Abstract

In the area of international trade, studies have examined whether increases in exchange-rate volatility affect the trade flows of Less Developed Countries LDCs. The aim of this study is to investigate empirically the impact of exchange-rate volatility on the export flows of Namibia as one of the developing countries over the period 1998 – 2008. These are achieved by means of utilizing quarterly data of exchange rate and the trade flow of real exports of Namibia for the period 1998 – 2008.

During the stipulated time period, Namibia had experienced tremendous volatility in its exchange rate. Therefore, an assessment of the economic performance of the Namibian exports over the period 1998 – 2008 had been used to conclude that the price of the Namibian dollar (N$) is important to its future economic performances.

The econometric analysis was employed to exploit the theory of cointegration, given the obvious non-stationarity of the time series. The study used Engle-Granger two step procedures. Three measures of exchange rate volatilities were used and produced mixed results. The mean adjusted relative change (V) as a measure of exchange rate volatility indicated positive and insignificant impact on real exports of Namibia. The moving average standard deviation (MASD) as a measure of exchange rate volatility produced a negative insignificant impact of exchange rate volatility on real exports of Namibia. The last measure of exchange rate volatility was the general autoregressive conditional heteroscedasticity (GARCH), which indicated a positive and significant impact of exchange rate volatility on Namibia's real exports. These results suggest that Namibia should start exploring possibility of macro-economic policy independence and be involved in the determination of exchange rate within the CMA framework.

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DEDICATION

I dedicated this piece of work to my Parents (Mr. & Mrs. Petrus and Helena Shipanga) who made it possible for the registration in terms of finance and their words of encouragement during the demanding times of my study, they are my inspiration. My brothers and sisters you accepted the harsh financial hardship that I have brought into the family because of my study and I want you guys to do the same when an opportunity presents itself. My gratitude extends to all friends relatives for whatever supports that made me cope with all the challenges during my study. Thank you all for your emotional supports.

DECLARATIONS

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

……. **……..**

Eden Tate Shipanga **Date**

CHAPTER 1

Introduction

1.1 Background Information

The study considers the analysis of the effect of exchange rate volatility on exports in Namibia. This topic has received a lot of attention in recent time as most researchers have tried to establish the relationship that exists between exchange rate and trade flows. The exchange rate volatility is a measure that intends to capture the uncertainty faced by exporters, due to unpredictable fluctuations in the exchange rates. Trade have been demonstrated in a number of studies to have backward linkages, both for employment generation and for poverty reduction. The foreign exchange earnings from trade could be a sizable source of revenue for the domestic economy. Therefore, establishing the relationship between the volatility of exchange rate and exports would give guidance on trade and exchange rate policy formulation.

Therefore, the behavior of the current account and the value of the domestic currency have been known as a focal point of much policy discussion for a long time in the economics literature. The conventional wisdom is that appreciation of domestic currency will lead to increased trade deficits and vice versa. The early proponents of flexible exchange rates, therefore, stressed that it would take care of trade imbalances, thereby allowing policy makers to address the domestic objectives. However, since the collapse of the Bretton Woods agreement in the early 1970s, exchange rate movements have not been consistent with these predictions (Todani & Munyama, 2005). This apparent conflict between theory and empirical evidence poses a problem in determining the optimal role of exchange rates in the formation of appropriate economic policies. The proposition that flexible exchange rates lead to balance of payment equilibrium position primarily rests on the purchasing power parity theory. However, exchange rates can deviate from the purchasing power parity for a long time and thus expose foreign trade to uncertainty in exchange rates. This study explored the issue of exchange rate uncertainty or risk on the volume of foreign trade empirically.

1.2 Background of the Study

Namibia belongs to the Common Monetary Area (CMA) which is characterised as fixed exchange rate regime. This arrangement was formalised by the accession of Namibia, Lesotho, Swaziland, Botswana and South Africa to a multilateral trade agreement in 1990.

Two dominant features of this arrangement are:

- a commitment by the central banks of Lesotho, Swaziland and Namibia to exchange their domestic currency for a specified amount of the reserve currency, the Rand "without restriction subject to a normal handling charge" at a fixed exchange rate
- an explicit requirement that at least a major proportion of their monetary liabilities be backed by the reserve currency (the Rand) or other foreign assets.

The agreement has provisions for the contracting parties to issue their own national currencies as well as to introduce measures for their domestic resources mobilisation in the interest of the development of their respective countries. South Africa has been the dominant factor in the CMA; hence, its exchange rate regime is flexible and it is exposed to volatility in the international markets, which is finally transmitted into the other member countries including Namibia. Due to the fact that South Africa has a well diversified economy, the effect of the volatility of exchange rates on its economy is bound to be more restricted than would Namibia and other CMA members. It is against this background that good economic policies are needed to protect Namibian exports if it is established that such exports are subject to exchange rate volatility.

It is said that the wide-ranging trade deal between South Africa and European Union (EU) holds far reaching economic implications for Namibia, Botswana, Swaziland and Lesotho. This is due to their economic ties with South Africa through the Southern African Customs Union (SACU). These impacts include increased products competition both in the EU and SACU markets, the revenue loss as a direct result of tariff reductions, and possible displacement of local production by the imported EU goods.

The Namibian economy depends on the extraction and processing of minerals for export. Mining accounts for 12.4% of GDP (National Planning Commission, 2007). Namibia is the fourth-largest exporter of non-fuel minerals in Africa and the world's fifth-largest producer of uranium. Rich alluvial diamond deposits make Namibia a primary source for gem-quality diamonds. Namibia also produces large quantities of lead, zinc, tin, silver, and tungsten. About half of the population depends on agriculture (largely subsistence agriculture) for its livelihood (Nelson, 2000)

Namibia qualified for the 'Wearing Apparel' provisions of Africa Growth and Opportunities for Act (AGOA) on December 3, 2001; although the country's fledgling textile and garment manufacturing industry was yet to fully exploit the opportunity hereunder. Namibia was recently, under "AGOA II", re-classified as a 'Lesser Developed Country' in terms of the AGOA, thereby extending AGOA's textile sourcing provisions to this country (expired on September 30, 2004). This was thought to boost the establishment of local garment production capacity, as well as providing an incentive for local textile manufacturers to ready themselves for the post 2004 period. A very large green-fields investment in a vertically integrated textile-garment factory was undertaken in the country's capital, Windhoek, largely as a result of AGOA (Ndalikokule, *et al.,* 2006).

Since Namibia is involved in international trade agreements, attention should be given to the impact of exchange rate volatility on the economy as the country continues to explore international markets for its exports. Understanding the impact of exchange rate volatility, will assist the country in implementing policies that promote exports.

1.3 Statement of the problem

The Namibian economy is highly dependent on trade. Exports of minerals remain the main foreign exchange earner, followed by the agricultural products such as raw meat, processed meat products and fisheries. Manufacturers are considered being the major

sources of employment because of their earnings on exported products (National Planning Commission, 2007). Any shock to the export sector, affects both employment and foreign exchange earnings. Hence, it is important to investigate the impact of exchange rate volatility on exports.

The research question driving the study is what is the impact of exchange rate volatility on the Namibian exports and how does the risk of such volatility affect export earnings? The study seeks to assist in formulating the best trade policies, which would address the economic disturbances created by the exchange rate volatility in order to promote and boost the overall economic performance of the Namibian economy.

Exchange rate volatility is known to create two effects, i.e., deficiency in domestic markets and the riskiness, which exporters encounter due to such volatility. These finally, are transmitted into the economy by means of trade imbalances which could affect the economic growth of the country.

1.4 The Purpose of the Study

This study will examine the effects of exchange rate volatility, or the variability of exchange rates, on Namibian exports for the period (1998 – 2008). It assesses whether the variability of exchange rate had impact on the performance of the country's export during the period 1998 – 2008.

The specific objectives of this work are:

(1) To asses econometrically, the relationship between exchange rate volatility and exports performance for the period 1998 to 2008.

(2) To suggest policies for the amelioration of the impact of such volatilities on the domestic economy.

1.5 Significance of the study

The study investigates the impact of exchange rate volatility on Namibia's exports. Establishing this impact on one hand, would assist policy makers to implement exchange rate policies that promote exports. On the other hand it would put exporters in a better position to address and avoid losses on foreign exchange earnings that arise from exchange rate volatility. Even though, the current exchange rate arrangement which pegs the Namibian dollar to the South African Rand has generated substantial benefits in the form of lower prices and a stable macro economy. It had also brought along certain costs one of which is the instability in the exchange rate and the consequences on exports performance.

Though, this study is not concerned with determining an alternative exchange rate arrangement. The establishment of such fluctuations in the exchange rate and quantitative determination of the magnitude of the impact of such volatility will go assist in focusing domestic policies on how to alleviate the impact. These would improve the country's trade balance and promote economic growth in return.

1.6 Limitations

Due to lack of a fairly consistent long time series data, the study is only covering a period of 1998 to 2008 using quarterly data. This has implications for the interpretation on the results for the long-term coefficients on this study's model.

1.7 Outline of the rest of the thesis

The structure of this study is organised as follows: Chapter two presents the Namibian economic overviews on exchange rate and exports. Chapter three explore theoretical foundation and literature reviews and models. Chapter four discuss the methodology, data and econometric procedures. Chapter five presents the estimation results and findings. Chapter six presents the conclusion and recommendations.

CHAPTER 2

An Overview of Exports and Exchange rate Volatility in Namibia

2.1 Introduction

This chapter focuses on the overview of Namibia's exports, exchange rate regime and exchange rate volatility. Like many other economy Namibia is no exception to the risks that exporters experience in the international market due to the fluctuation of exchange rate. Therefore, it is of greater concern that the level of exchange rate volatility has effect on the level of exports.

