

EXCHANGE RATE AND TRADE BALANCE IN ZAMBIA: AN EMPIRICAL INVESTIGATION OF THE J-CURVE EFFECT

by

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ABSTRACT

Trade balance is one of the main factors affecting the balance of payments position. This study examined the relationship between exchange rate and trade balance in Zambia, both in the short run and long run using quarterly data from 1998:1 to 2009:4. The study investigated how trade balance responds to exchange rate changes over time and if the J-curve exists for Zambia. The elasticity approach to the balance of payments was the theoretical framework applied in this study. The elasticity approach contends that there is a long term relationship between exchange rate and trade balance, though disequilibrium may exist in the short run.

A number of studies done in the past have shown that the relationship between exchange rate and trade balance varies across countries. Predictions about effects of exchange rate changes on the balance of trade may be affected by a number of factors. Apart from behavior of economic agents, macroeconomic and structural conditions that exist in a country may affect the responsiveness of imports and exports to exchange rate changes.

Cointegration, Vector Error Correction modeling and Impulse Response Functions are the time series econometric methods applied in this study. The empirical results have shown that there is a long term equilibrium relationship between exchange rate and trade balance. Depreciation of the exchange rate is effective in improving the Zambian trade balance in the long run. However, in the short run the trade balance initially deteriorates but eventually improves over the long run. Therefore, the response of trade balance to exchange rate appears to follow the J-Curve. The Marshal-Lerner condition for depreciation to improve trade balance is met in the long run, but not in the short run.

The Granger causality results have shown that causality runs from exchange rate to trade balance and not the other way round. Therefore, exchange rate may be used to influence and provide information about trade balance developments in Zambia. Policies that ensure stability and competitiveness of exchange rate should be promoted as one of the ways of strengthening the external balance position.

This study is dedicated to my lovely wife, Nandopu, wonderful son, Zambwe and “joy of my heart” daughter, Tabo.

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARDL	Auto-Regressive Distributed Lag
ARCH	Auto-Regressive Conditional Heteroskedasticity
ASEAN	Association of South East Asian Nations
BOZ	Bank of Zambia
BOP	Balance of Payments
COMESA	Common Market for Eastern and Southern Africa
CPI	Consumer Price Index
DF	Dickey-Fuller
DOTS	Direction of Trade Statistics
ECM	Error Correction Model
FCA	Foreign Currency Assets
FEMAC	Foreign Exchange Management Committee
FXO	Foreign Exchange Operation
FPE	Final Prediction Error
GDP	Gross Domestic Product
HIPC	Highly Indebted Poor Country
IMF	International Monetary Fund
ISI	Import Substitution Industrialization
MACO	Ministry of Agriculture and Cooperatives
MB	Monetary Base
MMD	Movement for Multiparty Democracy

MLE	Maximum Likelihood Estimators
NEER	Nominal Effective Exchange Rate
NTEs	Non -Traditional Exports
OGI	Open General License
OMO	Open Market Operation
PP	Phillips-Perron
PPI	Producer Price Index
PPP	Purchasing Power Parity
RER	Real Exchange Rate
SADC	Southern Africa Development Community
SDR	Special Drawing Rights
TOT	Terms of Trade
FNDP	Fifth National Development Plan
UNDP	United Nations Development Programme
UNIP	United National Independence Party
USAID	United States Agency for International Development
VAR	Vector Auto-Regression
ZCCM	Zambia Consolidated Copper Mines

CHAPTER ONE

INTRODUCTION

1.1 Background

When Zambia attained independence in 1964; it was a relatively prosperous nation with favourable economic indicators such as per capita income and external balance position. This remained the trend for the next decade until the mid 1970s when the decline started setting in. The decline was largely attributed to nationalization reforms that led to centralized planning as government increased its control of economic activities. There was also unsuccessful attempt of Import Substitution Industrialization (ISI). It is argued that these reforms made the domestic economy rigid; unresponsive to changes in internal and external environment (Saasa, 1996).

The over-valued currency and other export repression measures had made Zambia's exports relatively uncompetitive in international markets. Though imports were relatively cheaper, their growth was also hampered by import compression through administrative barriers and rationing of foreign exchange. Therefore, the level of trade reduced drastically. Such policies were also an important factor in Zambia's failure to diversify its export base in a viable manner, despite the high potential of NTEs. Luneta (2000) in his study of the impact of real exchange rate on NTEs concludes that the "real exchange rate misalignment and volatility adversely affected the performance of Zambia's NTEs."

The situation was exacerbated by major external shocks such as sharp increases in the price of oil and drastic falls in the price of copper and other base metals which were the country's main traditional exports. These factors led to worsening of the terms of trade for the country. There was stagnation of growth of national income and deterioration in other macroeconomic indicators. Copper exports and other base metals still remain the major foreign exchange earner for the country even today.

To deal with its balance of payments problems and finance importation of essential goods, the country resorted to heavy external borrowing. External debt was also contracted for developing infrastructure such as roads, schools, and hospitals in order to deliver on development commitments made during the independence struggle by United National Independence Party (UNIP). It was hoped that the commodity prices would recover quickly and this would enable the country to service the external debt without any difficulties. But the balance of payments position weakened even further. This led to massive build up of external debt stock. Due to the weakening of the external balance position, the Zambian currency, the Kwacha experienced rapid depreciation during the following years, despite attempts to fix the exchange rate. Price and foreign currency controls were introduced in order to stabilize the economy without much success.

Attempts were made in the mid 1980s by the UNIP government to reform the economy with technical and financial support from the International Monetary Fund (IMF) and World Bank. However, these reforms were largely unsuccessful for a number of reasons that included lack of local ownership of key macroeconomic reforms and weak political commitment to these policies.

In 1991, the new Movement for Multiparty Democracy (MMD) Government undertook economic reforms of liberalizing the economy. These reforms were also done with support of IMF and World Bank. The reforms included austerity measures to stabilize the Zambian economy which had experienced run away inflation and severe market distortions. The economy was also made more open to international trade and investment. Restrictions on imports and export were eased. Price and exchange rate controls were abolished.

In the subsequent years, Zambia has seen marked improvement in its general economic performance. Economic growth and external balance position have improved significantly (USAID, 2006). However, poverty still remains a major challenge; about 64% of the population still lives in abject poverty (CSO, 2007). Increases in metal prices on the international market between 2001 and 2007 led to massive investments in mining industry, especially mines producing copper.

These investments produced increased foreign exchange earnings that led to substantial real appreciation of the domestic currency during this period.

Trade reforms that have been implemented since 1991 have brought about a number of favorable changes in the country's trade position. There has been a significant increase in both imports and exports following the removal of trade barriers. The performance of Non-Traditional Exports (NTEs) has improved over the years (Musonda, 2008). For example between 1992 and 2000, NTEs have risen from less than 100 million US dollars to over 300 million US dollars. NTEs are composed mainly of agricultural products and semi-precious stones. Zambia's external balance position was further strengthened by massive debt write off by major international creditors through the Highly Indebted Poor Country (HIPC) initiative. External debt fell from 7.1 billion US (United States) dollars in 2002 to 1.618 billion US dollars as of December, 2007 (Bova, 2008).

During 2008, the impact of the global economic crisis had slowed down economic gains made in the past few years. Though still positive, projected economic growth for 2008 had to be revised downwards. A number of mines had closed and some workers retrenched. The external balance position had weakened and there was significant depreciation of the Zambian currency, the Kwacha. However, there was improvement in the performance of domestic economy in 2009 as the global economic outlook started to improve.

1.1.1 Exchange Rate developments in Zambia

Since independence, Zambia has experienced a number of phases in its exchange rate policy. Soon after independence in 1964, the country's currency known as Zambian Pound was fixed to the British Pound Sterling. However, in 1968 the Kwacha was introduced to replace the Zambian pound as the domestic currency. From 1971, as the Dollar was emerging as the only reserve currency under the Bretton Woods system, fixing of the exchange rate was switched from the British pound to the US Dollar (Mungule, 2004).

The Kwacha remained fixed to the US Dollar until 1976 when the policy was changed to peg it to the Special Drawing Rights (SDR) with occasional devaluations. This was some form of controlled floating management of the exchange rate. Pegging of local currency to the SDR was replaced by a crawling peg to a basket of currencies of Zambia's major trading partners in 1985. The Kwacha was devalued in a controlled manner at speed of one percent each month during this exchange rate regime.

As a result of dissatisfaction with continuous depreciation of the Kwacha and inefficiencies in manual allocation, a foreign exchange auction system was introduced in October, 1985 (Elbadawi and Aron, 1992). A Dutch auction system was operated from August, 1986 until March, 1987 when a two-tier version was introduced. In a two-tier auction system, exchange rate was allocated using two different windows.

