trade and Industrial Policies in Botswana.* Report to the Industrial Policy Thematic Working Group. Southern African Development Research Network. Available online: http://www.tips.org.za/files/botswana_paper.pdf [Accessed 27 May 2015].

APPENDIX

Annual data used for REER and Non-Mining exports study

Date	Non-Mining Exports (Pmillion)	REER 2007 = 100	World GDP (US$ million)
1981	118.00	113.1	11447474.67
1982	114.19	108.8	11345317.38
1983	117.92	108.1	11599034.49
1984	116.99	112.7	12037252.9
1985	138.49	97.8	12655390.4
1986	173.76	92.6	14976990.69
1987	150.97	91.5	17037198.18
1988	184.60	87.6	19073232.12
1989	229.27	89.4	20015965.6
1990	237.57	93.4	22515567.5
1991	154.81	90.6	23637570.95
1992	227.21	93.3	25304656.2
1993	276.58	98.2	25742469.77
1994	604.70	96.5	27634415.23
1995	1,280.80	96.4	30587805.29
1996	1,575.10	93.9	31242551.82
1997	1,696.64	93.2	31149765.58
1998	1,603.45	92.7	31024828.6
1999	1,164.62	94.3	32178806.86
2000	850.55	99.4	33221540.05
2001	926.69	103.2	33027374.96
2002	1,125.22	108.7	34311983.85
2003	1,690.58	113.5	38532212.83
2004	1,401.49	110.7	43412408.14
2005	9,825.40	106.1	46965342.24

2006	11,155.52	103.5	50880493.23
2007	15,302.08	100.0	57334859.19
2008	20,634.01	103.0	62867095.37
2009	19,171.91	106.3	59550530.56
2010	5,138.73	105.6	65224057.91
2011	6,592.38	106.6	72113244.85
2012	3,393.44	107.9	73506617.29
2013	2,021.20	109.9	75607073.62

Monthly data used in the exchange rate pass-through study

Date	CPI 2006 = 100	IMP 2006 = 100	REER 2006 = 100	CPI*
Jan 1998	49.9	47.9	93.3	43.0
Feb 1998	50.1	48.1	93.3	43.1
Mar 1998	50.5	48.5	93.7	43.4
Apr 1998	51.1	49.1	94.6	43.6
May 1998	51.4	49.3	94.5	43.8
Jun 1998	51.4	49.4	93.6	44.0
Jul 1998	51.7	49.6	89.4	45.0
Aug 1998	52	49.9	88.8	45.5
Sep 1998	52	50	87.3	46.3
Oct 1998	52.3	50.2	87.6	46.5
Nov 1998	52.6	50.5	87.8	46.5
Dec 1998	52.8	50.7	88.2	46.5
Jan 1999	53.3	51.2	88.7	46.8
Feb 1999	53.8	51.6	89.4	46.8
Mar 1999	54.4	52.3	90.6	46.8
Apr 1999	54.8	52.6	91	46.9
May 1999	55	52.8	91.1	46.9

Jun 1999	55.1	53	91.2	47.1
Jul 1999	55.2	53	91.2	47.1
Aug1999	56.4	54.1	93.4	47.0
Sep 1999	56.8	54.5	93.7	47.1
Oct 1999	57	54.8	94.1	47.3
Nov 1999	57.1	54.8	93.7	47.4
Dec 1999	57.2	54.9	93.9	47.5
Jan 2000	57.7	55.4	94	48.1
Feb 2000	58.1	55.8	94.7	47.8
Mar 2000	58.7	56.3	94.8	48.4
Apr 2000	59.4	57	94.3	49.0
May 2000	59.8	57.4	92.8	49.3
Jun 2000	60.1	57.7	92.8	49.6
Jul 2000	61	58.5	94.2	50.0
Aug 2000	61.1	58.7	95.4	50.2
Sep 2000	61.3	58.8	95.9	50.4
Oct 2000	61.8	59.3	96.9	50.6
Nov 2000	61.9	59.5	96.5	50.7
Dec 2000	62.1	59.6	96.7	50.8
Jan 2001	62.3	59.9	95.9	51.5
Feb 2001	62.4	59.9	95.8	51.6
Mar 2001	63	60.5	96.2	51.9
Apr 2001	63.2	60.7	96.3	52.2
May 2001	64.1	61.6	96.9	52.4
Jun 2001	64.3	61.7	97.1	52.6
Jul 2001	64.6	62	97.5	52.6
Aug 2001	64.8	62.2	98.1	52.5
Sep 2001	65	62.4	98.1	52.6
Oct 2001	65.4	62.8	98.8	52.6
Nov 2001	65.5	62.9	98.6	52.9