2.3 Overview of Namibia Exports

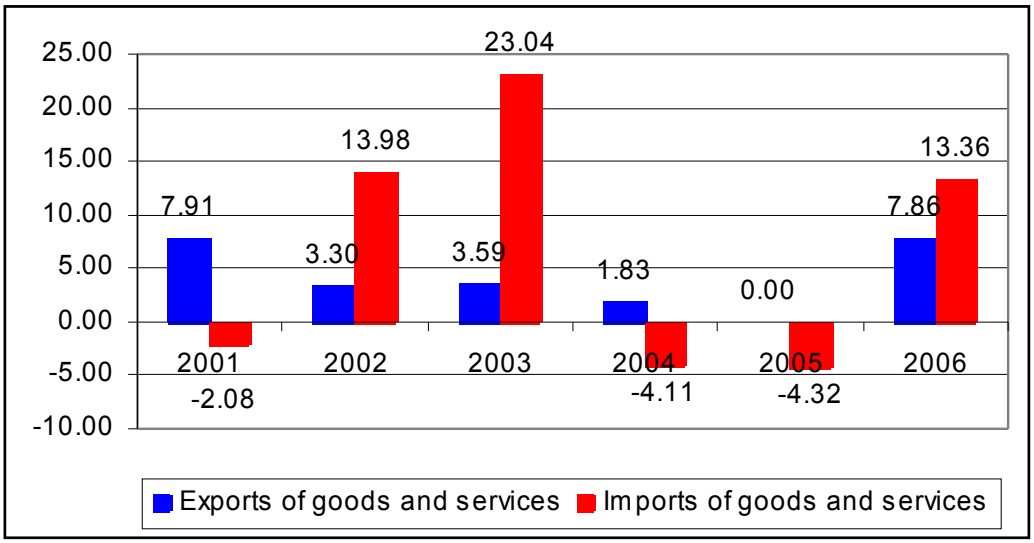
Namibia is endowed with various natural resources namely marine and minerals. Hence, its exports depends on the traditional primary sector, mainly mining, agriculture, and fisheries, as well as manufactured products, especially processed fish and meat, which has promoted export growth. Namibia's GDP growth averaged 5.2 percent between 2001 and 2007.

The country had adopted a national policy to measure the progress and economic growth known as "Vision 2030". This national vision is a perception of the future, which reveals and points to something new, beyond what is already available and accessible. It is designed in a broad, unifying vision, which serves to guide the country's five-year development plans (NDPs), starting with NDP1 through to NDP7. The first NDP1 cover a period of 1995 – 2000 and NDP2 for 2001 – 2006 then the rest follows subject to the five year period (National Planning Commission 2004).

So far, the growth of exports in Namibia as indicated in the NDPs has performed under expectation as reported in the NDP3 to establish the country's level of trade. The growth of exports during NDP2 averaged 6.7 percent per annum slightly below the Plan target of 7.0 percent, but well above the average rate of 2.6 percent recorded during NDP1. The

growth of imports averaged 5.7 percent per annum, exceeding the Plan target of 4.9 percent and higher than the average rate of 5.4 percent per annum recorded during NDP1. However, it is evident that the annual fluctuations in both exports and imports were quite significant as illustrated in Chart 2.1.

Chart 2.1: Growth Performance of Exports and Imports, 2001-2006 (percent)



Source, CBS, National Accounts, 1996-2006.

The exports of goods and services during NDP2 expanded sharply with a substantial increase in primary goods exports, which grew on average at 6.6 percent per annum. However, primary goods exports declined during 2001 (–13.4 percent), 2003 (-5.2 percent) and 2006 (-2.1 percent). This was due to reductions in the export of fish and other fish products as well as ores and minerals (see Table 2.1).

Exports of manufactured products recorded an average growth rate of 4.5 percent per annum during NDP2, but with negative growth rates in 2005 and 2006. Within the category of manufactured exports, refined copper and zinc performed substantially better by recording average rates of 47.8 percent and 48.4 percent per annum respectively while the exports of other manufactured products grew at an average rate of 36.0 percent per annum.

Table 2.1 Annual Average Percentage Growth Rates of Exports of Goods and Services

Item	NDP2 Average	NDP1 Average
Primary Goods	**7.9**	**4.2**
Live animals, animal products & crops, etc	16.9	-5.0
Live animals	8.0	-4.8
Animal products	8.7	18.5
Crops, vegetables, fruits, forestry products	54.4	-5.4
Fish and other fish products	144.6	-8.1
Ores and minerals	6.7	6.6
Metal ores including uranium ore	3.3	5.6
Other minerals	-4.0	14.8
Diamonds	9.2	8.0
Electricity	4.9	301
Manufactured products	**4.5**	**0.9**
Meat, meat preparations; hides, skins	2.1	-1.5
Prepared and preserved fish	-4.4	1.8
Beverages, other food products	3.2	20.0
Copper	47.8	-28.6
Zinc refined	408.4	7.3
Other manufactured products	36.0	10.9
Total exports of goods, fob	**6.3**	**2.3**
Services (excluding direct purchases by non-residents)	43.8	1.0
Direct purchases in Namibia by non-residents	4.3	2.6
Total exports of services	**9.0**	**8.2**
Total exports of goods and services	**6.6**	**2.1**

Source: CBS, National Accounts, 1996-2006.

During NDP2, the exports of goods and services rose to an average of 48.6 percent of GDP from 47.6 percent during NDP1. Also, the structure of the exports has changed significantly between NDP1 and NDP2 (see Table 2.2), with the reliance on primary goods declining (average of 43.1 percent of the total exports of goods and services in NDP2 against 46.9 percent in NDP1). Ores and minerals accounted for the lion's share of the primary goods exports (37.7 percent of total exports of goods and services) during NDP2 compared to 41.7 percent during NDP1. The exports of diamonds continued to play a major role in the exports accounting for 28.3 percent of the total during NDP2 versus 30.3 percent during NDP1.

The share of exports of manufactured products rose significantly to an average of 38.2 percent of the total during NDP2 compared to 33.3 percent during NDP1. The significant gainers in their shares included refined zinc, other manufactured products, and beverages and other food products with the rest losing ground. The share of goods in total exports rose to 83.6 percent (from 80.2 percent in NDP1) while that of services declined to 16.4 percent in NDP2 (from 19.8 percent in NDP1).

Table 2.2: Goods and Services Percentage Shares in Total Exports

Item	NDP2 Actual	NDP1 Actual
Live animals, animal products and crops, etc	4.9	5.0
Live animals	3.2	4.3
Animal products	0.3	0.3
Crops, vegetables, fruits, forestry products	1.5	0.3
Fish and other fishing products	0.5	0.2
Ores and minerals	37.7	41.7
Metal ores including uranium ore	8.8	10.4
Other minerals	0.6	0.4
Diamonds	28.3	30.3
Electricity	0.0	0.0
Meat, meat preparations	4.2	5.9
Prepared and preserved fish	19.2	20.1
Beverages, other food products	5.1	4.0
Copper	1.3	1.6
Zinc refined	3.7	1.2
Other manufactured products	4.8	1.6
Total exports of goods, fob	**83.6**	**80.2**
Services (excl. direct purchases by non-residents)	2.4	1.8
Direct purchases in Namibia by non-residents	14.0	17.9
Total exports of services	**16.4**	**19.8**
Total exports of goods and services	**100.0**	**100.0**
Exports of goods and services as % of GDP	48.8	47.6

Note: Totals of individual items may not add to 100.0 due to some discrepancies in original data.
Source: CBS, National Accounts, 1996-2006

NDP2 trade policy envisaged the diversification of trading links, penetrating new markets, consolidating and expanding market shares, and reducing the dependence on South African markets. The results show that there has been a significant gain in the share of exports to Angola (4.9 percent in 1998-2000 to an average of 10.9 percent in

NDP2) and modest gains in the average shares of total exports to Germany, France, Italy and USA while those to Canada, Switzerland and Spain showed some declines. The average shares of total exports going to South Africa and the United Kingdom remained largely constant (each at about 25 percent of the total). Thus, some trade diversification has been achieved. Also, trade diversification links seem to have facilitated the establishment of joint ventures between Namibian and foreign companies and promoted science and technology transfer, including in such areas as fishing and telecommunications (National Planning Commission, 2008).

According to the National Account 2000 – 2007, the level of export value of goods for Namibia in 2007 stood at N$ 25 185 million as compared to N$ 20 961 million in 2006. The main four products exported in 2007 were diamonds (N$ 5 782 million), metal ores including uranium (N$ 5 347), prepared and preserved fish (N$ 4 147 million), and zinc refined (N$ 3 593 million). Export of service stood at N$ 4 233 million as compared to N $ 3 598 million in 2006 (National Planning Commission, 2007).

Namibia continues to be a net importer of goods and services over the period of 2000 to 2007, thus recording a trade deficit except for the year 2006 when a trade surplus was recorded. The value of imports of goods stood at N$ 27 001 million in 2007 as compared to N$ 19 530 million recorded in 2006. The main products which contributed to the total imports of goods for 2007 were the transport equipments (N$ 4 956 million); chemical products and rubber and plastics products (N$ 2 854 million); machinery and equipment (N$ 2 645 million); and refined petroleum products (N$ 2 790 million). Imports of services stood at N$ 3 572 million in 2007 as compared to N$ 2 924 million in 2006 (National Planning Commission, 2007).