One window operated with the official rate which was fixed to the US dollar and mostly restricted to government foreign exchange transactions. The other window was used for commercial transactions and the exchange rate in this window was allowed to float between the official and a pre-determined upper rate. However, the auction system also failed to adequately address the challenges in the foreign exchange market and the Kwacha continued its downward trend against the dollar.

On May 5, 1987 a fixed exchange rate was re-introduced and a Foreign Exchange Management Committee (FEMAC) established to implement this system of foreign exchange transactions. The FEMAC would allocate foreign exchange and issue permits to eligible importers. Preferential treatment was given to Non-Traditional Exporters in that they could retain 50 percent of their foreign exchange earnings and were allowed to sell it above the official rate. However, these transactions outside the official fixed market were still subject to approval by the FEMAC. This was a way of encouraging faster growth of NTEs.

A two tier system was re-introduced in 1990 with the Bank of Zambia allocating foreign exchange at an official fixed rate under the FEMAC regulations.

The bulk of the foreign exchange sold at official rate was obtained from export of copper and cobalt through Zambia Consolidated Copper Mines (ZCCM). The other window operated at market rate and foreign exchange was provided by donor funds and NTEs.

Table 1: Summary of Exchange Rate Episodes in Zambia

Episode	Period	Type of Policy
1(a)	1964-1971	Foreign exchange rate fixed to British Pound
1(b)	1971-1976	Foreign exchange rate fixed to the US Dollar
2	1976-1983	Kwacha pegged to the SDR with periodic devaluations
3	1983-1985	Crawling peg to a basket of major trading partners' currencies
4	1985-1987	Foreign exchange auctions
5	1987-1989	Fixed to the US dollar with occasional devaluations
6	1990-1991	Dual exchange rate regime
7	1991-2010	Freely Floating exchange rate system

Source: Adopted from Mungule (2004) and Elbadawi and Aron (1992)

In 1991 the two tiers were unified into a single market determined foreign exchange system which operated under the Open General License (OGL) System. Bureaus of foreign exchanges and commercial banks now buy and sell foreign currency directly to market participants, without going through Bank of Zambia as was the case in the initial stages of freely floating exchange system. The Bank of Zambia only participates in the foreign exchange market primarily to reduce volatility.

1.1.2 Trade Performance of Zambia Since 1995

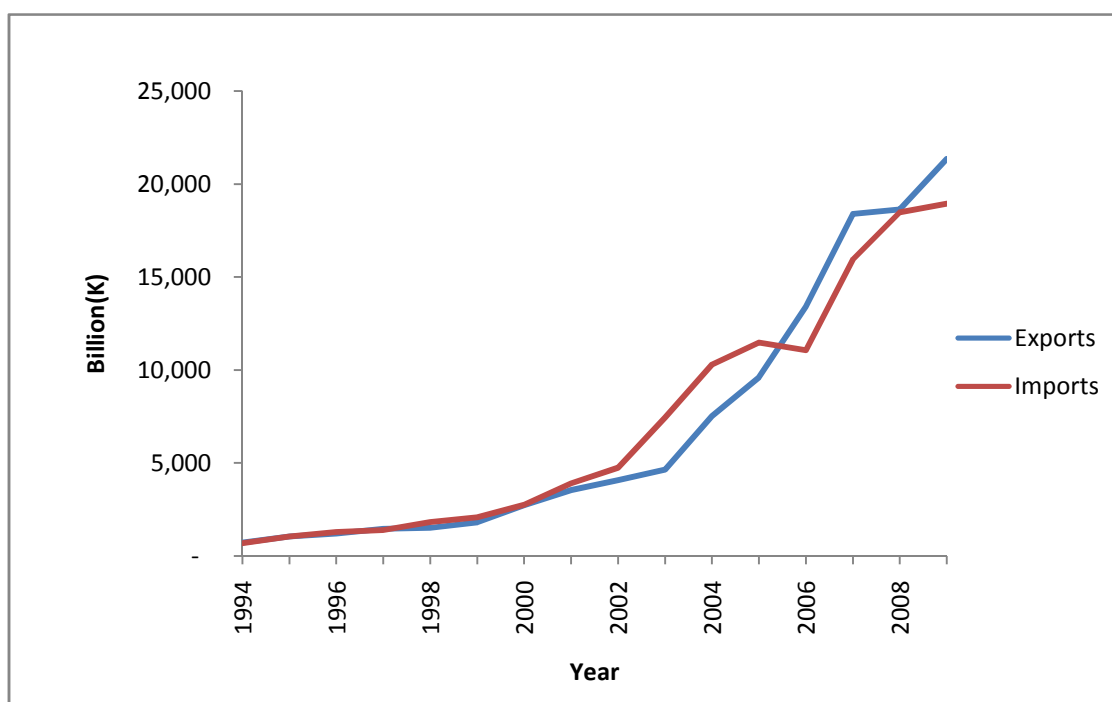
The trade performance of Zambia over the years has been influenced by a number of internal and external factors. The economic policies that the country has pursued over the years have significantly affected the trade development patterns. These trade policies relate to exchange rate regimes, types of controls on both imports and exports. The external factors are related to the prices of the country's major import and export commodities. Zambia is also a signatory to a number of trade agreements and protocols which have influenced the dynamics of its trade relations with other countries.

The trade liberalization reforms of the early 1990s produced changes to the country's trade structure. These changes included removal of controls on both imports and exports. Quantitative restrictions on imports were removed and tariffs were set at a much lower level than they used to be. The structure of import tariffs was also simplified by reducing the number of categories. Within a few years both imports and exports began favourably responding to these changes.

Since 1994 both imports and exports have grown significantly. Between 1994 and 1998 the growth in both imports and exports was relatively low compared to other periods. This is because it is during this time that the impact of the trade reforms was beginning to take hold. During this time imports and exports grew more or less at the same rate and trade position was generally balanced.

From 1998 to mid 2005, the growth rate of both imports and exports was much faster. However, imports grew much faster than exports to the extent that the trade balance was in perpetual deficit during this period.

Chart 1: Trends in Exports and Imports since 1994



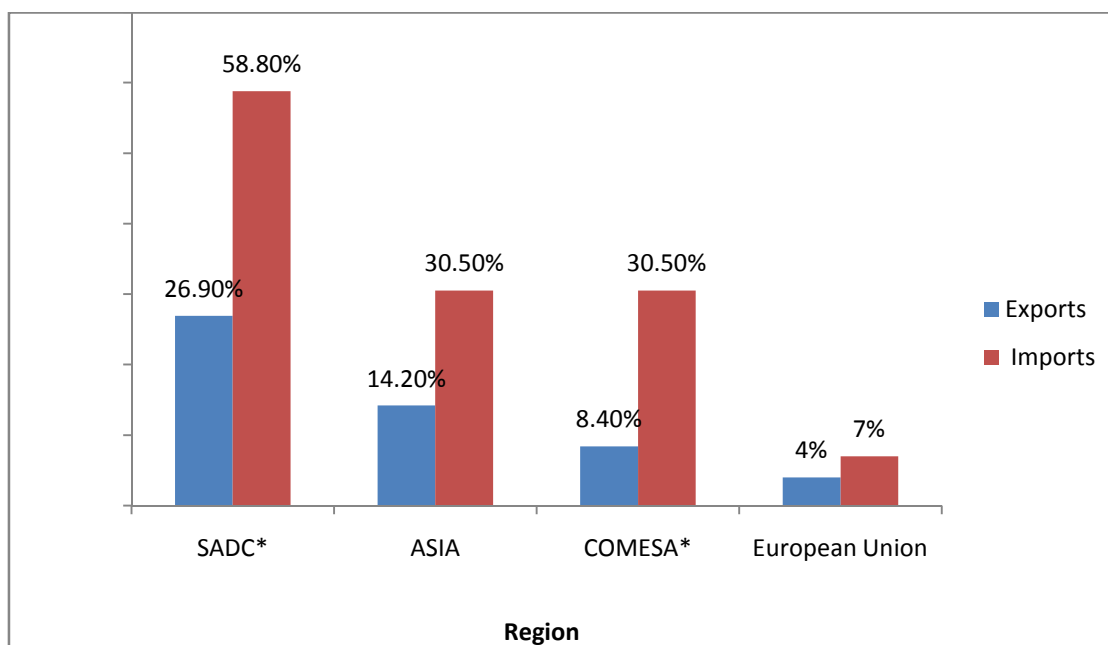
The trade deficits between 1998 and 2005 were as a result of drastic falls in the price of copper in the international markets. In 1998, copper prices had fallen by more 30 percent of the early 1990s (McCulloch *et al*, 2000). This led to heavy reductions in the value of copper exports. Copper is by far the largest export for the country accounting for more than 58 percent of total export revenues in 2004 (CSO, 2004).