Dec 2001	65.6	63	101.6	53.1
Jan 2002	65.9	63.2	101.3	54.1
Feb 2002	65.9	63.3	100.7	54.6
Mar 2002	66.8	64.2	101.1	55.2
Apr 2002	67.6	65	101.6	56.0
May 2002	67.8	65.1	101.6	56.4
Jun 2002	68.1	65.4	101.3	56.8
Jul 2002	70.3	67.5	103.8	57.7
Aug 2002	71.2	68.3	104.8	57.9
Sep 2002	71.6	68.8	104.6	58.6
October 2002	71.9	69	104.4	59.4
Nov 2002	72.4	69.5	105.1	59.7
Dec 2002	72.6	69.7	105.6	59.7
Jan 2003	73	70.1	105.6	60.3
Feb 2003	73.6	70.7	106.8	60.2
Mar 2003	74	71	106.7	60.9
Apr 2003	75	72	108.7	61.0
May 2003	75.4	72.4	108.5	60.9
Jun 2003	76.4	73.4	110.8	60.7
Jul 2003	76.4	73.3	110.9	60.7
Aug 2003	76.7	73.7	111.1	60.9
Sep 2003	76.8	73.8	111.4	60.7
Oct 2003	76.9	73.9	112.3	60.3
Nov 2003	77.2	74.1	113.2	59.9
Dec 2003	77.2	74.1	112.9	59.9
Jan 2004	77.5	74.4	112.4	60.4
Feb 2004	78.3	75.5	104.8	60.7
Mar 2004	79.1	76.2	105.6	61.1
Apr 2004	79.9	77.3	106.2	61.2
May 2004	81	77.6	107.4	61.2

Jun 2004	81.6	78.5	108.2	61.4
Jul 2004	81.5	78.4	108.1	61.6
Aug 2004	81.8	78.5	108.2	61.6
Sep 2004	82.3	79	109	61.6
Oct 2004	82.8	79.4	109.5	61.8
Nov 2004	83	79.7	109.1	62.1
Dec 2004	83.3	80	109.8	62.0
Jan 2005	83.7	80.5	110.2	62.2
Feb 2005	84	80.7	110.4	62.3
Mar 2005	84.2	81	109.5	62.9
Apr 2005	84.8	81.7	109.9	63.2
May 2005	86.1	84	97.5	63.2
Jun 2005	87.4	85.3	99	63.1
Jul 2005	88.2	86.5	99.1	63.7
Aug 2005	89.7	89	100	63.9
Sep 2005	90.5	89.9	100.1	64.2
Oct 2005	92.1	92	101.1	64.2
Nov 2005	92.4	92.3	101.1	64.2
Dec 2005	92.7	92.6	101.2	64.2
Jan 2006	94.3	93.3	101.9	64.6
Feb 2006	95	93.6	102	64.7
Mar 2006	95.8	94.4	102	65.0
Apr 2006	96.9	95.4	102.1	65.4
May 2006	97.8	96.8	101.3	65.7
Jun 2006	98.3	97.7	100.8	66.2
Jul 2006	98.7	98.3	100.5	66.9
Aug 2006	99.3	99	100	67.4
Sep 2006	100	100	100	67.6
Oct 2006	100.6	99.9	100.4	67.7
Nov 2006	100.5	99.8	99.8	67.6

Dec 2006	100.6	99.1	99.5	68.0
Jan 2007	101.3	99.6	99.2	68.5
Feb 2007	101.9	100.3	99.4	68.4
Mar 2007	102	99.4	98.4	69.0
Apr 2007	102.9	100.1	98.2	69.9
May 2007	104	101.5	98.1	70.3
Jun 2007	104.7	102.2	98.1	70.9
Jul 2007	106.2	104.5	98.9	71.6
Aug 2007	106.5	104.9	98.8	71.9
Sep 2007	106.8	104.6	98.3	72.5
Oct 2007	107.9	105.9	98.6	73.1
Nov 2007	108.2	106.4	97.9	73.4
Dec 2007	108.8	106.7	97.7	74.0
Jan 2008	109.8	108.1	97.8	74.8
Feb 2008	111.1	109.5	98.5	75.1
Mar 2008	112.1	109.6	98.1	76.3
Apr 2008	114.4	113.4	98.8	77.7
May 2008	116.6	117.2	99.2	78.5
Jun 2008	119.8	122	100.8	79.6
Jul 2008	122.1	126.3	101.3	81.2
Aug 2008	122.5	125.8	101.1	81.8
Sep 2008	121.8	123.1	100.2	81.9
Oct 2008	122	123.5	100.4	81.9
Nov 2008	124.5	122.4	102.3	82.0
Dec 2008	123.7	119.5	102.6	81.1
Jan 2009	123.8	117.2	102.6	81.4
Feb 2009	124.1	116.9	102.1	82.3
Mar 2009	125.2	117.8	101.9	83.4
Apr 2009	126	118.6	101.3	83.8
May 2009	126.4	119.3	100.5	84.1