2.4 Namibia's Exchange Rate Overview

Namibia being a member of the Common Monetary Area (CMA), it is subjected to rules and regulations that are governing this agreement. Within a monetary area, exchange rates between the participating countries are fixed and there are no payment restrictions. The CMA has many of the characteristics of a monetary union, as the exchange rates vis-à-vis other member states are fixed and capital flows are free. As a consequence, interest rates and the money supply cannot be directly influenced by the individual country. Monetary policy in such a system is at best subordinated to exchange rate policy, as domestic credit creation must be kept within limits in order to ensure a sufficient volume of net foreign assets of the banking system. In monetary unions there is usually also a high degree of policy coordination, which could be improved in the current CMA arrangement (Alweendo, 1999).

The arrangement constrains monetary expansion, restrains excessive government spending, and sends out credible signals to private agents about prospects for inflation. This is normally achieved when money growth in the peg currency country approximates that in the anchor currency country. The measured inflation rate may diverge because of the price of non-tradable goods, but in most cases they are cointegrated. In Namibia, the available evidence seems to support this conclusion. Since 1993 the domestic inflation rate has closely mirrored the prevailing rate in South Africa (Alweendo, 1999).

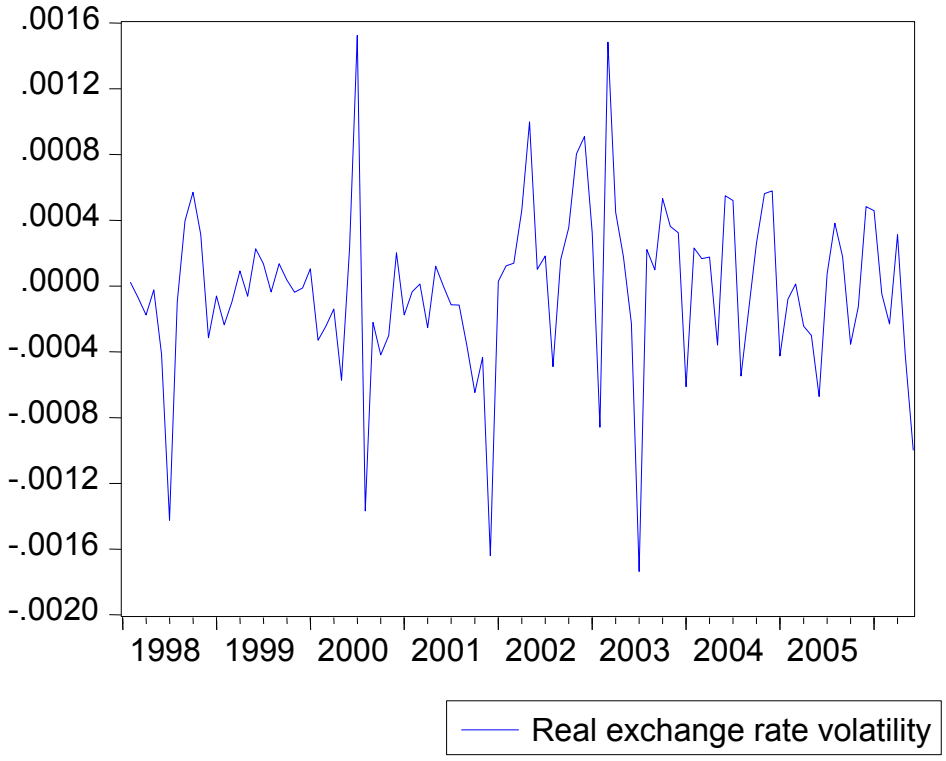
Another major advantage of the current arrangement is that it helps to avoid exchange rate fluctuations and reduces the unfavourable effects of exchange rate uncertainty on trade and investment. As South Africa is Namibia's main trading partner, a major benefit of CMA membership for Namibia is the elimination of uncertainty associated with exchange rate variability. It is precisely against this background that as Namibia tends to open up for other new markets the high the risk or unfavorable effects of exchange rate uncertainty increases. This effect eventually is transmitted into the economy thereby reducing the value of exports (Alweendo, 1999). Although the effect of exchange rate volatility is of short-term nature it is due to the flexibility of exchange rates by itself in

the international markets apart from the CMA markets. Market determined exchange rates are prone to excess volatility that can be damaging to the real economy. Overshooting of the exchange rate could have some real negative economic effects. The elimination of such fluctuations promotes economic stability. This is particularly important given the volume of Namibian trade with South Africa. Overshooting of the exchange rate between countries doing little trade may not matter much, but between countries engaged in substantial trade, it does. A stable exchange rate will ensure the stability of the prices of traded goods and hence eliminate volatility, not only in the exchange rate, but also in wages and prices and hence enhance economic performance.

But in Namibia's case the major exports earnings products are the mining, fish and products, which are mostly not being exported to South Africa or any of the CMA member. These transactions obviously are being affected by the overshooting of the exchange rate in the international markets. The individual CMA had little power to address these impacts of exchange rate volatility on their economy.

Exchange rate volatility in Namibia is presented in Figure 2.2. Figure 2.2 shows that the exchange rate has been volatile during the period 1998 to 2008. The biggest volatilities were observed in 1998, 2000, 2001 and 2003. This illustrates the relative changes of wide fluctuations for some periods and moderate fluctuations in other time periods, thus exemplifying the phenomenon of volatility of clustering.

Figure 2.2 Exchange rate volatility in Namibia



2.5 Summary

The chapter presented trends in Namibia's exports. It highlighted growth rate in exports and country's economic roadmaps, which are set to achieve the vision 2030. The exchange rate regime of Namibia is also presented with its conditions as well as the volatility. It also presented the results of actual exports in reference to the expected expansion of the economic sectors during the first and second National Development Plans.

CHAPTER 3

Literature Review

3.1 Introduction

This chapter focuses on the theoretical framework and relevant empirical studies to give an overview of all economic theories with regard to the relationship which exist between exchange rate volatility and exports. Empirical literature is not clear on the exact relationship between exchange rate volatility and exports. This remains an empirical puzzle as it differs from country to country. Although most of the studies have supported the idea of negative relationship, in our case this relationship is yet to be established reflecting the context of the Namibian economy.

3.2 Theoretical Review

From a theoretical point of view, the effect of exchange rate volatility on international trade is unambiguous. On the one hand, it is argued that a rise in exchange rate volatility increases the uncertainty of profits on contracts denominated in a foreign currency. This is due to the fact that risk leads risk-averse and risk-neutral agents to redirect their activity from higher risk foreign markets to the lower risk home market. On the other hand, higher exchange rate volatility and thus higher risk represent a greater opportunity for profit and might increase trade. The post Breton Woods models of the relationship between exchange rate regime and real effective exchange rate (REER) volatility recognize a sequence that starts in the seventies with monetary approach where exchange rate is mainly determined in asset markets. Then, the Mundell-Fleming-Dornbusch framework (MFD) introduces that in the short run there is price rigidity and in the long run the PPP holds, leave controversies in explaining exchange rate theory. Hallwood and McDonald, (1994) revealed that the traditional Mundell-Fleming-Dornbusch approach with sticky prices supports the idea of greater nominal and real volatility under flexible regimes. This greater volatility could lead to a distributive inefficiency because if the nominal exchange rate (NER) changes, given the price rigidity, the RER is likely to

change and, as a consequence, the allocation of factors in the production process could be affected.

Nevertheless, the volatility of exchange rates is the source of exchange rates risk and has certain implications on the volume of international trade, consequently on the balance of payments. Hooper, & Kohlhagen, (1978) as cited by Ozturk (2006) and others had presented theoretical analyses of the relationship between higher exchange-rate volatility and international trade transactions. Arguing that the higher exchange rate volatility leads to high costs for risk-averse traders and to less foreign trade. This is because the exchange rate is agreed on at the time of the trade contract, but payment is not made until the future delivery actually takes place. If changes in exchange rates become unpredictable, this creates uncertainty about the profits to be made and, hence, reduces the benefits of international trade. Ozturk (2006), further explains that exchange-rate risk for all country is generally not hedged because forward markets are not accessible to all traders. Even if hedging in the forward markets were possible, there are limitations and costs involved. For example, the size of the contracts is generally large, the maturity is relatively short, and it is difficult to plan the magnitude and timing of all international transactions to take advantage of the forward markets. Further recent theoretical developments suggest that there are situations in which the volatility of exchange rates could be expected to have either negative or positive effects on trade volume (Ozturk, 2006).

De Grauwe, (1988) stressed that the dominance of income effects over substitution effects can lead to a positive relationship between trade and exchange-rate volatility. This is because, if exporters are sufficiently risk averse, an increase in exchange rate volatility raises the expected marginal utility of exports revenue and therefore induces them to increase exports. De Grauwe, (1988) suggested that the effects of exchange rate uncertainty on exports should depend on the degree of risk aversion. Recently, theoretical models of hysteresis in international trade have shown that increased uncertainty from high volatility in exchange rates can also influence foreign trade, in particular if

significant sunk costs are involved in international transactions. It is difficult, however, to identify how trade will be affected.

This theoretical proposition is thought to be applicable to most of the developing and emerging countries where well developed financial markets simply do not exist. In this situation the variability of the firm's profit depends entirely on the realized exchange rate. Therefore, if the firm's objective is to maximize the expected utility of profit, then higher volatility of the exchange rate will lead to a reduction in exports in order to minimize the risk exposure. However, subsequent empirical studies reveal that this prediction is based on restrictive assumptions about the form of the utility function (De Grauwe, 1988; Dellas, & Zilberfarb, 1993). Even under the maintained hypothesis of risk aversion, the sign of the effect becomes ambiguous once the restrictions are relaxed.