After 2006, the growth of exports was much faster than that of imports such that there were huge surpluses in the country's trade position. However, around 2008 the growth in exports slowed down briefly on account of adverse effects of the global economic crisis. But in 2009 the export momentum recovered and trade surplus has continued its growth. The rapid increase in exports earnings in 2009 was fuelled by recovery in price of copper and other base metals which account for the largest proportion of total exports.

The profile of Zambia's trading partners has also been changing over the years. Traditionally, the major trading partners have been Western and Asian countries. Before trade reforms of the early 1990s, these traditional trading partners accounted for more than 60 percent of the country's total trade. After trade reforms in the early 1990s, relations with Common Market for Eastern and Southern African (COMESA) and Southern Africa Development Community (SADC) have steadily grown such that over 50 percent of Zambia's trade was with SADC and COMESA countries by 2004 (CSO, 2010).

In the SADC region, Zambia's main trading partners are South Africa, Congo, Zimbabwe, Botswana and Malawi. The country's main trading partners in the COMESA region are Kenya, Egypt and all the above SADC countries apart from South Africa and Botswana. Some countries, including Zambia are members of both SADC and COMESA.

Chart 2: Zambia's Export and Import Shares by Regional Grouping for March 2010.



Note: ()-some countries belong to both SADC and COMESA.*

Source: CSO, 2010.

Zambian export goods are still dominated by base metals of copper, cobalt and products thereof. Other export products are cement, sugar and agricultural products. The imports are mainly comprised of industrial supplies, capital goods, mineral fuels, oil, transport equipment, consumer goods, food and beverages.

1.2 Statement of Problem

For a small open economy like Zambia, expansion in trade, particularly export growth, is one of the major ways of sustaining economic growth as this provides resources to fuel domestic economic activities. This is acknowledged in the Fifth National Development Plan (FNDP) where growth in trade is to be promoted by reducing barriers to trade, maintaining a competitive exchange rate and money supply among other things. Most African governments, including Zambia substantially depend on revenue from trade through various taxes in order to finance development programmes.

One of the most common ways of measuring sustainability in external balance is analysis of trade balance (McGettigan, 2000). Chronic deficits in trade balance are an indicator of unhealthy external position that may lead to build up of foreign debt as a country relies heavily on external borrowing to finance essential imports. Apart from addressing domestic internal equilibrium, the economic reforms undertaken in the early 1990s were also meant to bring about external equilibrium.

It was argued that the opening up of the domestic economy to trade and liberalization of foreign exchange market would help correct relative international prices of traded goods and restore trade balance through adjustments to export and import patterns. The change in the exchange rate would induce changes in relative prices between domestic and imported goods.

In the case of a depreciation of the Zambian currency, domestically produced goods would be more competitive and foreign produced goods less competitive. As a result, consumption of locally produced goods would increase, while consumption of foreign produced goods reduces. As a result the trade balance would improve following depreciation of local currency. This mechanism of restoring trade equilibrium is valid if there is sufficient passing through effect of exchange rate changes on the volume of imports and exports.

After the structural changes in the domestic economy of the early 1990s, it was expected that depreciation and liberalisation of the exchange rate would promote faster growth in exports relative to imports. However, despite some improvements in the external balance situation, Zambia's position still remains precarious. Though both import and exports have expanded over the years following liberalization of the economy in 1992, imports have generally expanded faster than exports. The country experienced some trade balance surpluses in the early 1990s and mid to late 2000s, but trade balance deficits have largely dominated. For example between 2000 and 2004, imports grew by 37.54 percent, while exports grew by 24.27 percent.

The UNDP in its 2007 report on Zambia's debt strategies made the observation that, "to date, however, Zambian international trade performance and profile has largely designated the country as a net importer."

There are concerns that the country may continue facing trade balance deficits if it continues relying on a narrow base of primary export commodities with low world price and income elasticities. It is also argued that the structure of imports is not sufficiently responsive to changes in relative prices, since the make up is mainly of essential goods such as oil, manufactured goods and equipment which have few or no domestic substitutes. These factors make the country more vulnerable to external economic shocks.

Though economic theory predicts that the pattern of adjustment of trade balance to exchange rate depreciation follows a J-Curve, it is not known if this is the case for Zambia. The J-Curve is the idea that in the short run the impact of exchange rate depreciation is deterioration in the trade balance. However, in the long run the trade balance eventually improves following depreciation. There is therefore need to understand the extent to which the mechanism of exchange rate pass through to trade balance and J-Curve effect are applicable to the Zambian situation.

1.3 Objectives

1.3.1 General objectives

Understand the relationship between exchange rate and balance of trade for Zambia.

1.3.2 Specific Objectives

Investigate the short run and long run effects of exchange rate changes on trade balance.

To find out if the J-Curve effect exists for Zambia.

Derive policy options on sustainable management of trade balance in Zambia.

1.4 Hypotheses

It is hypothesized that there is a long run equilibrium relationship between exchange rate and trade balance in Zambia, such that depreciation of the exchange rate will lead to improvement in the balance of trade in the long run. The exchange rate is defined as the amount of Kwacha per US Dollar. Increase in the exchange rate will therefore imply depreciation of the domestic currency. However, in the short run depreciation will lead to worsening of the trade balance due to the presence of the J- Curve effects. It is assumed that in the short run the price effects dominate the volume effects of depreciation such that the overall effect is reduction in the trade balance. But in the long run, depreciation leads to improvement in the trade balance as both imports and exports volumes adjust to changes in relative prices. Therefore, the pattern of adjustment of trade balance to exchange rate depreciation is expected to be consistent with the J-curve effect.

1.5 Significance of Study

The exchange rate is an important macroeconomic variable that affects among other things trade and capital flows to a country. For a small country like Zambia with underdeveloped capital markets, the trade balance is very important factor in influencing the external balance position. According to Stucka (2004) quantification of the relationship between exchange rate and trade balance is important in that it provides information on how the exchange rate affects the trade balance both in the short run and long run. Though theory may make general predictions about the pattern of response of trade balance to exchange rate changes, it is only through empirical evidence that the size and timing of the effect can be clearly understood.

As far as information is available, no study has been done applying the balance of trade theories to explore the relationship between exchange rate and trade balance in Zambia. Most studies done in the developed world are largely consistent with theoretical predictions.

However, a number of studies that have been done in developing countries have produced more mixed results. This may reflect the more varying macroeconomic and structural characteristics of developing countries.

Besides, most studies in non-developed countries were done when most of their economies were still centrally planned. Therefore, it was very difficult to isolate the separate effects of variables from the data in such a situation when prices do not reflect market conditions. Structural changes to countries' economies covering the sample period in many of these studies may distort or render results to be unreliable. There is therefore need to provide more evidence with new data from sample periods under economic liberalised conditions. The information generated from this study will add information on policy options on sustainable management of the country's trade position.

1.6 Scope of the study

This study made use of quarterly time series of the variables from 1999 to 2008. A much larger sample would have provided greater insight into the issue. Data before 1999 has been excluded mainly because of inconsistency and unreliability. The Zambian economy before 1991 was generally centrally controlled by government. The structural break in the economy around 1991 was brought about by economic reforms which shifted the economy to be more market driven. Mixing the data from the two different economic episodes would have compromised the validity and reliability of results. Since the reforms were implemented in 1991, it was assumed that the actual effect started being realized at least after 1994. However, reliable quarterly time series data of variables of interest was only available from 1999.

1.7 Organization of the Dissertation

Review of literature related to this study is analysed in chapter two. In chapter three, the methods applied in this study are explained. These include the theoretical framework, estimation methods and data description. Chapter four is a discussion of the results and chapter five makes conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

A number of empirical studies have been done on the subject under investigation in both developed and developing countries in the past using recent developments in time series economic modeling. The evidence from empirical work on the relationship between exchange rate and trade balance is not uniform. Some studies by Hernan (1998) for Columbia and Lal and Lowinger (2002) for South Asian countries, Bhattari and Armah (2005) for Ghana, and Onafowora (2003) for East Asia among others have demonstrated existence of a relationship between exchange rate and trade balance both in the short run and long run. In general, the empirical evidence from these studies is consistent with the theoretical postulations of the elasticity approach to balance of payments and in particular confirms the existence of J-Curve in time path of adjustment of trade balance following exchange rate depreciation.

Other studies by Agbola (2004) for Ghana and by Puah, Yong and Lau (2008) for Association of South East Asian Nations (ASEAN)-5 member countries claim that the relationship between exchange rate and trade balance is weak, unreliable or does not exist. These studies are of the view that the relationship between exchange rate and trade balance is not significant either in the short run or long run.

Most of the studies done on this subject are based on the elasticity theory approach to the analysis of trade balance. Other studies analyse the effects of exchange rate changes on trade balance by applying the absorption or monetary approaches. Some studies include a combination of any two or all three theoretical approaches in one model. The elasticity approach analyse response of both imports and exports arising from changes in exchanges rates. The absorption approach attempts to capture the income effects arising from the substitution between domestic and foreign goods. In the monetary approach, the balance of payments is determined through the demand and supply of money. The data is either quarterly or yearly time series.