Jun 2009	128.2	122.4	101.5	84.5
Jul 2009	129.4	124.2	101.2	85.4
Aug 2009	130	125.3	101.2	85.6
Sep 2009	130.3	125.7	101.2	86.0
Oct 2009	130.4	125.8	101.2	86.0
Nov 2009	130.8	126.5	100.8	86.0
Dec 2009	130.9	126.6	101.1	86.2
Jan 2010	131.4	127.2	101.5	86.4
Feb 2010	131.7	127.4	101.3	87.0
Mar 2010	132.6	128.7	101.1	87.7
Apr 2010	135	130.6	101.7	87.8
May 2010	136.3	131.7	101.8	88.0
Jun 2010	138.1	135.1	103.1	88.0
Jul 2010	138.6	135.7	102.6	88.6
Aug 2010	138.7	135.9	102.3	88.6
Sep 2010	139.4	136.8	102.8	88.7
Oct 2010	139.7	137.3	102.7	88.9
Nov 2010	140.1	137.9	102.3	89.0
Dec 2010	140.6	138.4	102.8	89.2
Jan 2011	141.8	139.2	103.5	89.6
Feb 2011	142.9	141.3	103.8	90.2
Mar 2011	143.8	142.2	103.1	91.3
Apr 2011	146	144.8	103.4	91.6
May 2011	147.6	147.6	103.2	92.0
Jun 2011	149	148.1	104.1	92.4
Jul 2011	149.3	148.6	103.2	93.2
Aug 2011	150.8	150.9	103.7	93.4
Sep 2011	151.4	151.3	103.8	93.8
Oct 2011	152	152.1	103.8	94.2
Nov 2011	153	153.9	103.7	94.5

Dec 2011	153.5	154.6	104.5	94.6
Jan 2012	154.3	155.3	104.7	95.2
Fed 2012	154.7	155.7	104.5	95.7
Mar 2012	155.4	156.1	103.8	96.8
Apr 2012	156.9	156.7	103.6	97.2
May 2012	159	158.9	104.1	97.2
Jun 2012	159.8	159.7	104.5	97.5
Jul 2012	160.3	160.5	104.3	97.8
Aug 2012	160.8	161.1	104.4	98.0
Sep 2012	162.1	163.4	104.7	98.9
Oct 2012	162.8	164	105.2	99.5
Nov 2012	164.4	165.9	105.8	99.8
Dec 2012	164.9	166.3	106.5	100.0
Jan 2013	165.9	167.1	107.6	100.3
Feb 2013	166.2	167.5	107.1	101.3
Mar 2013	167.1	168.1	106.9	102.5
Apr 2013	168.2	168.4	106.6	102.9
May 2013	168.7	168.9	106.9	102.6
Jun 2013	169.1	169.5	107.2	102.9
Jul 2013	169.4	170.1	106.3	104.0
Aug 2013	169.8	170.5	106.5	104.3
Sep 2013	170.2	171	106.4	104.8
Oct 2013	170.6	171.4	106.9	105.0
Nov 2013	171.2	171.9	107	105.1
Dec 2013	171.7	172.4	107.8	105.4
Jan 2014	173.1	173.1	109	106.1
Feb 2014	173.9	173.4	108.8	107.3
Mar 2014	174.5	173.7	108.1	108.7
Apr 2014	175.9	174.2	107.7	109.2
May 2014	176.3	174.8	107	109.4

Jun 2014	176.8	175.2	107.5	109.7
Jul 2014	177	175.5	106.7	110.6
Aug 2014	177.5	176.3	106.7	111.0
Sep 2014	177.8	176.7	107.2	111.0
Oct 2014	178	177	107.3	111.2
Nov 2014	178.5	178	107.4	111.2
Dec 2014	178.1	176.6	108.2	111.0