As pointed out by De Grauwe, (1988), an increase in risk has both a substitution and an income effect. The substitution effect decreases export activities as an increase in exchange rate risk induces agents to shift from risky export activities to less risky ones. While a stable exchange rate motivate the agents to take their chances with the risky export activities in order to maximise their profit. The income effect, on the other hand, induces a shift of resources into the export sector when expected utility of export revenues declines as a result of the increase in exchange rate risk. Hence, if the income effect dominates the substitution effect, exchange rate volatility will have a positive impact on export activity. In addition, an increase in exchange rate volatility can create profit opportunity for firms if they can protect themselves from negative effects by hedging, or if they have ability to adjust trade volumes to movements in the exchange rate. Sercu, & Vanhull, (1992) and Franke, (1991) demonstrate that an increase in exchange rate volatility can increase the value of exporting firms and thus can promote exporting activities. De Grauwe, (1994) shows that increase in exchange rate volatility can increase the output and thus volume of trade if the firm can adjust its output in response to price changes. Broll, & Eckwert, (1999) demonstrate that an international firm with a large domestic market base has the ability to benefit from exchange rate movements by reallocating their products between domestic and foreign market. Thus,

higher volatility can increase the potential benefits from international trade. Moreover, from the political economy point of view, Brada, & Méndez, (1988) note that exchange rate movements facilitate the adjustment of the balance of payments in an event of external shocks, and thus, reduce the use of trade restrictions and capital controls to achieve the equilibrium, and this in turn encourages international trade.

The fundamental argument that exchange rate volatility impacts trade typically lies with the following two scenarios. First scenario is based on the international trade theories Hondroyiannis *et al.*, (2005) argued that from a two-country context, considering a firm located in country A that sells its product in country B (as well as in country A). Suppose that the firm sells in a forward market in each country so that the firm knows the future price of its product at the time it incurs its costs of production. However, if there are no futures or forward market for foreign exchange, the firm has an exchange risk for the future conversion of its sales revenues from country B into the currency of country A. If the firm is risk-averse, it would be willing to incur an added cost to avoid this risk, so that the risk, if not hedged, is an implicit cost. In the presence of such a cost, this reasoning suggests that the firm's supply price at each quantity of export sales is higher than in the absence of the risk. For such firms in the aggregate, the quantity of exports supplied at a given price is smaller with this risk than without it. The same reasoning applies to firms in country B. If the risk is present for firms in both countries, then both countries will reduce their supply for exports to each others, compared with those that would exist in the absence of exchange rate risk. Trade is reduced in a way similar to that resulting from an increase in transportation costs.

Where there is a forward market for foreign exchange, a discount of the forward exchange rate in one direction, below the expected future rate, is a premium in the other direction. Thus, if expectations are similar in the two countries, such a discount cannot be a deterrent to trade in both directions. However, the brokerage cost (spread) for forward transactions is generally greater than that for spot transactions in foreign exchange, and the spread is an increasing function of the variability of the exchange rate. Hence, the risk can be hedged only at a cost, the existence of future or forward markets for foreign

exchange does not change the thrust of the above argument though it reduces its quantitative significance. Therefore, arguments of this nature are however not always all on one side (Hondroyiannis *et al., 2005)*.

Hondroyiannis *et al.*, (2005) further presented alternative scenario for possibilities of increasing trade through exchange volatility. (i) Firstly, exporters may gain knowledge through trade that might help them anticipate future exchange rate movements better than can the average participant in the foreign exchange market. If this holds, then profitability of this knowledge could be used to offset the risk of exchange rate volatility. If exporters wish to hedge longer-term investment or other transactions, rather than use the forward-exchange market, they can borrow and lend in local currency to offset their other commitments. For example, a plant in a foreign country can be financed mainly with local capital, so that investors limit their exchange risk in the basic investment. (ii) Secondly a counter-argument of a special greater weight is that one must specify the alternative to exchange-rate volatility. If the volatility is attributable to fundamental factors' influencing the exchange rate, intervention by the authorities to reduce it would be unsustainable and eventually disruptive. To achieve a reduction of apparent, observed volatility, authorities would have to intervene with exchange controls or other restrictions on trade and payments. That intervention could be more harmful to trade, and reduce it more, than would unrestrained movement of the exchange rate. (iii) Thirdly, variability of an exchange rate does not measure the effect added amounts that foreign currency has on the overall riskiness on the firm's asset portfolio. The latter risk effect depends on the covariance of an exchange rate with the prices of the firm's other assets as well as the own variance of the exchange rate. In particular, the firm may hold a portfolio of several foreign currencies, thereby diversifying the risk. If variations in one currency's exchange rate against the home currency are negatively correlated with the variations in others, its variability reduces portfolio risk rather than increasing it when that currency is added to the portfolio. In general, variance by itself does not measure the exchange risk. (iv) Finally, if firms can adjust factor inputs in response to movements in the exchange rate, increased variability may create opportunities to raise profits. That is, movements in exchange rates represent not only risk, but also potential reward. If a firm adjusts inputs

to both high and low prices in order to take advantage of profit opportunities when prices are relatively high, its expected (or average) profits will be higher, the higher is exchange rate volatility, because the firm can sell more when the price is high and less when the price is low. If risk aversion is relatively low, the positive effect of greater price volatility on expected profits may outweigh the negative impact of higher profits, and the firm will produce and export more (Clark, *et al.*, 2004,; De Grauwe, 2005). As pointed out by De Grauwe, (2005), exporting goods can be viewed as an option, whereby the value of the option, rises when the volatility of the underlying asset increases when the exchange-rate becomes more favourable, the firm exercises its option to export.

3.3 Empirical literature

Siegar, & Rajan, (2002) in their study on Indonesia's trade performance in the 1990s had estimated the following export demand function:

$$X_t = f\left(Y_t^{foreign}, P_t, V_t\right) \quad \textbf{(1)}$$

Where (X_t) is export volume, ($Y_t^{foreign}$) is foreign or world GDP, (P_t) is terms of trade, and (V_t) is a measure of exchange rate volatility. They acknowledged that exchange rate volatility indeed have adversely effects on exports.

Todani, & Munyama, (2005) in line with Arize, *et al.,* (2000) and de Vita and Abbott (2004) among others estimated the following export demand equation:

$$X = f\left(RP, INC, VOL\right) \quad \textbf{(2)}$$

Where (X) is real export, (RP) is relative price, (INC) is income in trading partner as indicator of potential demand and (VOL) is a measure of exchange rate volatility. This equation leads them to conclude that either exchange rate volatility does not have significant impact or it has a positive impact on aggregate and goods exports.

Hondroyiannis, *et al.,* (2005) had estimated the following export demand function:

$$X = f(Y, RP, OP, V) \quad \textbf{(3)}$$

Where; (X) is volume of export, (Y) is real GDP of trading partner, (RP) is relative price, (OP) is real export earnings and (V) is measure of exchange rate volatility. Their result presented a negative impact of exchange rate volatility on exports.

Kasimans, & Kasimans, (2005), in line with Asseery and Peel, (1991); Chowdhury, (1993); Arize, (1995, 1997) estimated the following equation:

$$X = f(Y, P, V) \quad \textbf{(4)}$$

Where, (X) is the desired volume of export, (Y) is real foreign income, (P) is relative price and (V) is a measure of exchange rate volatility. This equation led them to conclude that exchange rate volatility have a positive impact on exports.

Bravo-Ortega, & Giovanni, (2005) explored the Remoteness and real exchange rate volatility by estimating the following equation:

$$X = f(Y, P, FDI, VOL) \quad \textbf{(5)}$$

Where, (X) is real exports, (Y) is real income, (P) is relative price, (FDI) is foreign direct investment and (VOL) is a measure of exchange rate volatility. They concluded that the effect of exchange rate volatility to exports is unambiguous.

Chit; *et al.,* (2008) had revealed that early theoretical partial equilibrium models of risk-averse firms that are constrained to decide trade volumes before exchange rate uncertainty is resolved have suggested a negative effect of volatility on trade if hedging is

not possible or is costly (Clark, 1973; Hooper and Kohlhagen, 1978). They estimated the following equation:

$$X = f\left(Y, Y^*, RP, Dist, Vol, CB, AFTA\right) \quad \textbf{(6)}$$

Where (X) is real exports, (Y, Y^*) are domestic and importing country's real GDP, (RP) is relative price, (Dist) is a set of gravity variables – the distance between two countries, (Vol) is a measure of exchange rate volatility, (CB) represent the sharing of common boarders and (AFTA) refers to membership to ASEAN Free Trade Area.

In a comprehensive survey of the literature on the impact of exchange rate volatility on trade flows, McKenzie (1999) concludes that the recent empirical studies have had "greater success in deriving a statistically significant relationship between volatility and trade". Calvo, & Reinhart, (2000) reviewed a more limited set of such studies and reached a similar conclusion. While a large number of these empirical studies have shown negative impacts of exchange rate volatility on total trade, exports and imports, some have also reported positive and insignificant consequences Siregar, & Rajan, (2002).