Variations of cointegration are the most common econometric methods used for testing for long-run equilibrium relationships among variables in most of these studies. Short run dynamics are tested using differences of variables and by impulse response functions. Information available so far indicates that no study of this nature has been done in Zambia.

Lal and Lowinger (2002) using quarterly time series data from 1985 to 1998 examined the relationship between Nominal Effective Exchange Rate (NEER) and trade balance for five South Asian countries of Bangladesh, India, Nepal, Pakistan and Sri Lanka. The Johansen Cointegration approach of applying maximum likelihood to an autoregressive representation was the method used for testing long run relationship among the variables. The dynamics of the model are analyzed using the Error Correction Model (ECM).

The results of the study show evidence of an equilibrium long term relationship between exchange rate and trade balance. Depreciation of the currencies of the five South Asian countries leads to improvements in their trade balances in the long run, though there was initial worsening of trade balance in the short run. This representation was confirmation of the existence of the J-Curve effect. Thus, the initial impact of depreciation was to reduce the trade balance, but eventually the trade balance improves.

There were significant differences in the time between depreciation and improvement in the trade balance among the South Asian countries that were surveyed. It took between two to five quarters before trade balance could improve following depreciation in the different countries. The differences in the time were attributed to the extent of the exchange rate disequilibrium in each country before adjustment. Countries which had a relatively more open exchange and trade policy required shorter time of adjustment.

An empirical study by Bhattari and Armah (2005) for Ghana found similar results with respect to the J-curve effect. The study estimated separately import and export functions of the Ghanaian economy. In each function the exchange rate was included as an independent variable.

Coefficients of exchange rate from each function were then summed to assess if they met the Marshal-Lerner condition for depreciation leading to improvement in the trade balance. Apart from real exchange rate the model captured effects of domestic and foreign income on trade balance. The data was annual time series from 1970 to 2000. The short run and long run relationships between variables were tested using the Johansen's (ECM) and the Engle and Granger (1987) procedures respectively.

Results showed that depreciation of the Ghanaian currency improved the trade balance in the long run, but not in the short run. The Marshal-Lerner condition for depreciation leading to improvement in the trade balance was therefore not met in the short to medium run but in the long run. Therefore, following currency depreciation the trade balance initially worsened before improving over the long run long. The sum of the value of short run elasticities of imports and exports was 0.353, which is less than the unity requirement for depreciation to lead to improvement in trade balance.

It was also demonstrated that a 10 percent devaluation of the Ghanaian currency resulted into a 7.2 percent rise in exports and 4.68 percent fall in imports in the long run. The sum of the value of elasticities for exports and imports barely meets the Marshal-Lerner condition even in the long run. It was concluded that the benefits from devaluation even in the long run are likely to be small. In general, this study is consistent with the theoretical predictions of the elasticity approach to the balance of payments.

Agbola (2004) in another study for Ghana used the Johansen Maximum Likelihood Estimators (MLE) multivariate cointegration for annual data from 1970 to 2002 and found slightly different results from those of Bhattari and Armah (2005) for Ghana. The study made use of a single Stock-Watson Dynamic Ordinary Least Squares to estimate both the short run and long run coefficients of key variables influencing the trade balance. The Stock-Watson Dynamic Ordinary Least Squares was chosen in that it does not only captures dynamics of the model and but also allows for simultaneity bias. The variables in the model included nominal exchange rate, domestic interest rate, foreign interest rate, domestic and foreign money supply, domestic and foreign income.

According to the results, depreciation of the exchange rate reduces the trade balance for Ghana in the short run. The short run results were similar to the findings of a study by Bhattari and Armah (2005) for Ghana. However, in the long run exchange rate depreciation had a negative impact on the trade balance of Ghana. The long run results contrasted with those of Bhattari and Armah (2005) for Ghana in which exchange rate depreciation led to improvement in the trade balance.

Therefore, the time path of adjustment of trade balance following depreciation did not follow the theoretical J-Curve. The dynamics of adjustment appear to follow what could be described as M-Curve. Depreciation of the exchange rate appears to have minimum immediate impact on the exchange rate. The reduction in trade balances eventually takes effect about a year following depreciation. The trade balance improves in the subsequent year before finally adjusting towards its long term equilibrium.

It is important to note that the empirical evidence from the two studies relating to Ghana includes sample data when domestic prices, exchange rate, imports and exports were heavily controlled, for substantial periods by the Government. This raises questions about whether it is possible for the pass on effects of exchange rate changes to sufficiently register in quantity of both exports and imports under such conditions. There was no evidence in both studies to show that the structural change to Ghana's economy around the early 1990s was adequately controlled for in both studies.

Another study by Hernan (1998) found that the exchange rate played an important role in determining the trade balance for Columbia. Hernan used the Johansen and Juselius's approach to estimation of multivariate cointegrating systems. The model captured the effects of the three approaches to the balance of payments; elasticity, absorption and monetary. Data was time series quarterly from 1979 to 1995. According to the cointegration results, there was a long term equilibrium relationship between the real exchange rate and the trade balance. Depreciation of the exchange was effective in improving trade balance both in the short run and long run. Any disequilibrium in the trade balance was corrected at a speed of 7 percent per quarter.

The estimate of the coefficient of exchange rate suggested that a 1 percent depreciation of the currency resulted into a 1 percent improvement in the trade balance in the long run. Therefore, in the case of Columbia the Marshal-Lerner condition for depreciation leading to improvement was met both in the short run and long run. The adjustment process of the trade balance following depreciation does not follow the J- Curve. There was need to for a more rigorous analysis of the short run dynamics probably by Impulse Response Functions to gain greater insight of the adjustment process.

A study by Puah, Yong and Lau (2008) investigated the relationship of exchange rate to trade balance for ASEAN -5 member countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand. During the late 1980s and early 1990s, these countries undertook liberalising reforms that opened up their domestic economies to international trade and investment. As a result of these reforms, they experienced rapid growth in their national incomes which were driven by exports mainly to USA and European Countries. The effect of exchange rate on trade balance was analysed with respect to USA in all these countries. USA was the major trading partner for all these countries during the time the study was being carried out. These countries are often cited by the World Bank and IMF as success examples of economic liberalising reforms.

The data was annual series from 1970 to 2004. There were major changes in the economic policy frameworks of these countries during that period. The relationship between exchange rate and the variables was tested using the Johansen-Juselius (1990) Error Correction cointegration technique. The results showed that exchange rates changes only affected the trade balance in the short run. In the long run, the relationship of exchange rate and trade balance was not significant. For Indonesia, there was no relationship between exchange rate and trade balance even in the short run. Since the variables were not cointegrated, the standard Vector Auto Regression (VAR) was used to analyse short run relationships among the variables.

Granger Causality test was used to analyse the direction of influence between exchange rate and trade balance. According to the Causality test results, the exchange rate Granger causes trade balance.

There was no evidence to support trade balance Granger causing exchange rate. With the exception of Indonesia, causality for the ASEAN-5 countries is from exchange rate to trade balance and not the other way round.

A number of possible explanations were given as to the limited role of exchange rate in influencing the long term trade balance positions of the ASEAN-5 countries. One of the possible explanations was that most countries in the ASEAN-5 had managed floating regimes. It is claimed that managed float regimes could create misalignment in foreign exchange markets that undermines the role of exchange rate in determining trade flows. This misalignment creates barriers to pass through mechanism of exchange rate to trade balance.

Another possible explanation is that the trade balance for these countries is primarily driven by export demand and not the relative prices via exchange rate. The other factor could be that gains in productivity could dominate losses in competitiveness arising from currency appreciation, to the extent that overall exports increase. A potential source of weakness in this study is that it does not take into account of the structural changes of the economies of the various countries. This could be said of many other studies where there were major transformations in the economies of such countries, especially those involving the economy changing from a controlled one to a more market oriented.

The conclusions of Puah, Yong and Lau (2008) for ASEAN-5 member countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand do not match with the study by Onafowora (2003) for the three ASEAN countries of Thailand, Malaysia and Indonesia. The study done by Onafowora (2003) used quarterly time series data for the period 1980:1 to 2001:4. The effect of exchange rate changes was investigated in terms of each country's bilateral trade with USA and Japan using cointegration and ECM approach that treats all the variables in the model as potentially endogenous. The short run dynamics were analysed by use of Impulse Response Functions, showing the response of the trade balance to one standard error depreciation of the exchange rate.

A dummy variable that was included in the model revealed that the 1997 Asian financial crisis had a significant negative impact on the trade balance of these three ASEAN countries. Stability tests revealed that the parameter estimates were fairly reliable despite major events during the sample period that affected the variables that were included in the model.