Exchange rates across the world have fluctuated widely particularly after the collapse of the Bretton Woods system of fixed exchange rates. Since then, there has been extensive debate about the impact of exchange rate volatility on international trade. The most commonly held belief is that greater exchange rate volatility generates uncertainty thereby increasing the level of riskiness of trading activity and this will eventually depress trade. On other hand, theoretical models show that higher risk present greater opportunity for profits and, thus exchange rate volatility, to the extent that it increases risk, should increase trade (Todani, & Munyama, 2005). However, the results by Todani, & Munyama, (2005) have shown the sensitivity of the models to the variable definitions used, which have led to their conclusion that, depending on the measure of volatility used, exchange rate volatility either does not have a significant impact on South Africa's exports flows or it has a positive impact on aggregate and goods exports.

Other researchers have found cases where a rise in exchange rate volatilities may have both positive and negative implications on exports and imports, depending on products' and countries' cases (Klein., 1990; McKenzie., 1998; Bailey, *et al.,* 1987; Koray, & Lastrapes., 1989; Aseery, & Peel., 1991; Kroner, & Lastrapes., 1993; McKenzie, & Brooks., 1997; McKenzie., 1998; Daly., 1998; Wei., 1999; Chou., 2000, Todani, & Munyama., 2005). However, these conclusions cannot be seen as definitive. There are also a few studies which conclude that exchange rate volatility plays no significant role in explaining exports and imports. This includes a study by Aristotelous (2001) which finds that exchange rate volatility has not had any significant impact on the performance of the British exports to the United States during the period of 1889-1999. In summary, the empirical literature has reaffirmed the inconclusive findings between currency volatility and trade as indicated by the theoretical literature on the subject.

Baum, *et al.,* (2001) used to use foreign income uncertainty to address the potentially omitted variable bias in similar studies to investigate the impact of exchange rate uncertainty and also to consider the entry/exit costs as well as evaluating producer's real options to participate in international trade on trade performance. In particular, they argue that higher volatility of foreign income may signal greater opportunities, and thus may have important implications for exporters' behaviour. Therefore, including income volatility as well as the interaction term of foreign income volatility and exchange rate volatility helps them to capture any possible nonlinearities and/or indirect effects in the relationship between exchange rate uncertainty and bilateral trade. Furthermore, Baum *et al.,* (2001) revealed that the relationship between exchange rate volatility and bilateral trade appears to be more complicated as the data support the concept that the link between exchange rate volatility and volume of exports is clearly not linear. In particular, for some country pairs considered, exchange rate volatility has a meaningful indirect effect on bilateral trade through the interaction with income volatility. They further demonstrate that uncertainty in foreign income may itself play an important role in the determination of trade flows. Although the magnitude and sign of the effect of income

volatility on trade varies across the bilateral relationships, it clearly differs from zero in many of those relations, implying that its effect must be considered.

According to Bahmani-Oskooee, *et al* (2006) in an effort to boost employment, a country could stimulate its exports and discourage its imports and thereby improve its trade balance. One policy that has received a great deal of attention in the literature is currency devaluation. By making exports cheaper and imports expensive, devaluation is said to improve the trade balance. The only condition required is that the sum of import and export demand price elasticities exceeds a unity, fulfilling the Marshall-Lerner condition, which is derived under the assumption of perfectly elastic supply of trade. Most previous studies that attempted to assess the Marshall-Lerner condition relied on price elasticities that were obtained by estimating aggregate import and export demand functions. These studies provided mixed conclusions as far as the effectiveness of devaluation or depreciation is concerned (Bahmani-Oskooee, *et al.,* 2006; Houthakker, & Magee, 1969; Khan, 1974; Goldstein, & Khan, 1976, 1978; Wilson, & Takacs, 1979; Haynes, & Stone, 1983a, 1983b; Warner, & Krienin, 1983; Bahmani-Oskooee 1986, 1998; and Bahmani-Oskooee, & Niroomand, 1998). The mixed conclusion could be related to aggregation bias. When aggregate trade data are employed in import and export demand functions, significant price elasticity with one trading partner could be more than offset by insignificant price elasticity with another trading partner, yielding insignificant price elasticity.

Wang, & Barrett, (2006) had examined and explored the impact of the conditional mean and conditional variance of real exchange rates on Taiwan's exports by estimating an innovative rational expectations-based multivariate GARCH-M model using sector- and destination-specific monthly data. By using more disaggregated data and attending to a variety of econometric issues that bedevil much of the existing literature on this high profile issue, they offered a new look at this longstanding question. Their main contribution was viewed as an improved econometric approach to investigating the link between exchange rate risk and export volumes. The most striking empirical finding was that they could not find any significant relationship between expected exchange rate

volatility and trade volumes outside of the agricultural sector, where export variability were great and exchange rate volatility had a strong trade-dampening effect. Agriculture appeared far more responsive to both expected exchange rates and to the expected volatility in the exchange rate than do other sectors in Taiwan's economy. Even in the agricultural sector, however, their results showed that failure to attend to issues of non-normality in the regression residuals seems to lead to substantial overstatement of the negative effect of exchange rate risk on trade flows and that the effects of expected exchange rate levels on export volumes were a complex mix of negative and positive effects over months.

3.4 Summary of the Empirical Literature

Table 3.1 presents a summary of the findings on the effects of exchange rate volatility on trade. Several empirical studies such as Ethier, (1973); Clark, (1973); Baron, (1976); Cushman, (1986); Peree, & Steinherr (1989) have shown that an increase in exchange rate volatility will have adverse effects on the volume of international trade. Other studies have demonstrated that increased volatility can have ambiguous or positive effects on trade volume: for instance, Viaene, & de Vries, (1992), Franke, (1991) and Sercu, & Vanhulle, (1992). But numerous studies have been conducted to investigate whether trade is influenced by exchange rate volatility. It is widely believed that increased exchange rate volatility inhibits the growth of foreign trade. Negative effects of exchange rate uncertainty on trade flows are reported by many authors. They have all found that exchange-rate risk depresses trade flows. However, studies by Hooper, & Kohlhagen, (1978); Gotur, (1985); Bailey *et al*., (1986, 1987); McKenzie, (1998); Aristotelous, (2001); Bailey, & Tavlas, (1988); Bahmani *et al.*, (1993); and Gagnon, (1993); among others, did not find any significant relationship between exchange-rate volatility and trade. On the other hand, McKenzie, & Brooks (1997); Klein (1990); Franke (1991); Giovannini (1988); Brada and Mendez (1988); Asseery and Peel (1991); Kasman, & Kasman, (2005); Sercu, & Vanhulle, (1992); Doyle, (2001) and Bredin *et al.*, (2003) have found positive effects of exchange rate volatility on trade.

Table 3.1 Exchange Rate Volatility and Trade: Literature Survey

Study	Sample Period	Nominal or real exchange rate used	Countries and Estimation technique used	Main Result
Akhtar and Hilton (1984)	1974-81Q	Nominal	OLS	Negative effect
Gotur (1985)	1974-82Q	Nominal	OLS	Little to no effect
Bailey, Tavlas and Ulan (1986)	1973-84Q	Nominal	OLS	Not significant, mixed effects
Bailey, Tavlas and Ulan (1987)	1962-85Q	Nomianal &Real	OLS	Little to no effect
Bailey and Tavlas (1988)	1975-86Q	Nominal	OLS	Not significant
Belenger et al. (1988)	1976-87Q	---	IVE	Significant and negative in 2 sectors
Brada and Mendez (1988)	1973-77A	Real	Cross section	Positive effect
De Grauwe and Verfaille (1988)	1975-85A	Real	Cross section	Level of trade significantly stronger within EMS than outside EMS
Koray and Lastpares (1989)	1961-85M	Real	VAR	Weak negative relationship
Mann (1989)	1977-87Q	Real	OLS	Few significant results
Peree and Steinherr (1989)	1960-85A	Nominal	OLS	Negative effect
Caballero and Corbo (1989)	--	Real	OLS and IVE	Significant and negative effect
Lastrapes and Koray (1990)	1975-87Q	Real	VAR	Weak relationship
Medhora (1990)	1976-82A	Nominal	OLS	Not significant and positive effect
Asseery and Peel (1991)	1972-87Q	Real	OLS - ECM	Significant and positive except for UK
Bini – Smaghi (1991)	1976-84Q	Nominal	OLS	Significant and negative effect
Feenstra and Kendall (1991)	1975-88Q	---	GARCH	Negative effect
Akhtar and Hilton (1991)	1974-81Q	Nominal	OLS	Not significant, mixed effect
Kumar and Dhawan (1991)	1974-85Q	Nominal & Real	OLS	Not significant and negative effect

Belenger et al. (1992)	1975-87Q	Nominal	IVE, GIVE	Significant and negative effect
Kumar (1992)	1962-87A	Real	Standard deviation	Mixed results
Savvides (1992)	*1973-86A*	*Real*	*Cross section*	Negative effect
Gagnon (1993)	Q	Real	Simulation analysis	Not significant
Frankel and Wei (1993)	1980-90A	Nominal & Real	OLS and IVE	Small and negative in 1980, positive in 1990
Kroner and Lastpares (1993)	1973-90M	Nominal	GARCH-M	Significant, varied signs and magnitudes
Chowdhury(1993)	1973-90Q	Real	VAR	Significant negative effect
Caporale and Dorodian (1994)	1974-92M	Real	Joint estimation	Significant negative effect
McKenzie and Brooks (1997)	1973-92M	Nominal	OLS	Positive effect
Mckenzie (1998)	1969-95Q	ARCH		Generally positive effect
Daly (1998)	1978-92Q	Real	---	Mixed results (overall likely have a positive correlation)
Hook and Boon (2000)	1985-97Q	Both	VAR	Negative effect on export
Aristotelous (2001)	1989-99A	Real	Gravitiy model	No effect on export
Doganlar (2002)	1980-96Q	Real	EG Cointegration	Negative effect on export
Vergil (2002)	1990-2000 Q	Real	Standard deviation	Negative effect on export
Das (2003)	1980-2001 Q	Both	ADF, ECM, Cointegration	Significant negative effect on export
Baak (2004)	1980-2002 A	Real	OLS	Significant negative effect on export
Tenreyro (2004)	1970-97A	Nominal	Gravity model	Insignificant and no effect on trade
Clark, Tamirisa, and Wei (2004)	1975-2000 A	Both	Gravity model	Negative and significant effect
Kasman & Kasman (2005)	1982-2001 Q	Real	Cointegration, ECM	Significant positive effect on export
Arize et al. (2005)	1973-2004 Q	Real	Cointegration, ECM	Significant negative effect on export
Hwang and Lee (2005)	1990-2000 M	Real	GARCH-M	Positive effect on import and insignificant effect on export

Lee and Saucier (2005)	1986-2003 Q	Nominal	ARCH-GARCH	Negative effect on trade

Source: (Ozturk, 2006).