The cointegration results showed that there was a long run relationship between the exchange rate and bilateral trade balances for the three ASEAN countries. Depreciation of the currencies of the three ASEAN countries resulted in improvement in their trade balances in the long run. In the short run depreciation of the currencies of Indonesia and Malaysia led to worsening of the bilateral trade balances with USA and Japan. For Indonesia the deterioration persists up to 3 quarters after which there is improvement in the trade balance.

For both Malaysia and Indonesia the J-Curve effect was observed in bilateral trade with USA and Japan. For Thailand, the J-Curve effect was observed with respect to its bilateral trade relations with the USA only. Deterioration in Thailand's bilateral trade balance with USA lasts up to 3 quarters following depreciation before it eventually improved. This pattern of response of trade balance to exchange rate changes is consistent with the J-Curve effect. With respect to Japan, Thailand's trade balance improved following depreciation even in the short run. Therefore, the response of Thailand's trade balance with respect to Japan does not follow the J-Curve.

Disaggregation of data help to provide a detailed analysis on how the trade balance responds with each of a country's trading partners. This is in recognition of the fact that some of a country's trading partners are relatively more important than others and aggregation of the data especially for countries with one or two relatively big trading partners may result in biased results.

Oskooe and Ratha (2007) investigated the influence of exchange rate on the trade balance of Sweden. The main objective of the study was to investigate whether the J-Curve existed for disaggregated data at bilateral level between Sweden and 17 of her trading partners, using quarterly time series data from 1980 to 2005.

The data is disaggregated in the sense that there is a separate analysis with respect to each of Sweden's trading partners. The actual model also captures the effects of domestic and foreign incomes on the trade balance. The short run and long run effects of exchange rate changes are analyzed by the bounds testing approach to the Error Correction modeling and cointegration respectively.

The bounds testing procedure uses the lower and upper critical values of the non – standard F test to determine the joint significance of all lagged level variables in the ECM. The F test is non standard because the lower and upper bounds are determined by the assumed order of integration of the variables. Therefore, the F test includes information about the integration properties of the variables. Unit root testing may be avoided in this method without compromising the validity of results. This method also allows for simultaneous testing on both short run and long run effects of exchange rate on trade balance since the model includes lagged differenced and level variables.

At a bilateral level, evidence of a short run relationship between exchange rate and trade balance was found in 14 out of 17 Sweden's trading partners. But evidence of J-Curve was found only in Sweden's bilateral relationship with 5 countries of Austria, Denmark, Italy, Netherlands and United Kingdom. In another 5 of Sweden's bilateral trade relationships, the short run negative effect of depreciation appear to persist even in the long run. In general, the depreciation of the Swedish currency led to long term improvement in the trade balance.

Another study by Stucka (2004) analyzed the effects of real exchange rate changes on the trade balance for Croatia. This study employed three variations of Auto-Regressive Distributed Lags (ARDL) model and two measures of competitiveness in order to have a more robust analysis. The three ARDL approaches developed by Pesaran, Shin and Smith (1996), Bewley(1979) and Wickens and Breusch(1988) were applied to test for cointegration and short run ECM dynamics among the variables. The two measures of competitiveness were based on the real exchange calculated using Consumer Price Index (CPI) and Producer Price Index (PPI).

Analysis was carried out using CPI and PPI derived exchange rates using each of the three ARDL approaches. Quarterly time series data was employed from 1994 to 2002. The trade balance was the aggregate of export and import ratio of Croatia's major six trading partners. About 55 percent of Croatia's total trade was with these six major trading partners.

In general, permutations of the three ARDL approaches and two measures of competitiveness yielded similar results in terms of the relationship of the real exchange rate to trade balance. Depreciation of the real exchange rate of Croatia was effective in improving the trade balance in the long run. However, in the short run due to influence of the J-Curve effect, the trade balance initially deteriorates. Deterioration in the trade balance after depreciation averaged up to one quarter before improving. On average, trade balance improvement of 0.94 to 1.3 percent resulted from a 1 percent permanent depreciation in the exchange rate. On average, measures of competitiveness based on CPI yielded higher estimates than those based on PPI.

A related study by Luneta (2000) analyzed the impact of exchange misalignment and volatility on Zambian NTEs. He used two models in his study. The first model specifies a function of the exchange rate, to establish the relationship between Real Exchange Rate (RER) and its determinants. The second model is reduced form of the export function which seeks to analyse relationship between NTEs and RER with other factors.

Secondary annual data from 1966 to 1991 was used. Testing for cointegration was done using the Engle and Granger two step procedure, while short run dynamics are analysed using the ECM. A proxy was included to capture the effect liberalization of economy around 1991 on NTEs.

It was found that the RER affected NTES in Zambia both in the short run and the long run. In particular RER misalignment and instability was a significant factor discouraging the growth of NTEs in Zambia. Exporters in Zambia were found to be more risk averse with regard to losses arising from exchange rate changes, especially since hedging instruments were limited.

It was observed that liberalization of the economy around 1991 had a negative impact on the performance of non-traditional exports.

In conclusion, it was observed that results from developed countries tend to give better evidence of the relationship between exchange rate and trade balance, while results from developing countries were more varied. The other observation was that using quarterly series yielded better results than annual data. This could be due to the smoothing effect of annual data such that changes which take effect within a year may not be evident.

CHAPTER THREE

METHODOLOGY

3.1 Theoretical Framework

In the literature of international economics, there are basically three main theories that explain the relationship between exchange rate and trade balance. These are the elasticity, absorption and monetary approach to the balance of payments. The elasticity and monetary approaches focus on the current account or trade balance, while the absorption approach considers both the current account and capital account. In the elasticity approach, the trade balance is analysed through changes to imports and exports as a result of exchange rate changes. The absorption approach extends the analysis and includes the macroeconomic income effects that arise out of changes in relative prices. The monetary approach analyse the trade balance in terms of disequilibrium in the demand and supply of money. The elasticity approach will be used because of its relevancy and applicability as it is the only one that offers theoretical justifications for the J-curve effect arising as a result of time lag considerations.

3.1.1 The Elasticity Approach

In analyzing the impact of exchange rate on trade balance, this approach focuses on the elasticity of import and exports. The elasticity approach has microeconomic foundations in that it considers behavioural responses to changes in relative prices in terms of the substitution effects only. The main assumption of the elasticity approach is that domestic and foreign incomes and prices are fixed, such that changes in relative prices between countries are due to changes in the exchange rate only. The development of the elasticity approach is attributed to Bickerdike (1920) and Alfred Marshal (1923); later extensions were made by Abba Lerner (1944), Robinson (1947) and Metzler (1948).

Marshal and Lerner developed the condition that should hold for depreciation to lead to improvement in the trade balance known as the Marshal-Lerner condition.

This states that for devaluation or depreciation to improve the trade balance, the sum of absolute values of the elasticity of imports and exports should exceed unity, that is;

$$\Omega_X + \Omega_M > 1 \quad (1)$$

Where; Ω_X is the elasticity of exports and Ω_M is elasticity of imports

This condition is applicable for a small country like Zambia which is a price taker on both her imports and exports.

In the elasticity approach the impact of exchange rate changes are analyzed in terms of price and volume effects. The price effects are such that in the case of depreciation, exports measured in foreign currency become relatively cheaper and imports measured in domestic currency become relatively expensive. The overall price effect on trade balance will therefore be negative following depreciation. Arising from the price effects are the volume effects. The volume effects reduce imports and expand exports. Imports will reduce since they are relatively more expensive in domestic currency while exports will increase since they will be cheaper in foreign currency following depreciation. The volume effects will be positive on trade balance and therefore works in opposite direction to the price effect. For depreciation to improve the trade balance, the volume effect should dominate the price effect.

However, since consumers and producers respond to changes in relative price with a lag, time considerations become important in the analysis. Time lag considerations arise because consumers and producers take time to change from established patterns. It may not be possible to change the quantity or effective price of existing export or import contracts soon after exchange rate changes. The existence of imperfect competition may also entrench significant market power on firms such that their market share is unaffected by change in relative prices in the short-run (Pilbeam, 2006).

According to Lal and Lowinger (2002), “while the exchange rate changes rapidly, the prices of traded goods and services and subsequently the volume of such goods will respond with a variable and often a lengthy lag.” These lag implications has given justification to what is called the J-Curve effect.

The idea behind the J-Curve is that in the short-run the balance of trade will deteriorate following depreciation but will improve in the long-run as consumers and producers respond accordingly. Therefore, it is generally considered that the Marshall-Lerner condition is more likely to hold in the long-run rather than in the shorter-run.