Finally, evidence is also obtained that supports the view according to the analysis of the dynamics of the exchange rate regimes needs to differentiate between developed and developing or emerging countries. In these countries, the relationship between volatility and exchange rate regime was the key question in reassuring a stable macroeconomic performance and a correct selection of the exchange rate regime.

In the light of the foregoing arguments, the relationship between exchange-rate volatility and trade appears to be an empirical question. In view of these conflicting results, this study will apply the model by Hondroyiannis, *et al.,* (2005) to examine the effect of exchange rate volatility on Namibia's exports. The Hondroyiannis model is appropriate because it uses data which are readly available in developing country such as Namibia. Since the South African Rand is flexible in the world trade market, which make Namibia also vulnerable to such regime. This, to our knowledge is the first such study on the Namibian economy. In next Chapter, we describe the methodology approach taken in this study.

3.5 Summary

This chapter explored other theoretical framework models used on related studies in modelling exchange rate and trade. The model for Namibia was adopted based on the modification of other empirical studies models to suit the Namibian economic situation. In brief, the theoretical results are conditional on the assumptions about attitudes towards risk, functional forms, type of trader, presence of adjustment costs, market structure and availability of hedging opportunities. Ultimately, the relationship between exchange rate volatility and trade flows is analytically indeterminate. Thus, the direction and magnitude of the impact of exchange rate volatility on trade becomes an empirical issues based on countries.

CHAPTER 4

Methodology

4.1 Introduction

This chapter focuses on the methodology and the model that is estimated in this study. The definitions of the variables used in the model, and also explains data sources and types of data employed. The study uses the Engle-Granger technique of time series analysis and unit root testing. Cointegration tests are computed to establish a long run and a short run relationship between variables. Finally it presents the estimation result using the econometric methodology discussed on this chapter.

The data have been collected from the Bank of Namibia and Central Bureau of Statistics (CBS) in National Planning Commission Secretariat. Using quarterly time-series data over the interval 1998 – 2008 this study to estimates time-series regressions based on the model below for Namibia total exports.

The research methodology will be exploratory and descriptive focusing on the existing literature. The study is focusing on the total exports between Namibia and the rest of the world. Although the Namibian dollar is linked to South African Rand, it is expected that given the fluctuation of the rand in the international market is indirectly translated or passed to the CMA currencies of which Namibia is not an exemption. Therefore, exploring Namibia's exports using the real exchange rate would give a clear understanding of the country's economic performance.

The research employes both qualitative and quantitative approaches:

- *Quantitative method* is used through the econometrics analysis to assess the relationship between exchange rate volatility and exports performance. The Engle-Granger two-step estimation technique is used. This technique entails the determination of the long-term cointegration relationship through testing for stationarity of the residuals using Augmented Dickey Fuller (ADF) test. Any non-stationarity is then corrected by means of a short-term error correction model (ECM).

- *Qualitative method* will be used by considering the application of available data to give a descriptive analysis on the trend in exports performance in Namibia. It will also look at existing literature and harness the results of the econometric work for policy direction.

4.2 Model formulation

Following various literature review this study adopt the model by Hondroyiannis, *et al.,* (2005), though modified to suit the Namibian situation as follows:

$$Y = \beta_1 + \beta_2 WI + \beta_3 P + \beta_4 V + e \qquad \textbf{(7)}$$

Where:

- Y is the value of Namibia's total exports to the rest of the world in real terms.
- P is the relative price of Namibia to the world price.
- V is real effective exchange rate volatility.
- e is a random error term, and t indexes time.
- WI is the world income.

In equation (7), the coefficients are assumed to be constants. The signs of the coefficients are expected to be positive for both relative price and world income. The sign of the coefficient volatility is expected to be negative or positive. These will explain the conclusion of this study.

The study proceeds with the application of econometrics techniques to investigate the relationship between exchange rate volatility and exports, using the following tests: Unit root test, Cointegration test and Error Correction Model (ECM).

Unit root test

This model refers to a situation of nonstationarity series, where the variance of the series is not stationary. This refers to the effect which is not carried over to the next period or the value of the current period does not depend on the previous period's value. In this case there is no short run effect, if there is an effect on the series that effect would never be adjusted and there will never be an equilibrium point because the effect is equal to a unit. To have a clear picture of the Unit root test, consider a variable Y that has a time series represented by a first order autoregressive AR(1).

$$Y_t = \rho Y_{t-1} + \varepsilon_t \quad \textbf{(7)}$$

Where Y_t is exports at time t, Y_{t-1} is the lag of export in the previous period and ε_t is the disturbance term that is generated from a white noise process and assumed to be independently and identically distributed with Zero mean and constant variance and ε 's are uncorrelated across time

According to Gujarati, (2003), the estimation is done using the Ordinary Least Squares (OLS) method. Divide the estimated coefficient of in each case by its standard error to compute the tau statistic (τ) : and refer to the Augumented Dickey- Fuller (ADF) tables. It the computed absolute value of the tau statistics exceeds the ADF, then reject the hypothesis that $\rho = 0$, which indicates that the time series is stationary. Alternatively, if the computed absolute value of the tau statistics does not exceed the critical tau value, then do not reject the null hypothesis.

Cointegration Test

This step is used to find out whether the variables share a common stochastic trend, i.e. to test whether two or more variables are cointegrated. The test is useful for estimating a long-run relationship between time series macroeconomic variables, as most of the macroeconomic variables, are nonstationary in their levels, trend over time and seem to follow random walk. Cointegration technique provides a means of identifying and hence avoiding spurious regressions generated by the nonstationary time series.

Consider the following regression equation, where it includes three variables Y_t, P_t and V_t, and three cointegrating vectors β_0, β_1 and β_2. Where Y_t is Real Export, P_t, is Relative Price and V_t is Exchange Rate Volatility.

$$Y_t = \beta_0 + \beta_1 P_t + \beta_2 V + \mu_t \quad \textbf{(8)}$$

Where $\mu_t = Y_t - (\beta_0 - \beta_1 P_t - \beta_2 V_t)$ **(9)**

To test whether any long run equilibrium relationship would exist among the three variables, two steps had to be followed:

Step 1: Estimate equation (8) by using OLS, and then save the residuals. Assume that three variables and become stationary after differencing once. Which means they are integrated in order 1, I(1)

Step 2: Perform the ADF test on the residuals. If null hypothesis is rejected H0: the residuals are not stationary), the residuals are stationary and all variables are integrated.

The residual equation has the following form:

$$\Delta u_t = \alpha_1 \mu_{t-1} + \alpha_2 \Delta \mu_{t-1} + \alpha_3 \Delta \mu_{t-2} + \alpha_{j+1} \Delta \mu_{t-j} + \varepsilon_t \quad \textbf{(10)}$$

Where μ_{t-1}: the first lag of the residual; $\Delta \mu_{t-1}$, $\Delta \mu_{t-2}$,.....$\Delta \mu_{t-j}$: the lags of Δu_t. This will ensure that there is no correlation in error terms.

Error Correction Model

The error correction model (ECM) combines the short run and the long run relationship of the variables in one equation. It confirms the existence of the long run relationship among the variables. The error term from the cointergration equation (8) corresponds to the deviation from the long run equilibrium relationship and can be used as the error correction terms in describing the short run dynamic specification. Consider the following model:

$$\Delta y_t = \beta_0 + \beta_1 \Delta p_t - \beta_2 [y_{t-1} - y_1 - y_2 p_{t-1}] + u_t \quad \textbf{(11)}$$

A constant term is the short run elasticity, and it measures the impact of changes in p_t on y_t. If $\beta_1 = 0$, then y_t is not responding to a deviation from the long run equilibrium in the

previous periods. $[y_{t-1} - y_1 - y_2 p_{t-1}]$ is the disequilibrium error in the previous periods, and it shows the adjustment toward the long run equilibrium.

4.3 Econometric statistical package

There are statistical tools in Econometrics designed to model the conditional mean of a random variable has described different methods of modelling the conditional variance, or volatility, of a variable. There are several reasons that you may wish to model and forecast volatility. First, you may need to analyze the risk of holding an asset or the value of an option. Second, forecast confidence intervals may be time-varying, so that more accurate intervals can be obtained by modelling the variance of the errors. Third, more efficient estimators can be obtained if heteroskedasticity in the errors is handled properly. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modelled as a function of past values of the dependent variable and independent or exogenous variables. ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986) and Taylor (1986). These models are widely used in various branches of econometrics, especially in financial time series analysis.

4.4 Data

In what follows, the study describes these data. The dependent variables in the estimated equations are the Namibia's total exports to the rest of the world. There are problems

involved in devising proxies for the independent variables. Theory tells us that income in trading-partner nations should affect a country's imports. Due to fact that Namibia's economy is very small, the factor of income effect could not be established in this study since imports from Namibia to the rest of the world is believed to be very minimal compared to their total imports. Therefore, in this study the independent variable is the exchange rate volatility, considering Namibia real effective exchange rate. To construct an exchange rate volatility variable for this study, the proceeding is as follows.

The independent variables used in the current study are real exchange rate, price and world income. The construction of the exchange rate volatility is presented below.

4.5 Construction of Variable

As already explained, exchange rate volatility is a measure that intends to capture the uncertainty faced by exporters due to unpredictable fluctuations in the exchange rates. Clearly, this is an unobservable variable and thus its measure is a matter of contention. Consequently the literature is not unanimous as to which measure of volatility is most appropriate. This study presents three types of exchange rate volatility measures following methods appearing in the existing literatures.

4.5.1 Mean-adjusted relative change

First the study considers the mean-adjusted relative change in the exchange rate as a measure of volatility by Gujarati, (2003), which is constructed as follow:

Let: X_t = log of Namibia's real effective exchange rate (REER)

$dX_t = X_t - X_{t-1}$ = relative change in the REER

$V = dX_t$ – mean (mean of dX_t) **(12)**

Therefore, V is the mean adjusted relative change in the REER. Thus taking a square root of the mean adjusted relative change (V^2) is used as a measure of volatility because being a squared quantity, its value will be high in periods when there are large changes in the exchange rate and its value will be comparatively small when there are modest changes in exchange rate respectively.

Some researchers had used different types of models to measure exchange rate volatility. For example Todani, & Munyama, (2005) adopting the Bollesrslev, (1986) generalized autoregressive conditional heteroskedasticity (GARCH) models, and moving average standard deviations. These other measures are presented in the next sections.

4.5.2 The Moving Average Standard Deviation (MASD) Model

Moving average standard deviation of the growth rate of exchange rate as a second measure of volatility had been used extensively in the literature, authors such as Abbot, (2004); Das, (2003); Chowdhury, (1993); Arize, (200); Kasman, (2005); Soric (2007); Kene, & Rodrick, (1986); Karay, & Lastrapes, (1989); Hondroyannis, *et al.,* (2005). The measure is presented as follows:

$$Vol_{t+m} = \sqrt{\left(\frac{1}{m}\right)\sum_{i=1}^{m}\left(ER_{t+i-1} - ER_{t+i-2}\right)^2} \qquad \textbf{(13)}$$

Where ER_{t+1} is the real effective exchange rate for both the current and previous period while m is the order of moving average which in this case is three "3" because we are dealing with quarterly data. The economic logic behind this relation is to test for stable and significant response of exports to one percent change in the standard deviation.

4.5.3 The ARCH GARCH model

The final measure of volatility is the ARCH proposed by Engel, (1982) and GARCH proposed by Bollerslev, (1986) and it has been adopted by various authors such as

Suppaat, *et al.,* (2003); Chit, *et al.,* (2008); Sauer, & Bahara, (2001); Clark, *et al.,* (2001). It is presented as follow:

$$E_t = \alpha_0 + \alpha_1 E_{t-1} + \mu_t \quad \text{(a)}$$
$$h_t = \beta_0 + \beta_1 \mu^2_{t-1} + \beta_2 h_{t-1} \quad \text{(b)} \qquad \textbf{(14)}$$

Where μ_t is a random error μ_t distributed N$(0, h_t)$ and the conditional variance could be seen in (b) representing three terms: the mean β_0; the one period lag of the squared residual form the exchange rate equation μ^2_{t-1} which represents news about the volatility from previous period (the ARCH term); and last period's forecast error variance, h_{t-1} (the GARCH term).

4.5.4 Statistical measure of Real Exports

Real exports (Y) are constructed as nominal exports deflated by the consumer price index (CPI) as follows:

$$Y = \frac{EXP}{CPI} * (100) \qquad \textbf{(15)}$$

Where *EXP* is the nominal values of Namibia's exports to the rest of the world and CPI is the Consumer Price Index.

4.5.5 Statistically measure of Relative Prices

Relative price (P) is expected to be equal to the REER.

$$P = (REER) \quad \textbf{(16)}$$

Where $(REER)$ is the Namibia's real effective exchange rate as computed by the central bank (Bank of Namibia).

4.5.6 Statistical measure of the World Income

The world income had been constructed using the weight of the main major trading partners of a country. The measure is presented as follows:

$$WI = Y^i(\omega^i) \quad \textbf{(17)}$$

For $i=1,....n.$ where n is the number of major trading partners. WI, represents the world income, Y^i is the GDP and ω^i is the trade weight of each major trading partner.

All other variables will be as defined in the IMF International Financial Statistics series and the National Income accounts of the National Planning Commission.

4.6 Summary

The chapter presented the methodology used in this study for estimation. Explained in details the data and illustrated how the data was constructed. It also presented the

estimation techniques employed to address the data natures of stationarity and explain the techniques in details. Finally it presented the data sources.

CHAPTER 5

Estimation Results

5.1 Introduction

This chapter presents the results of the cointegration modelling to establish the stationarity of the time series data. Starting with the unit root tests on all the variables and proceeds to the estimation of the model.

5.2 Unit Root Results

This model refers to a situation of nonstationarity series, where the variance of the series is not stationary.The stationarity test results are presented in table 5.1

Table 5.1 Unit root tests

Series	Model	Variables in level	Variables in first difference
		ADF	**ADF**
lnY	Constant	-0.0074	-8.5228**
	Const&Trend	-4.8790*	-8.5170**
	None	-1.8584	-8.0530**
lnP	Constant	-1.4958	-4.9217**
	Const&Trend	-2.7525	-4.8597**
	None	-0.9072	-4.9172**
lnWI	Constant	-1.3105	-1.9777
	Const&Trend	-1.2083	-1.5449
	None	0.0927	-2.1975*
lnVit	Constant	-6.5464**	-12.5397**
	Const&Trend	-6.4647**	-12.3578**
	None	-6.6330**	-12.7026**
lnMASD	Constant	-4.7776**	-9.1640**
	Const&Trend	-4.7142**	-9.0568**
	None	-4.3617**	-9.2853**
lnGARCH	Constant	-5.4324**	-9.8819**

	Const&Trend	-5.3578**	-5.8589**
	None	-1.0071	-10.01772**

Notes: */** significant at 5%/1% level respectively

Observing from the unit root table one can make good judgement to establish the series cointegration. To ensure that there is no violation of econometric procedure, at least two explanatory variables should be non-stationary, to allow the long-run model estimation. In this case all the three measure of exchange rate volatility (lnV, lnMASD, lnGARCH) and the dependent variables (lnY) are stationary as shown by the results in table 5.1. The two other explanatory variables (lnP, lnWI) are only stationary after the first difference.

5.2 Estimation results

The establishment of series data stationarity allows us to run the Engle-Granger two step procedures of estimations. Three equations were estimated individually using three measures of exchange rate volatility to establish the effect of exchange rate volatility on the Namibian exports. First the long-run equation for each measure or exchange rate volatility is estimated followed by its error correction model (ECM).

5.2.1 Estimation results using the mean-adjusted relative change (V) as a measure of exchange rate volatility.

The long-run results are presented in the following equation and the t-statistics are in parentheses:

$$\ln Y = 18.3385 + 0.8861\ln WI - 1.9475\ln P + 0.0014\ln V \quad \textbf{(18)}$$
$$(5.4289)\quad (6.0879)\qquad (-4.0699)\qquad (0.0708)$$

R squared 0.712

Equation (18) shows that an increase in the world income (WI) and exchange rate volatility (V) by 1 percent causes Namibia's real exports (Y) to increase by 0.8861 and 0.0014 percent. However, the coefficient of volatility is not statistically significant. The relative price (P) is associated with a decrease in real export (Y), and shows that an increase in the relative price by 1 percent causes the Namibia's real export to decrease by 1.9475 percent and the coefficient is statistically significant. Even though, the coefficient for the volatility (lnV) is very minimal (0.0014), this gives certain indication that there is a positive relationship between exchange rate volatility and exports in Namibia.

The residuals from Equation (18) are tested for stationarity using the ADF test statistic and the results show that the ADF statistics of -3.9982 reject the null hypothesis of non-stationarity at all levels of significance. This means that the residuals are stationary. Since the residuals from the long run relationship are stationary, it allows for the specification of the error correction model (ECM), which represents the short-run dynamics of the system. The results of the ECM are presented in equation (19) with the t-statistics in parentheses:

$$\Delta\ln Y = -0.7198\text{RESIDUAL}(-1) - 0.6409\Delta\ln WI(-1) - 1.4828\Delta\ln P + 0.02\Delta\ln V \quad \textbf{(19)}$$
$$(-4.6376)\qquad (-2.1042)\qquad (-2.1002)\qquad (0.0114)$$

R Squared 0.458

Diagnostic statistics (probabilities in squared brackets)

Normality:	JB(2)	=0.105	[0.949]
Serial correlation:	LM(2)	=0.107	[0.899]
Heteroscedasticity	White(1)	=0.837	[0.578]
	ARCH(1)	=1.174	[0.286]

Stability RESET(2) =0.188 [0.830]

The results of the ECM model show a negative and significant coefficient of the lagged residual. This means that the short run dynamics adjust into the long-run equilibrium instead of moving away from the equilibrium path. It shows that about 72 percent of disequilibrium is corrected every quarter. The ECM was diagnosed for possible violation of the Gaussian or classical linear regression assumptions. The results show that the equation is well-specified and no violation of the Gaussian assumptions. This make the model a good fit and illustrates that the estimated model provides a good representation of the Namibian real exports.