3.2 Model

Error Correction Modeling is adopted that has been used in similar studies by Bahmani-Oskooe and Ratha, 2007; Lal and Lowinger, 2002; Onafowora, 2003 and Pesaran *et al* (1997). According to Granger representation theorem, if two or more variables have a long term equilibrium association, then the relationship between them can be expressed in the form of an ECM (Engle and Granger, 1987; Gujarati, 2003). The ECM is presented as:

$$\Delta \log TB_t = \beta + \sum_{i=1}^p \gamma_i \Delta \log TB_{t-i} + \sum_{j=1}^q \omega_j \Delta \log EXR_{t-j} + \lambda_k \mu_{t-1} + \varepsilon_t \quad (2)$$

The exchange rate and trade balance are the variables in this model. Where TB is the trade balance; EXR is the exchange rate; ω, γ, β and λ are coefficients; p and q are the lag lengths of TB and EXR respectively ; μ_{t-1} is the Error Correction term and ε_t is the white noise error term. A significant and negative value of the Error Correction term shows that any short run deviation will converge towards long run equilibrium. While a positive value shows that the relationship between the variables is explosive and does not adjust towards long run equilibrium. Part of the equation that has variables in difference form explains short run dynamics between cointegrated variables.

The trade balance is generally expressed as the difference between merchandise imports and merchandise exports. If exports(x) are larger than imports (M), there is a trade surplus. On the other hand if imports are larger than exports, then there is a trade deficit. For this study, imports and exports are aggregate figures with respect to all the country's trading partners in nominal Kwacha values.

However, in the above equation (2) the Trade Balance (TB) is expressed in ratio form $\left(\frac{X}{M}\right)$ to make it insensitive to units of measurements and to allow for log transformations even when it is negative (Lal and Lowinger, 2002).

If ratio $\left(\frac{X}{M}\right)$ is less than one, the trade balance is in deficit, since imports are more than exports and if the ratio $\left(\frac{X}{M}\right)$ is more than one, the trade balance is in surplus, since exports are more than imports. This ratio form of balance of trade has been applied in similar studies such as Bahmani-Oskooe and Else (1994) and Hernan (1998). Logging is recommended because most economic data is highly skewed (non-normal) due to the presence of outliers. Logging has relatively greater effect on larger values and lesser effect on smaller values (Luneta, 2000). The log form also allows for direct estimation of elasticities from the various coefficients.

The exchange rate is defined as the nominal value of the Kwacha per unit of the USA dollar. Therefore, an increase in the exchange rate represents a depreciation of the Kwacha, whereas a decrease in the exchange rate is an appreciation.

3.3 Estimation Procedure

This study will make use of time series economic data. According to Gujarati (2003) most economic time series variables are not stationary but are integrated of order one. For a time series to be regarded as stationary, the mean, variance and covariance should be independent of the time at which the observation is made. A time series that is stationary will exhibit mean reversion and variance is finite (Hernan, 1998). The order of integration is the number of times a particular series will have to be differenced to make it stationary. If variables have the same order of integration then there is a possibility that they are cointegrated. Cointegration means that there is a long term equilibrium relationship among the variables under consideration.

Correct estimation of linear relationships among economic variables using Ordinary Least Squares (OLS) can only be done if the time series are cointegrated or stationary (Engle and Granger, 1987). If this is not the case the problem of spurious regression may arise.

Spurious regression arises when it is erroneously demonstrated that there is a relationship among economic variables when in actual fact such a relationship does not exist.

To avoid the problem of spurious regression, the time series data will be tested for stationarity and cointegration.

Granger causality test will be done to determine the direction of the relationship between exchange and trade balance. The Error Correction Model (ECM) will be used to analyse dynamic relationships among the variables. Impulse response functions will then be applied to graphically demonstrate the impact of exchange shocks to trade balance.

3.3.1 Data Stationarity

It is important to understand the stationary properties of the time series data before proceeding with other tests and econometric procedures. Unit roots tests are generally applied to determine if time series variables are stationary or not. The presence of a unit root is evidence of non-stationarity of a time series variable. There are several tests that can be done to check for stationarity of a time series variable. These tests include the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF), Phillips Perron (PP) and several others. This study will make use of the ADF because it is relatively easy to understand and widely included in most statistical packages.

The ADF test is based on the null hypothesis (H_0): that the variable has a unit root or is not stationary against the alternative (H_1): that the variable has no unit root or is stationary. However it is always desirable to compare results obtained using ADF with other unit root tests to check for consistency. The limitations of each test statistic such as number of observations, power and size of test should be taken into account.

3.3.2 Cointegration

Cointegration confirms likelihood of a long term structural relationship among time series variables by proving the absence of spurious correlation and therefore validates the use of linear regression (Atta *et al*, 1999).

The most common methods used in testing for cointegrations of variables are the Engle and Granger (1987) and Johansen and Jeselius (1994) procedures. However, the Johansen and Jeselius procedure is considered to be superior in that it doesn't consider, aprior that a single cointegration vector exists but rather tests the number of cointegration vectors (Agbola, 2004).

Further more, unlike the Engle and Granger, the Johansen and Jeselius method is not sensitive to choice of dependent variable as it considers all variables as endogenous (Dhliwayo, 1996). Shirvan and Wilbratte (1997) argue that the Engle and Granger (1987) method is "static and does not account for dynamic relationship among variables" and that "the estimated coefficients have non-standard distributions and therefore cannot be used for tests of hypothesis on true coefficient values."

Additionally, for more than two variables, the Ordinary Least Square (OLS) estimators of Engle and Granger are consistent but are not efficient. Therefore, this study will make use of the Johansen and Jeselius procedure of testing for cointegration. This procedure involves the application of Maximum Likelihood Estimation (MLE) to an autoregressive equation.

3.3.3 Granger Causality Test

Although the cointegration test provides information about the long run equilibrium relationship between two or more variables, it does not give details about the direction of the causality. However, the information about the direction of causality may be provided by economic theory. The elasticity approach to the balance of payments predicts that exchange rate changes are most likely to influence trade balance changes and not the other way. The Granger causality test provides means of empirically testing the direction of causality between related variables. According to Granger (1969) "X is said to Granger cause Y if present value of Y can be predicted with greater accuracy by past values of X". The Granger causality test is done in a bilateral manner in the sense that it simultaneously tests for influence in opposite directions. The Granger causality test is given by the following equations 3 and 4:

$$\log TB = \mu_1 + \sum_{k=1}^m \alpha_m \log TB_{t-m} + \sum_{k=1}^n \beta_n \log EXR_{t-n} + \varepsilon_{1t} \quad (3)$$

$$\log EXR = \mu_2 + \sum_{k=1}^n \beta_n \log EXR_{t-n} + \sum_{k=1}^m \alpha_m \log TB_{t-m} + \varepsilon_{2t} \quad (4)$$

Where TB is the trade balance; EXR is the nominal exchange rate; m and n are the lag lengths of TB and EXR respectively; α , β and μ are constants and ε is the error term.

The test applies the F statistic to test the significance of the coefficients of each variable in influencing the other variable. This is done by testing the significance of the β_s and α_s in equations 12 and 13 respectively. The lag length is chosen by using the Akaike information criteria.

3.3.4 Impulse Response Functions

A country which runs an open economy is subject to a number of shocks that might arise due to drastic changes in the internal or external environment. Impulse responses functions are used to analyze the pattern of the effects of such shocks on the outcome variable. The impulse response functions were generated using unrestricted VAR model developed by Perasan and Shin (1998). This was done by introducing one unit of innovation or shock to one variable in order to understand the pattern of effects on another variable in the unrestricted VAR. The existence of the J-Curve effect can also be analyzed by impulse response functions.

3.3.5 Auxiliary Statistical Tests

A number of diagnostic tests were carried out to verify if the model was correctly specified. Diagnostic tests were done to check for serial correlation, Auto-regressive Conditional Heteroskedasticity (ARCH), normality of residuals and stability of the model.

3.4 Data

This study made use of quarterly secondary data from 1999 to 2008. The data was obtained from Bank of Zambia (BOZ) and Central Statistics Office (CSO). All the variables were transformed into natural logarithms. The variables were chosen in accordance with theory of balance of trade and related empirical work done in the past. The sample period was chosen due to consistency and availability in data after major transformation in the Zambian economy in 1991. Before 1991, economic fundamentals did not reflect market conditions because of extensive government controls. Though there are econometric techniques for combining data from two different time periods, however, when there has been fundamental shift in the structure of the economy like was experienced in Zambia in 1991, the task gets very complicated to the extent that the reliability of the results may be compromised.

CHAPTER FOUR

EMPIRICAL RESULTS

Empirical analysis was carried out using Eviews version (5.1) econometric software. The empirical analysis proceeded in the following manner. Firstly, the econometric characteristics of the variables were analyzed in terms of stationarity and cointegration. The econometric characteristics of the variables provide the basis and justification for subsequent estimation procedures. Granger Causality, Vector Error Correction modeling and Impulse Response Functions were then employed to analyse the relationship between exchange rate and trade balance.