5.2.2 Estimation results using the Moving Average Standard Deviation (MASD) as a measure of exchange rate volatility.

The long-run results are presented in the following equation and the t-statistics are in parentheses:

$$\ln Y = \underset{(5.7813)}{18.6978} + \underset{(6.1244)}{0.8626}\ln WI - \underset{(-4.2645)}{1.964}\ln P - \underset{(-1.2817)}{0.0283}\ln MASD \quad \textbf{(20)}$$

R squared 0.724

Equation (20) shows that an increase in the world income (WI) and exchange rate volatility (MASD) by 1 percent causes Namibia's real export (Y) to increase by 0.8626 percent, and the coefficient is statistically significant. The relative price (P) is associated with a decrease in real export (Y), and shows that an increase in the relative price by 1 percent causes the Namibia's real export to decrease by 1.9640 percents and the coefficient is statistically significant. The coefficient for the measure of volatility has a negative sign and it shows that a 1 percent increase in exchange rate volatility causes real exports to decrease by 0.0283 percent. However the coefficient is not statistically

insignificant. This suggests that although the coefficient is negative, exchange rate volatility does not have a significant impact on Namibia's exports.

The residuals from Equation (20) are tested for stationarity using the ADF test statistic and the results show that the ADF statistics of -4.0702 reject the null hypothesis of non-stationarity. This means that the residuals are stationary at all levels of significance. Since the residual from the long run relationship is stationary, it allows for the specification of the error correction model (ECM) which represents the short-run dynamics of the system. The results of the ECM are presented in equation (21) with the t-statistics in parentheses:

$$\Delta \ln Y = -0.7595 RESIDUAL(-1) - 0.6791 \Delta \ln WI(-1) - 1.6569 \Delta \ln P - 0.0287 \Delta \ln MASD \quad \textbf{(21)}$$
$$(-4.6376) \qquad (-2.1042) \qquad (-2.1002) \qquad (0.0114)$$

R Squared 0.458

Diagnostic statistics (probabilities in squared brackets)

Normality:	JB(2)	=1.103	[0.576]
Serial correlation:	LM(2)	=0.315	[0.732]
Heteroscedasticity	White(1)	=0.702	[0.688]
	ARCH(1)	=1.174	[0.286]
Stability	RESET(2)	=0.015	[0.985]

The result of ECM model shows a negative and significant coefficient of the lagged residual. This means that the dynamics adjust into the long-run equilibrium instead of moving away from the equilibrium path. It shows that 76 percent of disequilibrium is corrected every quarter. The ECM was diagnosed for possible violation of the Gaussian or classical linear regression assumptions. The results show that the equation is well-specified and no violation of the Gaussian assumption. This make the model a good fit and illustrate that the estimated model provides a good representation of the Namibian real exports.

5.2.3 Estimation results using the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) as a measure of exchange rate volatility.

The long-run results are presented in the following equation and the t-statistics are in parentheses:

$$\ln Y = \underset{(7.3458)}{18.6978} + \underset{(6.4349)}{0.7918}\ln WI - \underset{(-5.6920)}{2.4595}\ln P + \underset{(3.7698)}{0.1016}\ln GARCH \quad \textbf{(22)}$$

R squared 0.788

Equation (22) shows that an increase in the world income (WI) and exchange rate volatility (GARCH) by 1 percent causes Namibia's real export (Y) to increase by 0.7918 and 0.1016 percent. Both coefficients for the world income and exchange rate volatility are statistically significant. The relative price (P) is associated with a decrease in real export (Y), and shows that an increase in the relative price by 1 percent causes the Namibia's real export to decrease by 2.4595 percent and the coefficient is statistically significant. The significance of the coefficient of the volatility indicates that there is a positive relationship between exchange rate volatility and exports in Namibia.

The residuals from Equation (22) are tested for stationarity using the ADF test statistic and the results show that the ADF statistics of -4.6929 reject the null hypothesis of non-stationarity at all levels of significance. This means that the residuals are stationary. Since the residual from the long run relationship is stationary, it allows for the specification of the error correction model (ECM) which represents the short-run dynamics of the system. The results of the ECM are presented in equation (23) with the t-statistics in parentheses:

$$\Delta\ln Y = \underset{(-5.1717)}{-0.8072}RESIDUAL(-1) - \underset{(-2.1847)}{0.5654}\Delta\ln WI(-1) - \underset{(-2.8677)}{1.7734}\Delta\ln P + \underset{(4.1624)}{0.06881}\Delta\ln GARCH \quad \textbf{(23)}$$

R Squared 0.566

Diagnostic statistics (probabilities in squared brackets)

Normality:	JB(2)	=0.3356	[0.846]
Serial correlation:	LM(2)	=0.2521	[0.779]
Heteroscedasticity	White(1)	=0.7956	[0.611]
	ARCH(1)	=0.4313	[0.516]
Stability	RESET(2)	=0.0234	[0.977]

The result of ECM model shows a negative and significant coefficient of the lagged residual. This means that the dynamics adjust into the long-run equilibrium instead of moving away from the equilibrium path. It shows that 81 percent of disequilibrium is corrected every quarter. The ECM was diagnosed for possible violation of the Gaussian or classical linear regression assumptions. The results show that the equation is well-specified and no violation of the Gaussian assumption. This make the model a good fit and illustrate that the estimated model provides a good representation of the Namibian real exports.

5.3 Summary

This chapter illustrated the construction of the variable to be used in the analysis equation, and established the series stationarity by means of unit root as well as looking at the line graph of the series. The volatility was established using three types of

measures of volatility namely the mean adjusted relative change (V), the moving average standard deviation (MASD) and the general autoregressive conditional heteroscedasticity (GARCH). The real effective exchange rate (REER) has been employed to establish the relative price (P). The Namibian consumer price index (NCPI) had been used to deflate the export values to establish the real exports (Y). The world income variable was constructed using the major trading partners and their weights taken from the central bank (Bank of Namibia).

The study ran the estimation using the Engle-Granger two step procedures, using three types of exchange rate volatility measures. The study produced mixed results. The mean adjusted relative change as a measure of volatility shows that there is a positive and insignificant relationship between exchange rate volatility and exports. The GARCH indicates a positive and statistically significant impact of exchange rate volatility on real export of Namibia. The MASD measure of exchange rate volatility produced a negative impact of exchange rate volatility on real export of Namibia, but the coefficient is not statistically significant.

CHAPTER 6

6.1 Conclusions

The study investigated the relationship between volatility and export performance for Namibia for the period 1998 to 2008 using quarterly data. It reviewed many studies with various approaches and arguments in determining and establishing the relationship between exchange rate volatility and export. Chapter one introduced the concepts and gave the overview of the topic in relation to the Namibian situation looking at the macro-economic policies arrangement and the trade agreements.

In chapter two, the study presented the economic overview of Namibia looking at the exchange rate and exports. It presented possible circumstances faced by the Namibian exporters, outlining the risks that exist in the international markets. Chapter three looked at the empirical literatures on exchange rate volatility and exports. Where various findings of many other researchers have been presented which demonstrated the experience of various different economies.

Chapter four, discussed the methodology and construction of the variables, presented the analysis and the results of Namibia's exports and exchange rate volatility. It must be pointed out that there is no one unique formula measuring exchange rate volatility. Therefore in this study three types of measures were adopted from various studies. The Eview.5 statistical program was used to do the data analysis and the model estimation. The Engle-Granger two step procedures methodology was adopted to take care of the cointegration and estimate the model of this study.

The results show the sensitivity of the three types of exchange rate volatility estimation models to the variables definitions used. The study reveals that when mean adjusted relative change is used as a measure of exchange rate volatility, the impact of exchange volatility on export is positive but not significant. The MASD produced a negative relationship between exchange rate volatility and Namibia's real export, but the coefficient is not statistically significant. When GARCH method was used as a measure of exchange rate volatility, the result indicates that an increase in exchange rate volatility causes real export to increase. The coefficient of this measure of exchange rate volatility

is statistically significant. These results compares favourably to those in the empirical literature.

These findings may provide a potential explanation for many studies' difficulties in finding a consistent link between exchange rate volatility and exports using a simplistic measure of exchange rate volatility.

This study had presented few shortfalls in the Namibia's macro-economic policies and agreements with the common currency market area (CMA), as the result demonstrated that there is an effect of exchange rate volatility on exports. Although, the Namibian dollars is fixed to South Africa rand, the fluctuation of the rand in the international markets is being transferred to the Namibian exporters and this leave the country with few options to address the impact of exchange rate volatility.

6.2 Recommendations

The study recommends further analysis on this topic and the government should start exploring the possibility of macro-economic policy independence and be involved in the determination of exchange rate in the CMA framework. The government should develop clear industrial policy which should guide and motivate entrepreneurship and expansion on the manufacturing sector as the export is being dominated by the mining products, which are exported in their raw forms.

Finally, the study suggests further applications of similar methodology to Namibia's trade (both exports and imports) data, as this would be useful to determine the substitution effect and comparative advantages. Overall, the aggregate exports and goods equations presented in this study do provide profound basis for further research as well as the improvements in the methodology and equations. This study suggests that future theoretical and empirical research should further investigate the effect of exchange rate volatility on exports flows, while entertaining the notion that the impact of exchange rate uncertainty could be identified by working through these stochastic elements.

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