4.1 Unit Root Test Results

Unit root test of the ADF were done in order to understand the time series properties of the two variables. The null hypothesis (H_0) of the ADF is that the series have a unit root or are non-stationary against the alternative hypothesis (H_1) that the series do not have a unit root or are stationary. The actual test was carried out to ensure that there was no serial correlation and heteroskedasticity in the estimated residuals. The Durbin-Watson and Jarque-Bera test suggested that there was no problem of serial correlation and heteroskedasticity respectively. The optimum lag length was chosen using the Akaike Information Criteria (AIC).

Table 2: Augmented Dickey Fuller (ADF) Results for Non-stationary of Variables.

Variable	Number of Lags	1% ADF Critical Value	ADF Test Statistic	Order of Integration
Exchange Rate	2	-2.6244	-3.6171	
D Exchange Rate ^{**}	1	-3.6171	-3.8221	I(1)
Trade Balance	2	-3.6171	-2.0829	
D Trade Balance ^{**}	2	-3.6228	-4.8777	I(1)

^{**}Denotes rejection of hypothesis of unit root at 1percent.

Notes: All the variables are expressed in natural logarithms; D is the first difference operator.

The results of the ADF tests indicate that both variables have a unit root in levels and are therefore not stationary in the levels. Evidence of unit root in levels is consistent with the time series charts of both variables depicted in graph A1 as they appear to be non-stationary in levels. However, the null hypothesis of a unit root in the variables was rejected for both variables in their first difference form at significance level of one percent. This suggested that both variables were stationary in the first difference form and were therefore integrated of order one.

4.2 Johansen- Juselius Cointegration Test Results

The unit root tests revealed that both variables are non stationary in levels but stationary in first differenced form. Since the variables are integrated of the same order, there exists a possibility that they could be cointegrated. Cointegration implies that there is an equilibrium long run relationship between variables. If variables are cointegrated, a mechanism exists to ensure that any short run deviations in the relationships are corrected over the long run. There is need to test for cointegration before employing the ECM which ties the short run relationship to long run equilibrium. The cointegration test was carried out using both Trace and Maximum- Eigen Statistics in order to increase the robustness of the results. The outputs of the cointegration test are reported in table 3.

Table 3: Cointegration Test Results

Trend assumption: No deterministic trend (restricted constant)

Series: LOG(TB) LOG(EXR)

Lags interval (in first differences): 1 to 6

A. Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.496409	26.30465	20.26184	0.0065
At most 1	0.105169	3.666963	9.164546	0.4640

Trace test indicates 1 cointegrating equation at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

B. Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.496409	22.63769	15.89210	0.0037
At most 1	0.105169	3.666963	9.164546	0.4640

Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The results of both tests show that a single cointegration relationship exists between exchange rate and trade balance at 95% significant level.

4.3 Granger Causality Test Results

The results of the pairwise Granger causality tests are presented in table 4 below. The first row of the table suggests that the null hypothesis that exchange rate does not Granger cause trade balance cannot be accepted at 5 percent significance. But the second hypothesis that trade balance does not Granger cause exchange cannot be rejected.

Table 4: Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Probability
LOG(EXR) does not Granger Cause LOG(TB)	3.90570	0.03003
LOG(TB) does not Granger Cause LOG(EXR)	1.80901	0.17969

Lags: 2

4.4 Error Correction Modeling

The main interest is to understand how the exchange rate influences the trade balance in the short run and the long term adjustment process. The ECM links the short run effects of exchange rate on trade balance to the long term equilibrium. Since the variables are cointegrated and integrated of the same order, the ECM is an appropriate framework for analyzing the dynamics of the relationship of exchange rate and trade balance. The results of the analysis within the ECM framework are presented in table 5 below.

The variables in the differenced form provide information about the short run relationship while the Error Correction (EC) term provides information about the long run adjustment process between the variables.

The specific model only includes the significant coefficients of the variables. The lags structure was determined by lag exclusion test and inverse root of the characteristic polynomial. Diagnostic tests presented in summary in table 6 and in detail in the appendix reveal that the model is fairly stable and reliable. In the specific model the coefficient of exchange rate are statistically significant only at second and third lags. The Error Correction (EC) term is negative and significant at 5 percent.

Table 5: Error Correction Model, Dependent Variable: D Log TB

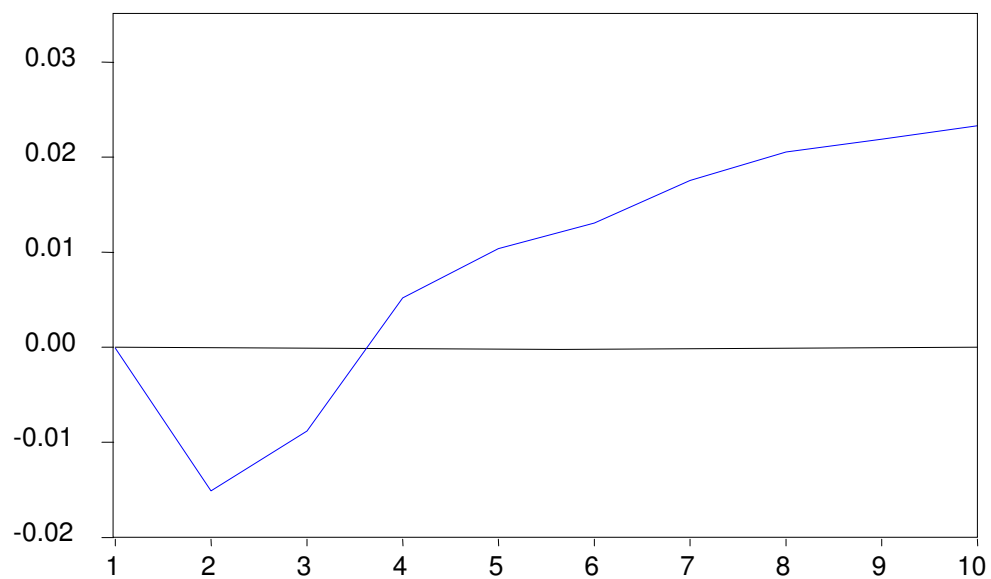
Variable	Coefficient	Standard Error	t-Value
D[LOG(TB)-1]	0.6173	0.215	2.859
D[LOG(TB)-2]	-0.3453	0.155	-2.22
D[LOG(EXR)-2]	-0.356	0.171	-2.089
D[LOG(EXR)-3]	-0.602	0.168	-3.58
EC(-1)	-0.167	0.055	-3.007
<u>Diagnostic Tests</u>			
Normality	Jacque Bera [3.68]Prob. (0.4509)		
Serial Correlation	LM[1.291] Prob. (0.8628)		
Heteroskedasticity	χ^2 [28.930] Prob.(0.5213)		
Stability condition	Inverse roots of AR characteristic polynomial<1		

4.5 Generalized Impulse Response functions

Generalized Impulse Response Functions developed by Pesaran and Shin (1998) were generated using the unrestricted VAR in order to show graphically how the trade balance adjusts with respect to exchange rate changes.

A one standard deviation innovation is introduced to the exchange rate and pattern of response of trade balance is depicted in Chart 3.

Chart 3: Response of Trade Balance to Exchange Rate Innovation



CHAPTER FIVE

DISCUSSION

The ADF results revealed that both variables were non stationary in the level form but stationary when differenced once. The fact that the variables are both non stationary could lead to the spurious conclusion that they are related when in fact it is just coincidence that they are move together over time. This suggested the need for cointegration test as a way of verifying the authenticity of the long term equilibrium relationship between exchange rate and trade balance. The results of the cointegration test showed that there is a long term equilibrium relationship between exchange rate and trade balance. Therefore the relationship between the two variables is not explosive but converges over the long run.

Though the cointegration test shows that there is a long term equilibrium relationship between exchange rate and trade balance, it does not tell us the direction of the relationship. Whether it is the exchange rate that influences trade balance or trade balance influences exchange rate or there is mutual influence in both directions. The direction of the relationship was determined by the Granger causality test which showed that the direction of influence is from exchange rate to trade balance and not the other way. This means that trade balance position can be influenced by exchange rate policies but not the other way round.

The result that exchange rate Granger causes trade balance and not the other way is consistent to what was found in similar studies by Puah *et al* (2008) and Bahmani-Oskooee (1998). In these studies exchange rate was found to influence the trade balance but the trade balance was not able to influence the exchange rate. Puah *et al* (2008) argues that the trade balance is derived from import and export activities and is therefore not expected to influence the exchange rate. But the import and export activities are influenced by the exchange rate changes.

The ECM is a way of linking short run dynamics with the long term equilibrium. In the general ECM model, the coefficients of the differenced exchange rate show a pattern that is consistent with the J-Curve effect. Initially the coefficients of exchange rate at lower lags are negative but are positive at higher lags. This shows that the immediate impact of exchange rate depreciation is a decrease in the trade balance. This provides evidence that in the short run, the conditions for meeting the Marshal-Lerner condition for a positive effect of exchange rate depreciation on trade balance will not be realized. This is so because in the short run it is not possible to make adjustments to the pattern of imports and exports. The positive effect of depreciation eventually takes hold as both importers and exporters adjust to changes in the relative prices over time. Depreciation of the domestic currency is therefore effective in improving the trade balance position in the long run but not in the short. The error term is significant and has the expected negative coefficient which also demonstrates that any short run disequilibrium between the two variables will be corrected in the long run.

The evidence of J-curve effect is further exemplified by the diagrammatic response functions of trade balance to exchange rate innovation. It is shown that the immediate impact of exchange rate depreciation is initial worsening in the trade balance. The initial impact of one standard deviation innovation is reduction in the trade balance of about 1.5 percent. Deterioration in the trade balance persists for about two quarters; thereafter the trade balance improves and settles at a new equilibrium level about 2 percent higher. The pattern of response of trade balance as a result of depreciation is consistent with the J-Curve effect. This result is similar to a number of studies by Lal and Lowinger (2002), Puah *et al* (2008), Stucka (2004) and Bhattari and Armah (2005) who found evidence of the J-Curve effect.

Limitations of study

It is appreciated that there are other factors influencing the trade balance such as money supply, budget deficits, domestic and foreign incomes which could have been included in the model to provide a broader analysis. However such a broader analysis may be lacking in detail than more focused studies.

The other limitation of this study is that import and export figures are simply aggregates for all of Zambia's trading partners. Though much easier to apply, aggregate figures do not show the relative importance of each country's trading partners in the process of trade balance adjustments to exchange rate changes. Often times there could be a one or two nations or regions who may account for a significant proportion for a country's foreign activities. Though the data used in this study is quarterly from 1999 to 2008, a longer sample period would have provided more insight.

CHAPTER SIX

CONCLUSION AND POLICY OPTIONS

In this study, the relationship between exchange rate and trade balance was examined using the time series quarterly data from 1999: 1 to 2008:4. The exchange rate is the nominal value of Zambian Kwacha per US Dollar, while the trade balance is aggregate value with respect to all of Zambia's trade partners. Cointegration, Granger Causality, ECM, and Impulse Response Functions were the methodological approaches applied.

The results from empirical analysis show that both exchange rate and trade balance are non stationary in levels but are integrated of order one. That is both variables have unit roots in levels but are stationary when differenced once. The cointegration test revealed that the variables have a long term equilibrium relationship which can be analyzed within the ECM. The Granger causality tested the significance of the causality between the two variables, revealed that exchange rate Granger causes trade balance, but trade balance does not Granger cause exchange rate. Therefore, the direction of influence is from exchange rate to trade balance according to the Granger causality test.

The pattern of effect of exchange rate depreciation on trade balance as depicted in the ECM and Impulse Response Functions appear to follow the J-Curve effect. We can conclude that the Marshal-Lerner condition for improvement in the trade balance following depreciation does not hold in the short run but in the long run. That is, following depreciation the trade balance initially worsens before eventually improves over the long run. An Error Correction mechanism exists between trade balance and exchange that ensures that any short run deviation from equilibrium is restored in the long run. Therefore, the relationship between exchange rate and trade balance is not explosive but converges towards long term equilibrium.

The implication is that exchange rate movements can be relied upon to provide information about trade balance changes.

Exchange rate is therefore an effective tool in influencing trade balance activities in Zambia. Exchange rate policy and implementation should therefore take into account the particular effects on trade balance both in the short run and long run. In particular, monetary and fiscal policies should be tailored in a manner that promotes a competitive exchange rate regime and favorable trade balance position. Activities that are likely to undermine the operation of a competitive exchange rate regime such as excessive growth in money and high budget deficits should be curbed.

This study could be extended by considering the effects of exchange rate changes through the broad trade balance equation which considers foreign, domestic incomes, money supply, budget deficit and other variables. The analysis could consider the causal and feed back effects of these variables in the trade balance model. Another related area for further investigation would be to disaggregate the trade balance data according to each of Zambia's main trading partners. This would help to separate the influence of adjustment of trade balance to exchange rate changes at a bilateral or regional level. Such an analysis would be very useful in providing information on the relative importance of each trading partner during the process of trade balance adjustment to exchange rate changes.

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APPENDICES

Chart 4A: Series of Trade Balance (TB) and Exchange Rate (EXR) - 1999 to 2008.

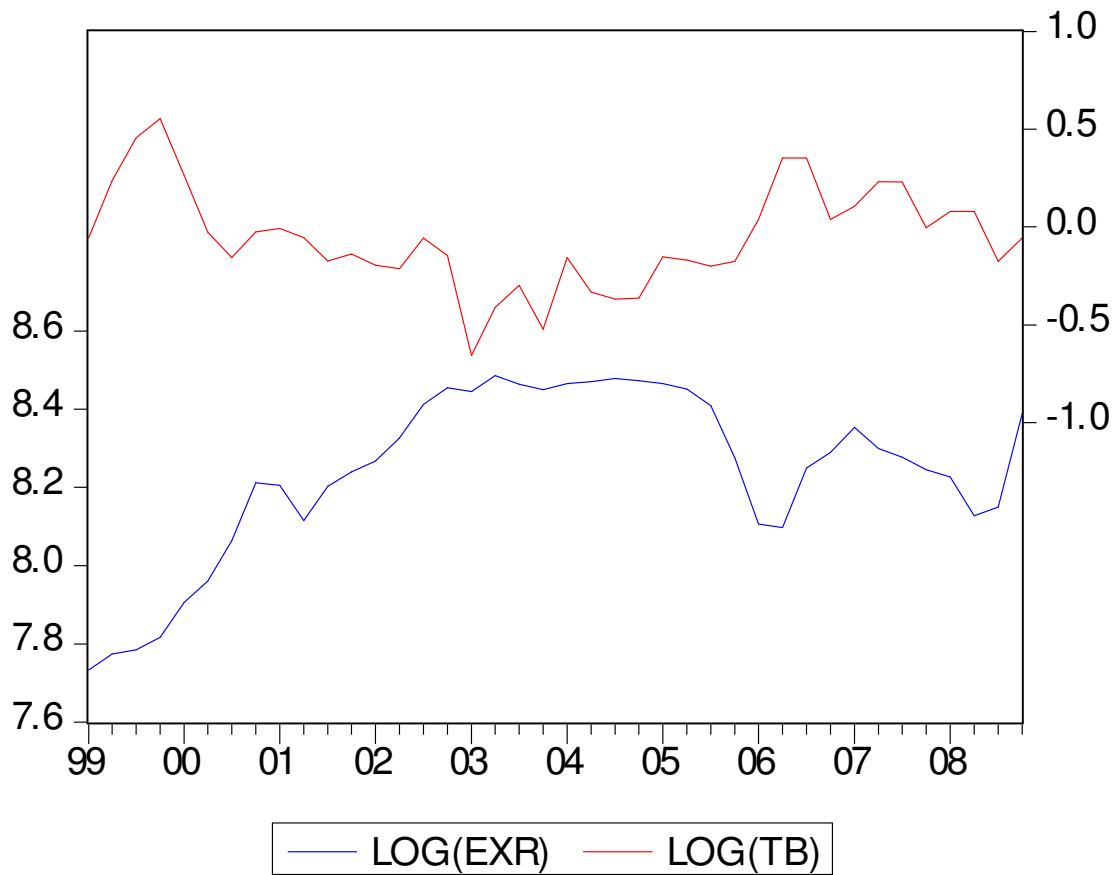


Table 6A: VEC Residual Normality.

Component	Skewness	Prob.
1	-0.310306	0.4410
2	-0.012769	0.9747
Joint		0.7427

Component	Kurtosis	Prob.
1	1.931570	0.1846
2	2.072440	0.2494
Joint		0.2137

Component	Jarque-Bera	Prob.
1	2.353666	0.3083
2	1.327405	0.5149
Joint	3.681071	0.4509

Table 7A: VEC Residual Heteroskedasticity Tests

Sample: 1999Q1 2008Q4

Joint test:

Chi-sq	Df	Prob.
28.93011	30	0.5213

Individual components:

Dependent	R-squared	F(10,26)	Prob.	Chi-sq(10)	Prob.
res1*res1	0.140229	0.424062	0.9217	5.188479	0.8782
res2*res2	0.295836	1.092322	0.4032	10.94593	0.3617
res2*res1	0.342904	1.356804	0.2540	12.68745	0.2417

Table 8A: VEC Stability Condition Check

Roots of Characteristic Polynomial
variables: LOG(TB) LOG(EXR)

Lag specification: 1 4

Root	Modulus
1.000000	1.000000
0.785221	0.785221
0.302399 - 0.628590i	0.697546
0.302399 + 0.628590i	0.697546
-0.160174 - 0.630632i	0.650655
-0.160174 + 0.630632i	0.650655

VEC specification imposes 1 unit root(s).